USDA United States Department of Agriculture | Forest Service | Eastern Region Regional Office

626 East Wisconsin Avenue
Suite 800
Milwaukee, WI 53202
414-297-3600

File Code: 6270
Date: November 16, 2020

Mr. Lewis Freeman
Executive Director
Allegheny-Blue Ridge Alliance
P.O. Box 96
Monterey, VA 24665-0096

Dear Mr. Freeman:

This is our final response to your Freedom of Information Act (FOIA) request #2020-FS-R9-05587-F. Your request was received in this office on July 31, 2020 and considered perfected on August 28, 2020. In your request you asked for the following records:

1. "All information that was produced by the Forest Service for project scoping and other collaboration with interested parties.
2. All information that was received by the Forest Service from interested parties during scoping and any other collaborative interactions.
3. All correspondence (formal and informal) between the Forest Service and interested parties during scoping and other collaborative interactions, including e-mails and notes from meeting, telephone calls, video conferences, etc.
4. All information that was presented at meetings (in-person and virtual) between the Forest Service and interested parties, regardless of whether the information was presented by the Forest Service or other parties.
5. All existing descriptive and analytical information about the project, including:
    a. Project area description and boundary (maps and/or GIS layers),
    b. Purpose and Need,
    c. Description and location of proposed activity areas (including maps and/or GIS layers),
    d. Protective measures for environmental resources,
    e. Expected impacts to environmental resources, and
    f. Any formal or informal consultation with the U.S. Fish and Wildlife Service (including formal and informal correspondence, e-mails, call notes, meeting notes, etc.)."

A reasonable search was conducted by the FOIA staff on the Monongahela National Forest and 558 pages of records were found responsive to your request. All responsive records were referred to the Office of the General Counsel, U.S. Department of Agriculture for review on November 2, 2020.

Upon review of these records, it has been determined that 69 pages have been partially redacted in accordance with 5 U.S.C. § 552(b)(4), 5 U.S.C. § 552(b)(5), and 5 U.S.C. § 552(b)(6). The remaining 489 pages are being released in full.

Exemptions

FOIA Exemption 4 of the FOIA, 5 U.S.C. 552(b)(4), protects "trade secrets and commercial or financial information obtained from a person [that is] privileged or confidential." This exemption is intended to protect the interests of both the government and submitters of information. The very existence of Exemption 4 encourages submitters to voluntarily furnish useful commercial or financial information to the government and provides the government with an assurance that required submissions will be reliable. The exemption also affords protection to those submitters who are required to furnish commercial or financial information to the government by safeguarding them from the competitive disadvantages that could result from disclosure. The exemption covers two distinct categories of information in federal agency records, (1) trade secrets, and (2) information that is (a) commercial or financial, and (b) obtained from a person, and (c) privileged or confidential. Specific Forest Service business information contained in these records has been redacted pursuant to Exemption 4 of the FOIA, 5 U.S.C. § 552(b)(4).

FOIA Exemption 5 permits the Government to withhold "inter-agency or intra-agency memorandums or letters which would not be available by law to a party in litigation with the agency." The most commonly invoked privilege incorporated within Exemption 5 is the deliberative process privilege, the general purpose of which is to "prevent injury to the quality of agency decisions." Specifically, three policy purposes consistently have been held to constitute the bases for this privilege: (1) to encourage open, frank discussions on matters of policy between subordinates and superiors; (2) to protect against premature disclosure of proposed policies before they are actually adopted; and (3) to protect against public confusion that might result from disclosure of reasons and rationales that were not in fact ultimately the grounds for an agency's action.

Deliberative Process Privilege

We have determined that records that are subject of this request contain communications of a deliberative nature or remain in a draft state and were not considered or adopted in any continuing action or the decision process. This information also includes emails of a deliberative nature that would be available to the public. These records were drafted to encourage open, frank discussions on matters of policy between subordinates and superiors, to protect against premature disclosure of proposed policies before they are adopted and to protect against public confusion that might result from disclosure of reasons and rationales that were not in fact ultimately the grounds for an agency's actions. These records are being partially redacted pursuant to the deliberative process component of Exemption 5 of the FOIA, 5 U.S.C. § 552(b)(5).

FOIA Exemption 6 permits the Government to withhold all information about individuals in "personnel and medical and similar files," where the disclosure of such information "would constitute a clearly unwarranted invasion of personal privacy." In determining whether a particular disclosure would constitute an unwarranted invasion of personal privacy, the Forest Service must balance the public's right to disclosure against the privacy interest of the individual whose privacy might be affected by disclosure.

The determination of whether the disclosure of private information is required under Exemption 6 turns not on the identity of the requester or on the particular purpose for which the records are sought, but on the nature of the information requested and its relationship to the core purpose for which Congress enacted the FOIA: to shed light on an agency's performance of its statutory duties. We have determined that certain personal information shared in emails and other personal information that is the subject of your request would be an unwarranted invasion of personal privacy and must be withheld pursuant to Exemption 6 of the FOIA, 5 U.S.C. § 552(b)(6).

Fees

Pursuant to Title 7 Code of Federal Regulations (CFR), Subtitle A, Part 1, Subpart A, Appendix A, the FOIA allows for the assessment of search and duplication costs. The first 100 pages of duplication and two hours of research time are provided free of charge. We made the discretionary decision to grant you a waiver of fees, therefore, no search and duplication costs are being assessed with this release.

Appeal Rights

This concludes the Eastern Region's response to your FOIA request. The FOIA provides you the right to appeal this response. Any appeal must be made in writing, within 90 days from the date of this letter to the Chief, USDA Forest Service.

Additionally, due to the concerns surrounding the COVID-19 virus we are only accepting appeals electronically at this time. Please email your appeal to SM.FS.WOFOIA@usda.gov. The term "FOIA APPEAL" should be placed in capital letters in the subject line of the email along with the FOIA case number (2020-FS-R9-05587-F) assigned to your request. To facilitate the processing of your appeal, please attach a copy of this letter to your request as well.

If you need further assistance or would like to discuss any aspect of your request, please contact the FOIA Public Liaison at (202) 205-1542. Additionally, you may contact the Office of Government Information Services (OGIS) National Archives and Records Administration to inquire about the FOIA mediation services they offer. The contact information for OGIS is as follows:

Office of Government Information Services
National Archives and Records Administration
8601 Adelphi Road-OGIS
College Park, Maryland 20740-6001
e-mail: ogis@nara.gov
telephone: (202) 741-5770
toll free: (877) 684-6448
facsimile: (202) 741-5769

If you have questions regarding this FOIA request, you may contact Douglas Meloche douglas.meloche@usda.gov at (404) 293-8373.

Sincerely,

for

GINA OWENS
Regional Forester

Enclosures

cc: Douglas Meloche, Karen Stevens

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Friday, February 7, 2020 7:22 AM
To: Raione, Richard P -FS; Bard, Jane F -FS; Torres, Amy S -FS; Martin, Jay - FS; Conner, Tami -FS; Brooks, Gregory - FS; Morgan, Jonathan R -FS; Tasker, Kyle - FS; Coleman, Amy - FS; Tarter, Kim - FS; Tanner, Cheryl L -FS
Cc: Cochran, Shawn M -FS
Subject: RE: GHFR insecticide background

Richard,

Thank you for this clarification. When I spoke to Jay on Wednesday, he thought that pesticides could be applied in any of the regen units, which totals 351 acres. Can you verify which acreage (20 or 351 acres) is correct?

Thanks,

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

Forest Service
Monongahela National Forest

p: 304-635-4466
c: 304-704-8134
adrienne.nottingham@usda.gov

200 Sycamore Street
Elkins, WV 26241
www.fs.fed.us

Caring for the land and serving people

From: Raione, Richard P -FS <richard.raione@usda.gov>
Sent: Thursday, February 6, 2020 7:21 PM
To: Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>; Bard, Jane F -FS <jane.bard@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Brooks, Gregory - FS <Gregory.Brooks@usda.gov>; Morgan, Jonathan R -FS <jonathan.morgan@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>
Cc: Cochran, Shawn M -FS <shawn.cochran@usda.gov>
Subject: RE: GHFR insecticide background

Hi Adrienne – Thanks for your inquiry. Please submit your technical input as required on time on Friday, February 7. I'd like to start reviewing this and other important inputs over the weekend. As you suggested, please send an addendum related to these insecticides on Monday at the latest.

Yes, assume the pesticides in the email string below will be used. Are there any policies, standards, guidelines or regulations (WV and or Federal) that specifically prohibit their use on the MNF ?

(b)(5); Deliberative Process Privilege

[redacted]

(b)(5); Deliberative Process Privilege

[redacted]

Richard Raione, COR, PG, CPG, CGWP
District Ranger

Forest Service
Gauley Ranger District, Monongahela National Forest

p: 304-846-2695
f: 304-846-4307
richard.raione@usda.gov

932 North Fork Cherry Road
Richwood, WV 26261
www.fs.fed.us

Caring for the land and serving people

From: Nottingham, Adrienne C -FS
Sent: Thursday, February 6, 2020 5:07 PM
To: Bard, Jane F -FS <jane.bard@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>
Subject: RE: GHFR insecticide background

Richard,

Thank you for sending this information out. I quickly reviewed the attached document, but do not see where it specifically states what pesticides will be used for this project.

(b)(5); Deliberative Process Privilege

[redacted]

Also- there are soil and water concerns surrounding the treatment of HWD with imidacloprid soil tablets due to increased pesticide mobility (which can be attributed to the carbon contents and acidity of the soils in this project area).

Thanks,

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

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Monongahela National Forest

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c: 304-704-8134
adrienne.nottingham@usda.gov

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Caring for the land and serving people

From: Bard, Jane F -FS <jane.bard@usda.gov>
Sent: Thursday, February 6, 2020 4:52 PM
To: Raione, Richard P -FS <richard.raione@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>
Subject: GHFR insecticide background

Jay asked me to write up a little more detail on the scope and scale of potential insecticide use in the GHFR project, to help with the context and intensity. Danielle Martin's email gives a potential list of insecticides currently in use elsewhere in the state for forestry.

Richard reviewed it today, and asked me to add a couple things, which I did prior to sending this out. Jay asked me to send it to the specialists who had asked for more details.

Jane Bard
Silviculturist
Forest Service
Monongahela National Forest, Gauley Ranger District
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jane.bard@usda.gov
932 North Fork Cherry Road
Richwood, WV 26261
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Caring for the land and serving people

From: Martin, Danielle K -FS <danielle.k.martin@usda.gov>
Sent: Thursday, February 6, 2020 10:04 AM
To: Bard, Jane F -FS <jane.bard@usda.gov>
Subject: Fwd: insecticides in WV

Hi Jane,

Below is a list of pesticides that the WVDA uses. I will continue to ask other partners.

Danielle Martin
Forest Pathologist
USDA Forest Service

Morgantown, WV
Cell: 304.276.4171

From: Carrington, Kristen <kcarrington@wvda.us>
Sent: Thursday, February 6, 2020 10:02:23 AM
To: Martin, Danielle K -FS <danielle.k.martin@usda.gov>
Subject: RE: insecticides in WV

I don't really have a set list but the chemicals we use are:

EAB - emamectin benzoate brand name Tree-age
HWA- imidacloprid, we use Coretect for soil treatments and Ima-jet for tree IV
HWA- dinotefuran, Safari we don't use this chemical but I think the NPS does
We haven't done any treatments for BBD. I am going to use Neem oil on the beech orchard for BLD but that is made from a plant.

This is all I could think of. I hope it helps!

Kristen 😊

From: Martin, Danielle K -FS <danielle.k.martin@usda.gov>
Sent: Wednesday, February 5, 2020 3:18 PM
To: Carrington, Kristen <kcarrington@wvda.us>
Subject: insecticides in WV

Hey Jane Bard called requesting a list of insecticides commonly used in WV for controlling insect pests such as EAB, HWA, BBD (in the case of BBD it would be a herbicide). Is there such a list you can think of?

Thanks for any info.

Danielle K. H. Martin
Forest Pathologist
Forest Service
Forest Health Protection
Morgantown Field Office
p: 304-285-1531
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f: 304-285-1505
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180 Canfield Street
Morgantown, WV 26505
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<image007.png><image008.png>
Caring for the land and serving people

ADDRESS CHANGE: As part of the OneUSDA initiative, all Forest Service email addresses have been changed from **@fs.fed.us** to **@usda.gov**. Please update your address book to include my new email address: danielle.k.martin@usda.gov

Stevens, Karen L -FS

From: Torres, Amy S -FS
Sent: Thursday, December 19, 2019 2:41 PM
To: Nottingham, Adrienne C -FS
Cc: Bard, Jane F -FS; Tarter, Kim - FS; Raione, Richard P -FS; Coleman, Amy - FS; Tasker, Kyle - FS; Hale, Gavin -FS; Walter, Terry J -FS; Fry, John - FS; Tolley, Tim -FS; Brake, Timothy -FS; Tanner, Cheryl L -FS; Cober, William J -FS; Wilson, Will -FS; Stevens, Karen L -FS; Ash, Jeremy - FS; Artale, Diane -FS; Mullins, Amelia -FS; Conner, Tami -FS; Edwards, Matthew J -FS; Whetsell, Carol L -FS
Subject: RE: GHFR Landing Question

Hi Adrienne.

Sorry I didn't reply sooner.

The answer regarding the question of landings is thus. Landing sites do not count as part of the 3000 acre veg treatments. Only the actual treatments count as part of the acreage. Landings would be like temp roads in that if they are created for the project they will need to be decommissioned within 3 years unless the landings are part of an existing turnout or other existing area such as a parking lot, trailhead, etc., then it can be maintained like you would with an existing road. Also, landings would be covered for areas outside of the 3000 acres.

In addition, I wanted to also clarify that no matter how many veg treatment types are executed within an area, the acreage is still counted once. For example. You decide to do mechanical treatments on 5 acres. Then you decide to go in and burn in the same 5 acres. This acreage only counts once for the sake of our 3,000 acre limit (so it counts as 5 acres for both treatments, not 10 acres (5 for the mechanical and 5 for the Rx Burn).

Please let me know if you have any additional questions.

(b)(6) [redacted]

Happy Holidays, everyone!

Amy Torres
Environmental Coordinator
Forest Service
WO Business Operations, Enterprise Program
p: 801-597-7633
amy.torres@usda.gov
87155 Kellmore Street
Eugene, OR 97402
www.fs.fed.us
Caring for the land and serving people

From: Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>
Sent: Tuesday, December 17, 2019 7:27 AM
To: Torres, Amy S -FS <amy.torres@usda.gov>

Cc: Bard, Jane F -FS <jane.bard@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Hale, Gavin -FS <gavin.hale@usda.gov>; Walter, Terry J -FS <terry.walter@usda.gov>; Fry, John - FS <john.fry@usda.gov>; Tolley, Tim -FS <tim.tolley@usda.gov>; Brake, Timothy -FS <timothy.brake@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>; Cober, William J -FS <william.cober@usda.gov>; Wilson, Will -FS <will.wilson@usda.gov>; Stevens, Karen L -FS <karen.stevens@usda.gov>; Ash, Jeremy - FS <jeremy.ash@usda.gov>; Artale, Diane -FS <diane.artale@usda.gov>; Mullins, Amelia -FS <amelia.mullins@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>; Whetsell, Carol L -FS <carol.whetsell@usda.gov>
Subject: GHFR Landing Question

Hi Amy,

I started to review some of our proposed action shapefiles this morning and realized I don't have a good understanding of how landings play into the CE category we are using for GHFR. About half (17) of the landings proposed for use are new.

Can you provide some information on this? Also, more specifically, do landings count towards the treatable acres and how will they be treated after the project is implemented.

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

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adrienne.nottingham@usda.gov

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www.fs.fed.us

Caring for the land and serving people

Stevens, Karen L -FS

From: Tolley, Tim -FS
Sent: Tuesday, December 10, 2019 4:19 PM
To: Tasker, Kyle - FS
Subject: RE: GHFRP - Tim's thoughts on analysis

In answer to your question, there apparently is no difference between what we consider "decommissioning" and what we have been doing as a matter of routine closeout ... "water bar and walk away".

From: Tasker, Kyle - FS
Sent: Tuesday, December 10, 2019 4:16 PM
To: Tolley, Tim -FS <tim.tolley@usda.gov>
Subject: RE: GHFRP - Tim's thoughts on analysis

Thanks for sending this. It's definitely helpful. I think you, Adrienne, and I should all be giving a consistent message, and so it's a good idea to keep talking about things as we encounter them.

(b)(5); Deliberative Process Privilege [redacted]

Also FYI, I was told that Amy Mullens is working on a temporary road and landing layout, so hopefully that will at least give us a number of miles, nevertheless it still would be difficult to quantify an amount or the effects of sediment, unless we have the time to use models.

Kyle Tasker
Fisheries Biologist

Forest Service
Monongahela National Forest

p: 304-799-4334 x7995519
kyle.tasker@usda.gov

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Marlinton, WV 24954
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Caring for the land and serving people

From: Tolley, Tim -FS
Sent: Tuesday, December 10, 2019 1:52 PM
To: Tasker, Kyle - FS <kyle.tasker@usda.gov>
Subject: GHFRP - Tim's thoughts on analysis

Hi Kyle,

Attached are a just a few of my preliminary (and scattered), but far from complete, thoughts on how to analyze the effects. I just thought I'd throw this to you so that we move toward a consistent message. I don't know if it will be helpful to you or a hindrance. Everything is very preliminary and subject to change, and open to suggestions.

(b)(5); Deliberative Process Privilege

[redacted]

Ok. I guess I'd better get back to the grind.

Tim

Timothy Tolley
Hydrologist
Forest Service
Monongahela National Forest, Supervisor's Office

Stevens, Karen L -FS

From: Lammie, Samuel - FS
Sent: Wednesday, December 11, 2019 1:46 PM
To: Fry, John - FS
Cc: Stevens, Karen L -FS; Lammie, Samuel - FS
Subject: RE: DRAFT Gauley Healthy Forests Restoration Map - High Value Resource Areas (HVRA) boundaries
Attachments: DraftGisrBaseMapHvraFinalAcres.pdf

Another revision with High Value Resource Areas labeled with a preliminary priority.

Table

High Value Resource Assets

GisAcres	Name	ID
3,874.5	Richwood	1
3,154.2	Lake Summit	2
232	Briery Knob	3
292.2	Cranberry Mountain Nature Center	4
514.6	Falls of Hills Creek	5
282.6	South Fork Cherry River	9
152.2	Round Mountain	9
1,464.4	Cranberry River	9
2,390.1	Kennison Mountain	9

0 (0 out of 9 Selected)

High Value Resource Assets

From: Lammie, Samuel - FS
Sent: Wednesday, December 11, 2019 8:35 AM
To: Fry, John - FS <john.fry@usda.gov>
Cc: Stevens, Karen L -FS <karen.stevens@usda.gov>
Subject: RE: DRAFT Gauley Healthy Forests Restoration Map - WUI boundaries

Attached

From: Lammie, Samuel - FS
Sent: Tuesday, December 10, 2019 5:59 PM
To: Fry, John - FS <john.fry@usda.gov>
Cc: Stevens, Karen L -FS <karen.stevens@usda.gov>
Subject: DRAFT Gauley Healthy Forests Restoration Map - WUI boundaries

John,

I've attached the DRAFT map – I've also placed a hardcopy on your desk.

Let me know if we need to modify, etc.

Sam

PS Let me know if Kaylynne needs a copy of the shapefile!

Sam Lammie PMP, GISP
GIS Coordinator *for Location Intelligence*

USDA Forest Service
Monongahela National Forest

p: 304-635-4525
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Caring for the land and serving people

Stevens, Karen L -FS

From:	Walter, Terry J -FS
Sent:	Monday, December 9, 2019 12:38 PM
To:	Lammie, Samuel - FS
Cc:	Bridges, Kelly - FS; Fry, John - FS; Goins, Kaylynne - FS; Conner, Tami -FS
Subject:	RE: Gauley Wildland Urban Interface - Revised

I fogot to mention, when I hit private property boundaries, I just stopped the WUI line since we cannot do work on them.

From: Lammie, Samuel - FS
Sent: Tuesday, December 3, 2019 5:55 PM
To: Walter, Terry J -FS <terry.walter@usda.gov>
Cc: Bridges, Kelly - FS <kelly.bridges@usda.gov>; Fry, John - FS <john.fry@usda.gov>; Goins, Kaylynne - FS <kaylynne.goins@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Lammie, Samuel - FS <samuel.lammie@usda.gov>
Subject: Gauley Wildland Urban Interface - Revised

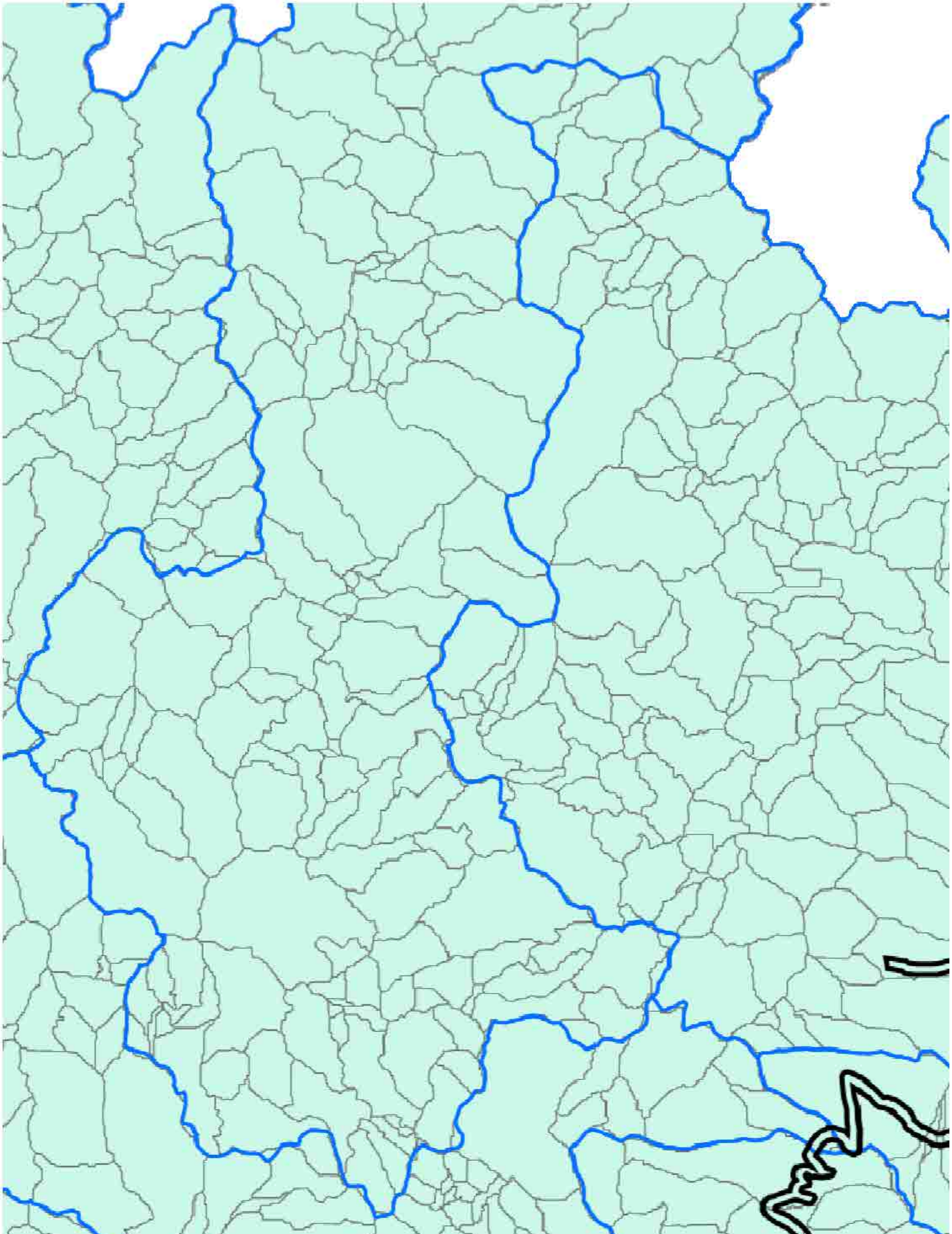
Hi Walt – when you have a moment maybe we can take a look at your revised WUI…

What I am looking for from you is a handle on where the WUI boundary is anchored (to roads, streams, watersheds, or ?)…

Although the 6th level HUCs are too big in size (in blue below)we do have smaller catchment basins as developed by WVU in the past. This layer might make more sense to try to tie in to (see the snapshot below and I am only showing the 500 ft buffers in black).

Thanks,

Sam



From: Martin, Jay - FS
Sent: Tuesday, December 3, 2019 1:50 PM
To: Lammie, Samuel - FS <samuel.lammie@usda.gov>
Subject: FW: Gauley Wildland Urban Interface - Revised

Here you go.

Jay Martin
South Zone NEPA Planner
Forest Service
Monongahela National Forest, Marlinton / White Sulphur Ranger District
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f: 304-799-6820
jay.martin2@usda.gov
1627 Cemetery Rd.
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From: Conner, Tami -FS <tami.conner@usda.gov>
Sent: Tuesday, December 3, 2019 8:03 AM
To: Bard, Jane F -FS <jane.bard@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: FW: Gauley Wildland Urban Interface - Revised

Info

Tami Conner
Ecosystem Staff Officer
Forest Service
Monongahela National Forest
p: 304-635-4457
tami.conner@usda.gov
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Elkins, WV 26241
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Caring for the land and serving people

From: Fry, John - FS
Sent: Monday, December 2, 2019 3:55 PM
To: Raione, Richard P -FS <richard.raione@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>
Subject: Fwd: Gauley Wildland Urban Interface - Revised

Updated revised WUI map.

Get Outlook for iOS

From: Goins, Kaylynne - FS <kaylynne.goins@usda.gov>

Sent: Monday, December 2, 2019 3:53:19 PM

To: Fry, John - FS <john.fry@usda.gov>

Subject: Gauley Wildland Urban Interface - Revised

John,

Here is the revised map of the Gauley WUI with the adjustments Walt requested. The acreage within the boundary has been adjusted to reflect the changes.

Thanks,

Kaylynne Goins
Public Affairs Intern
Forest Service
Monongahela National Forest, Supervisor's Office
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Caring for the land and serving people

Stevens, Karen L -FS

From: Mullins, Amelia -FS
Sent: Friday, January 10, 2020 8:43 AM
To: Tolley, Tim -FS
Cc: Tasker, Kyle - FS; Nottingham, Adrienne C -FS
Subject: RE: GHFR project - temporary roads and skid trails question
Attachments: GHFR_TempRoads_010920.CPG; GHFR_TempRoads_010920.dbf; GHFR_TempRoads_010920.prj; GHFR_TempRoads_010920.sbn; GHFR_TempRoads_010920.sbx; GHFR_TempRoads_010920.shp; GHFR_TempRoads_010920.shp.xml; GHFR_TempRoads_010920.shx

(b)(5); Deliberative Process Privilege [redacted]

I did do a very quick walk through of most the areas but consider I covered the entire project area in less than 5 days. Most of the areas have existing skid trails I can only think of about 3-4 units that don't. As you can see most of the skid trails do show up on the Lidar and I tried to locate the roads on those existing features. I did notice that skid trails on gentle slopes or coming up a fairly flat ridge where there is little to no cut bank the feature is not showing up on the Lidar.

Also wanted to clarify that in flat areas close to landing locations the timber would be conventionally harvest but not roads built. This is primarily the areas directly adjacent to heli landings on Hinkle Mt.

Let me know if you have any other questions I may be able to clarify.

From: Tolley, Tim -FS
Sent: Thursday, January 9, 2020 4:36 PM
To: Mullins, Amelia -FS <amelia.mullins@usda.gov>
Cc: Tolley, Tim -FS <tim.tolley@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>
Subject: GHFR project - temporary roads and skid trails question

Hi Amy,

I have a question about the *GHFR_SkidTrails_122019* GIS layer (I believe you provided the information for that layer). For the project we have only 2 temporary roads for a total of approximately 2,600 ft. All the rest (the "GHFR_SkidTrails_122019" layer) are not considered to be "temporary roads" created by this project because they are placed on existing features and thus do not require any new "excavation". [redacted]
(b)(5); Deliberative Process Privilege [redacted]

(b)(5); Deliberative Process Privilege

[redacted]

I cc'd Kyle and Adrienne since I expect that they will have the same question. I don't know if you have a quick answer or if perhaps we should talk about it.

Sorry to bother you (I know you have a lot going on), and I appreciate your help.

Thanks.

Tim

Timothy Tolley
Hydrologist

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Stevens, Karen L -FS

From: Cober, William J -FS
Sent: Thursday, February 20, 2020 7:27 AM
To: Raione, Richard P -FS; Conner, Tami -FS; Edwards, Matthew J -FS; Morgan, Jonathan R -FS; Bard, Jane F -FS; Fry, John - FS
Cc: Cober, William J -FS; Piehler, Kirk G -FS
Subject: RE: WSR Study report

Thanks Richard for some clarification and the points you made about protecting users, [redacted]
(b)(5); Deliberative Process Privilege

We would still need to do additional NEPA work for the eligible W&SR section and consult with the NPS prior to any management actions. I reached out to our RO W&SR lead and waiting to see what she has to say.

We have a conference line reserved for Friday 2/21/20, I hope folks can join.

1 (888) 844-9904 Passcode (b)(4) [redacted]

When: 2/21/20 @ 0800

Discussion Topic: NRI-North Fork Cherry River Proposed Management Actions

W.J. Cober
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From: Raione, Richard P -FS
Sent: Wednesday, February 19, 2020 5:21 PM
To: Conner, Tami -FS <tami.conner@usda.gov>; Cober, William J -FS <william.cober@usda.gov>; Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>; Morgan, Jonathan R -FS <jonathan.morgan@usda.gov>; Bard, Jane F -FS <jane.bard@usda.gov>; Fry, John - FS <john.fry@usda.gov>
Subject: FW: WSR Study report

Hi Folks - The first question is whether or not the WO amendment –see below email string –Ch. 80 Section 9 part b is still valid or not. Someone needs to check for current validity.

Assuming it is still valid, section 9b clearly allows for a range of veg mgmt. and timber harvest practices … if designed to protect users….

(b)(5); Deliberative Process Privilege
[redacted]

Finally, keep in mind that within this ¼ mile buffer, the proposed action only calls for up to 1/3 commercial thinning of trees (this is what I really meant by feathering) so that the visibility of this veg mgnt is insignificant in this zone. Also bear in mind that essentially all of this 1/3 thinning will be conducted primarily via helicopter. In summary, all of this together serves to protect *the users and the river environment*.

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From: Cober, William J -FS
Sent: Wednesday, February 19, 2020 3:01 PM
To: Raione, Richard P -FS <richard.raione@usda.gov>
Cc: Cober, William J -FS <william.cober@usda.gov>
Subject: FW: WSR Study report

Richard

(b)(5); Deliberative Process Privilege
[redacted]

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From: Edwards, Matthew J -FS
Sent: Wednesday, February 19, 2020 11:38 AM
To: Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

(b)(5); Deliberative Process Privilege

[redacted]

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From: Cober, William J -FS
Sent: Wednesday, February 19, 2020 11:31 AM
To: Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>
Cc: Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

(b)(5); Deliberative Process Privilege

[redacted]

(b)(5); Deliberative Process Privilege [redacted]

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From: Edwards, Matthew J -FS
Sent: Wednesday, February 19, 2020 11:20 AM
To: Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

(b)(5); Deliberative Process Privilege [redacted] Hopefully Richard can be on the call on Friday.

Matthew J Edwards
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From: Cober, William J -FS
Sent: Wednesday, February 19, 2020 8:23 AM
To: Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Piehler, Kirk G -FS <kirk.piehler@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

I found some additional information that I feel ties to our Forest Plan. Forest-wide Management Direction: Chapter II page 37, ***Standard WS03 – When management actions are proposed that may compromise the outstandingly remarkable value, classification, or free-flowing character of an eligible Wild and Scenic River segment, a suitability study shall be completed for that eligible river segment prior to initiating the action.***

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[redacted]

https://www.nps.gov/subjects/rivers/consultation-instructions.htm

Instructions for consulting with the National Park Service regarding NRI compliance issues:

The **Council on Environmental Quality (CEQ)**, under 5(d)(1) Wild and Scenic River Act authority, provides guidance to federal agencies with permitting and/or granting authority for projects on or near rivers listed on the NRI. In accordance with **executive memorandum**, all agencies must "take care to avoid or mitigate adverse effects" to rivers identified in the Nationwide Rivers Inventory. For projects on federal lands, check with the local land manager to verify that the segment is still considered 'eligible and/or suitable' in their most recent land or resource management plan.

The National Park Service (NPS) is available to assist other federal agencies in carrying out this process; however, it is the role of the federal permitting agency (not the National Park Service) to ensure that effects to NRI rivers are avoided or mitigated. **Assessment/Environmental Impact Statement process, entities proposing projects that could affect NRI, should research river value information to find up to date information. Here is a sampling of research resources**. Do not limit your research to these national sources; supplement this with other national as well as state and local sources.

If you do not hear from NPS within 30 days, CEQ states that you may proceed with the following in mind:

1. Determine whether the proposed action could affect an NRI river.

- Check the current regional/state NRI list to determine whether the proposed action could affect an NRI river (i.e., is the proposed action location in the vicinity of the NRI segment).
- If an NRI river segment could be affected by the proposed action, an environmental assessment or and environmental impact statement may be required depending on the significance of the effects.
- If the action would not affect an NRI river, no further action is necessary regarding the NRI.

2. Determine whether the proposed action could have an adverse effect on the natural, cultural, and recreational values of the NRI segment. These values are listed as "outstandingly remarkable values" (ORVs) on the state NRI list. Adverse effects on NRI rivers may occur under conditions which include, but are not limited to:

- Destruction or alteration of all or part of the free flowing nature of the river;
- Introduction of visual, audible, or other sensory intrusions which are out of character with the river or alter its setting;
- Deterioration of water quality; or

- Transfer or sale of property adjacent to an NRI river without adequate conditions or restriction for protecting the river and its surrounding environment.

3. Determine whether the proposed action could foreclose options to classify any portion of the NRI segment as wild, scenic, or recreational river areas.

- In some cases, impacts of a proposed action could be severe enough to preclude inclusion in the Wild and Scenic River System, or lower quality of the classification (e.g., from wild to recreational). If the proposed undertaking could effectively downgrade any portion of the NRI segment, you should consult with NPS.
- Proposed actions (whether uses or physical changes), which are theoretically reversible, but which are not likely to be reversed in the short term, should be considered to have the effect of foreclosing for all practical purposes Wild and Scenic River status. This is because a river segment, when studied for possible inclusion in the Wild and Scenic River System, must be judged as it is found to exist at the time of the study, rather than as it may exist at some future time.
- If a proposal, including one or more alternatives, could have an adverse effect on an NRI river, an EA, or if the effects are significant, an EIS must be prepared.

4. Incorporate mitigation/avoidance measures in the proposed action to the maximum extent feasible within the agency's authority.

If NPS does not respond to your request for assistance within 30 days, you may proceed with completing preparation and circulation of the environmental assessment or EIS as planned. Even where NPS has been unable to comment on the environmental assessment or DRAFT EIS, you are still obligated to "…take care to avoid or mitigate adverse effects on the rivers identified in the Nationwide Inventory…"

Last updated: February 27, 2019

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From: Piehler, Kirk G -FS
Sent: Thursday, February 13, 2020 3:54 PM
To: Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Cober, William J -FS <william.cober@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: RE: WSR Study report

Matt,
W.J. is out, so I took a look at Forest Plan and handbook references for WSR.

In the FP, Chapter III, page III-6, is following information:

Portions of four eligible Wild and Scenic River segments occur within this prescription area, totaling 25.3 miles. River miles, classification, and values are described in the table below. Rivers are currently managed according to Wild and Scenic River Act guidance for their classification, and to maintain their outstandingly remarkable values and free-flowing status.

Eligible Wild and Scenic River Segments in MP 3.0			
River Name	Classification	Outstandingly Remarkable Values	Miles
North Fork Cherry River	Recreational	Scenery, Recreation	10.8
Glady Fork	Recreational	Recreation	2.8
Laurel Fork	Scenic	Recreation	4.4
Williams River	Recreational	Scenery, Recreation	7.3

Your reference to WS03, Chapter II, identifies suitability study requirement for actions that may compromise ORV. I could not find specifics in handbook for that type of study or reference to ¼ threshold, but do not doubt presence in document. I did find the following for veg. management; there is specific reference to Recreational Classification applicable to North Fork Cherry River.

WO AMENDMENT EFFECTIVE DATE: 01/30/2015 DURATION: This amendment is effective until superseded or removed. 1909.12_80 Page 32 of 41 **FSH 1909.12 – LAND MANAGEMENT PLANNING HANDBOOK CHAPTER 80 – WILD AND SCENIC RIVERS**

9. Vegetation Management.

a. Wild Rivers. Cutting of trees and other vegetation is not permitted except when needed in association with a primitive recreation experience, to protect users, or to protect identified outstandingly remarkable values. Examples of such exceptions include activities to maintain trails or suppress wildfires. Prescribed fire and wildfires managed to meet resource objectives may be used to restore or maintain habitat for threatened, endangered, or sensitive species or restore the natural range of variability.

b. Scenic and Recreational Rivers. A range of vegetation management and timber harvest practices are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character.

Kirk Piehler
Natural Resources and Engineering Group Leader

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From: Conner, Tami -FS
Sent: Thursday, February 13, 2020 1:26 PM
To: Piehler, Kirk G -FS <kirk.piehler@usda.gov>
Subject: FW: WSR Study report

Can we discuss when you get a minute?

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From: Raione, Richard P -FS
Sent: Thursday, February 13, 2020 1:24 PM
To: Conner, Tami -FS <tami.conner@usda.gov>
Subject: FW: WSR Study report

fyi

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From: Edwards, Matthew J -FS
Sent: Thursday, February 13, 2020 10:26 AM
To: Cober, William J -FS <william.cober@usda.gov>
Cc: Raione, Richard P -FS <richard.raione@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: WSR Study report

WJ, do you have access to the Wild and Scenic Rivers study report that was conducted sometime in the 1980s or 1990s?

There is language in the LRMP (page II-37) that states that river corridors include the shorelines that generally extend ¼ mile on either side of the eligible river segments. Standard WS03 states*: When management actions are proposed that may compromise the outstandingly remarkable value, classification, or free-flowing character of an eligible WSR segment, a suitability study shall be completed for that eligible river segment prior to initiating actions.* We are

(b)(5); Deliberative Process Privilege

[redacted]

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Stevens, Karen L -FS

From: Raione, Richard P -FS
Sent: Friday, February 7, 2020 5:46 PM
To: Torres, Amy S -FS; Walter, Terry J -FS; Fry, John - FS; Conner, Tami -FS; Martin, Jay - FS
Subject: RE: WUI white paper - rationale for wui development on GHFRA CE

Hi – I have not seen or heard anything….. John or Walt – what's the status?

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From: Torres, Amy S -FS
Sent: Friday, February 7, 2020 5:18 PM
To: Raione, Richard P -FS <richard.raione@usda.gov>; Walter, Terry J -FS <terry.walter@usda.gov>; Fry, John - FS <john.fry@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: RE: WUI white paper - rationale for wui development on GHFRA CE

Was the WUI white paper finalized?

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From: Raione, Richard P -FS <richard.raione@usda.gov>
Sent: Tuesday, February 4, 2020 12:21 PM
To: Walter, Terry J -FS <terry.walter@usda.gov>; Fry, John - FS <john.fry@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>
Subject: FW: WUI white paper - rationale for wui development on GHFRA CE

Walt, John, et al:

We need to incorporate/address the comments from Tami and Amy please. See attached.

(b)(5); Deliberative Process Privilege

[redacted]

Thanks for your assistance. ☺

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From: Torres, Amy S -FS
Sent: Tuesday, February 4, 2020 12:23 PM

To: Conner, Tami -FS <tami.conner@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>
Subject: RE: WUI white paper - rationale for wui development on GHFRA CE

Hi Tami,

Here are my edits and comments.

Thanks!

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From: Conner, Tami -FS <tami.conner@usda.gov>
Sent: Tuesday, February 4, 2020 7:35 AM
To: Martin, Jay - FS <Jay.Martin2@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>
Subject: WUI white paper - rationale for wui development on GHFRA CE

Amy and Richard - please take a look at the attached document written by John Fry - I added some comments, but would also like your comments to this. I see this as being added to the project record as a document that explains the progression of WUI development during this CE IDT process. Thanks.

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From: Martin, Jay - FS
Sent: Tuesday, February 4, 2020 8:11 AM
To: Conner, Tami -FS <tami.conner@usda.gov>
Subject: FW: Review

Tami,
Here's John's rational with a few edits from me for your review. I worked with him a bit yesterday on this.

Thanks

Jay Martin
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From: Martin, Jay - FS
Sent: Monday, February 3, 2020 4:02 PM
To: Fry, John - FS <john.fry@usda.gov>
Subject: RE: Review

John,
I made a few very minor edits – to typos. See what you think.

Thanks

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From: Fry, John - FS <john.fry@usda.gov>
Sent: Friday, January 31, 2020 1:38 PM
To: Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: Review

Jay,

Please review. Is this what you had in mind.

Thanks,

Get Outlook for iOS

Gauley Healthy Forest Restoration Scenery Management System Matrix

Unit #	Treatment Type	GIS Acres	Existing Scenic Integrity	Scenic Attractiveness	Concern Level	Visibility And Scenic Class	Activity Consistent with SMS
R3	Regen- Ground Based	29	High/ Moderate	Distinctive/ Typical	High	FG1	Yes, unit cannot be seen from TR236 or N. Fork Cherry River
R4	Regen- Ground Based	25	High/ Moderate	Distinctive/ Typical	High	FG1	Yes, unit cannot be seen from TR236
R5	Regen- Ground Based	26	High	Typical	High	FG1	Yes, unit cannot be seen from the 39/55 portion of the HSH
R6	Regen- Ground Based	15	Moderate	Typical	Moderate	FG1	Yes, will be seen from gated FR946, within Roaded Natural ROS class
R8	Regen- Ground Based	38	Moderate	Typical	Moderate	FG1	Yes
R9	Regen- Ground Based	34	Moderate	Typical	High	FG1	Yes
R10	Regen- Ground Based	39	Moderate	Typical	High	FG1	Yes
R74	Regen- Ground Based	36	Moderate	Typical	High	FG1	Yes
R1	Regen- Helicopter	41	High/ Moderate	Typical	High	FG1	Yes, topography will screen and blend unit from being seen from SR 39/17
H2	Regen-Helicopter	29	High/ Moderate	Distinctive/ Typical	High	FG1	Yes, unit cannot be seen from TR236 or N. Fork Cherry River
H7	Regen-Helicopter	39	Moderate	Typical	High	MG1	Yes
T11	Thinning-Conventional	24	Moderate	Typical	High	FG1	Yes
T12	Thinning-Conventional	44	Moderate	Typical	High	FG1	Yes
T13	Thinning-Conventional	48	High/ Moderate	Distinctive/ Typical	High	FG1	Yes, cannot see from N. Fork of Cherry River
T16	Thinning-Conventional	28	Moderate	Typical	High	FG1	Yes
T17	Thinning-Conventional	20	Moderate	Typical	Moderate	FG1	Yes
t18	Thinning-Conventional	25	Moderate/ High	Typical/ Distinctive	High	FG1	Yes
T20	Thinning-Conventional	33	Moderate/ High	Distinctive/ Typical	High	FG1	Yes
T21	Thinning-Conventional	75	Moderate/ High	Distinctive/ Typical	High	FG1	Yes
T22	Thinning-Conventional	34	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
T23	Thinning-Conventional	45	Moderate/ High	Distinctive/ Typical	High	MG1	Yes
T28	Thinning-Conventional	17	Moderate	Typical	High	MG1	Yes
T29	Thinning-Conventional	6	Moderate	Typical	High	FG1	Yes
T31	Thinning-Conventional	34	Moderate	Typical	Moderate	FG1	Yes, cannot be seen from Summit Lake CG
T34	Thinning-Conventional	27	Moderate	Typical	High	FG1	Yes
T36	Thinning-Conventional	50	High	Distinctive	High	FG1	Yes

Unit #	Treatment Type	GIS Acres	Existing Scenic Integrity	Scenic Attractiveness	Concern Level	Visibility And Scenic Class	Activity Consistent with SMS
T38	Thinning-Conventional	23	Moderate	Typical	High	FG1	Yes
T41	Thinning-Conventional	23	Moderate/ High	Distinctive/ Typical	High	FG1	Yes
T44	Thinning-Conventional	22	Moderate/ High	Distinctive/ Typical	High/ Moderate	FG1	Yes
T46	Thinning-Conventional	31	Moderate	Typical	Moderate	FG1	Yes
T49	Thinning-Conventional	17	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
T50	Thinning-Conventional	31	Moderate	Typical	High	FG2	Yes
T52	Thinning-Conventional	49	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
T53	Thinning-Conventional	17	High	Distinctive	High	FG1	Yes
T58	Thinning-Conventional	31	High	Distinctive	High	FG1	Yes
T65	Thinning-Conventional	49	Moderate	Typical	High	FG1	Yes
T69	Thinning-Conventional	35	High/ Moderate	Distinctive/ Typical	High/ Moderate	FG1	Yes
T70	Thinning-Conventional	38	High/ Moderate	Distinctive/ Typical	High	MG1	Yes
T71	Thinning-Conventional	73	Moderate	Typical	High	FG1	Yes
T72	Thinning-Conventional	13	Moderate	Typical	High	FG1	Yes
T73	Thinning-Conventional	9	Moderate	Typical	High	FG1	Yes
T76	Thinning-Conventional	8	Moderate	Typical	High	FG1	Yes
T77	Thinning-Conventional	19	High	Distinctive	High	FG1	Yes
T78	Thinning-Conventional	30	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
T79	Thinning-Conventional	56	Moderate	Typical	High	FG1	Yes
T80	Thinning-Conventional	2	Moderate	Typical	Moderate	FG1	Yes
T81	Thinning-Conventional	60	Moderate	Typical	Moderate	FG1	Yes
T82	Thinning-Conventional, Prescribed Burn	39	Moderate	Typical	Moderate	FG1	Yes
T83	Thinning-Conventional	30	Moderate	Typical	Moderate	FG1	Yes
T84	Thinning-Conventional	15	Moderate	Typical	Moderate	FG1	Yes
T85	Thinning-Conventional	102	Moderate	Typical	High	FG1	Yes
T86	Thinning-Conventional	50	Moderate	Typical	High	FG1	Yes
T87	Thinning-Conventional	16	Moderate	Typical	High	FG1	Yes
T88	Thinning-Conventional	43	Moderate	Typical	Moderate	FG2	Yes
T89	Thinning-Conventional	34	High	Distinctive	High	FG1	Yes
T90	Thinning-Conventional	16	Moderate	Typical	Moderate	FG2	Yes
T91	Thinning-Conventional, Prescribed Fire	16	Moderate	Typical	Moderate	FG1	Yes
T92	Thinning-Conventional, Prescribed Fire	23	High	Distinctive	Moderate	FG1	Yes
T93	Thinning-Conventional, Prescribed Fire	13	Moderate	Typical	Moderate	FG1, MG1	Yes
T94	Thinning-Conventional, Prescribed Fire	49	High	Distinctive	High	FG1	Yes
Unit #	Treatment Type	GIS Acres	Existing Scenic Integrity	Scenic Attractiveness	Concern Level	Visibility And Scenic Class	Activity Consistent with SMS
T95	Thinning-Conventional, Prescribed Fire	51	High	Distinctive	High	FG1	Yes

T96	Thinning-Conventional,	30	High/ Moderate	Distinctive/ Typical	High/ Moderate	FG1	Yes
T97	Thinning-Conventional, Prescribed Fire	9	Moderate	Typical	Moderate	MG1	Yes
T98	Thinning-Conventional,	10	Moderate	Typical	Moderate	FG1	Yes
T99	Thinning-Conventional	21	Moderate	Typical	Moderate	FG1	Yes
T100	Thinning-Conventional	12	High	Distinctive	High	FG1	Yes
T101	Fuel Break	6	High	Distinctive	High	FG1	Yes
H14	Thinning-Helicopter	51	Moderate	Typical	Moderate	FG1	Yes
H15	Thinning-Helicopter	145	High	Distinctive	High	FG1	Yes, while unit can be seen from HSH, it is in Rural/Roaded Natural ROS class
H24	Thinning-Helicopter	97	Moderate	Typical	Moderate	FG1	Yes
H25	Thinning-Helicopter	24	Moderate	Typical	Moderate	FG1	Yes
H27	Thinning-Helicopter	35	Moderate	Typical	Moderate	MG1	Yes
H30	Thinning-Helicopter	49	Moderate	Typical	Moderate	FG1	Yes
H48	Thinning-Helicopter	13	Moderate	Typical	Moderate	FG1	Yes
H59	Thinning-Helicopter	64	High/ Moderate	Distinctive/ Typical	Moderate	FG1	Yes
H60	Thinning-Helicopter	19	High	Distinctive	High	FG1	Yes
H61	Thinning-Helicopter	93	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
H62	Thinning-Helicopter	31	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
H63	Thinning-Helicopter	63	High	Distinctive	High	FG1	Yes
H64	Thinning-Helicopter	63	High/ Moderate	Distinctive/ Typical	High	FG1	Yes
H75	Thinning-Helicopter	24	Moderate	Typical	Moderate	FG2	Yes

Definitions

Existing Scenic Integrity – State of Naturalness (high, medium, low)

Scenic Attractiveness
Distinctive -Landforms, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality,
Typical - Landforms, vegetation patterns, water characteristics, and cultural features combine to provide ordinary or common scenic quality,
Indistinctive – Landforms, vegetation patterns, water characteristics, and cultural features have low scenic quality.

Concern Level –
High – high public use/ importance roads, trails and viewpoints
Moderate – moderate public use/ importance roads, trails and viewpoints
Low – low public use/ importance roads, trails, and viewpoints

Visibility	Scenic Class
FG – Foreground (300'-1mi)	High Public Value - 1
MG – Middle-ground (1/2 mi-4mi)	Moderate Public Value – 2
BG – Background (4mi-horizon)	Low Public Value - 3

Scenic Classes
1 = Very High, 2 = High, 3= Moderately/ High,
4 = Moderate, 5 = Moderate/ Low, 6 = Low
7 = Very Low

Summary of MNF Soils Resource Program Collaboration Efforts

The Soils Resource Program of the Monongahela National Forest (MNF) has not collaborated with partners specifically on the Gauley Healthy Forest Restoration Project. The development of this project did not utilize products derived from the long-term collaborative efforts between the Forest and the primary partners of the Soil Resource Program – West Virginia University, USDA Natural Resource Conservation Service – National Cooperative Soil Survey, and the USFS Northern Research Station (NRS01).

However, the Soils Resource Program has and is currently collaborating with partners on soil survey mapping updates, ecological inventory mapping in the red spruce and oak hickory ecosystems, landscape scale restoration techniques for soil quality improvements, and outreach and education in a general forest-wide concept. This combined collaborative effort has benefited many of the Forest's projects including Mower Tract, Upper Greenbrier North, the Big Mountain, Sharp Knob, Greenbrier South East, and the Lower Williams Liming projects. Data was collected in all of these project areas and across the forest to develop land management tools to inform project development, integrate landscape level resource connections, and provide recommendations for mitigations, design criteria and restoration recommendations. These activities include 1) soil survey inventory and updates, 2) ecological site description (ESD) development, 3) soil carbon BMPs for red spruce restoration efforts and 3) soil nutrient restoration.

Soil Survey Updates and Mapping: The MNF Soil Resource Program has collaborated with the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and West Virginia University (WVU) Division of Plant and Soil Sciences (PSS) to facilitate research and field weeks with the intent of gathering site-specific soil physical and chemical data that could be used to update the NRCS soil survey maps in this region. These collaborative efforts to update soil surveys on the MNF have helped the forest to meet the NEPA requirements of best available science and are also used to inform landscape scale restoration. The objectives of these efforts are to help move the soil resource towards the desired conditions outlined in the MNF Land and Resource Management Plan.

Ecological Site Description Development: Updated soil surveys as outlined above provide the foundation for ESD development. The MNF has been heavily impacted by historic anthropogenic activities which resulted in drastic changes to both the landscape as well as the ecosystem services which the landscape can provide. These landscape alterations have made it challenging to identify areas to prioritize various types of restoration (red spruce, oak-hickory, etc.). However, because the soil changes very slowly with time, it can be used as a record of historic conditions. Soil physical and chemical properties can be used to determine historic vegetative communities present at a given location- especially for the red spruce ecosystem. For the past decade, partners have been working to develop methodologies to create ESDs. These ESDs can be used across the MNF to prioritize areas for both red spruce and oak-hickory restoration.

Terrestrial Liming Project: The Soil Resource Program recently executed the Lower Williams Liming project (2017-2018). This project was proposed as a restoration project to improve soil quality in an inherently acidic ecosystem that has historically received high levels of acid deposition in the past century. The Forest partnered with professors and graduate students at WVU Division of Plant and Soil Sciences to develop a monitoring protocol to evaluate effects of terrestrial liming on soil quality.

Holcomb Vernal Pool Study: Dr. James Thompson, West Virginia University Soil Science Professor, is collaborating with the MNF and NRCS to conduct research on the Hydropedology of Vernal Pool Systems (NE-1438). The objectives of this project are to (i) improve the understanding at regional scales of how vernal pool ecosystems differ in distribution, hydrology, hydroperiod, redox chemistry, and carbon storage flux, (ii) identify the need for additional hydric soil indicators for northeast vernal pools, (iii) develop morphometric indices of the hydroperiod within vernal pools, and (iv) estimate the current density of vernal pools within each of the subregions and develop predications of the numbers that have been lost because of disturbance. The study location is located on the Gauley Ranger District in the northern hardwood landscape in the vicinity of Holcomb Run.

Trainings and Workshops: Each year the MNF Soils Resource Program cohosts trainings and workshops with their partners (NRCS, WVU and other universities and national forests within the region). These trainings and workshops are meant to introduce new technologies and science to both current and new staff. These events also offer the opportunity to have soil scientists from the region to collaborate while simultaneously gathering data for specific and defined goals and objectives.

Summary of MNF Soils Group Collaboration Efforts

The Soils Group of the Monongahela National Forest has not collaborated with partners specifically on the Gauley Healthy Forest Restoration Project. However, the Soils group has previously collaborated with partners on soil mapping updates, landscape scale restoration and soil quality improvement efforts. Some of these integrated projects include Mower Tract, Upper Greenbrier North, Big Mountain, Sharp Knob, Greenbrier South East, and Lower Williams Liming projects. These activities include 1) soil survey inventory and updates, 2) ESD development, 3) red spruce restoration efforts 3) large-scale terrestrial liming project.

Soil Survey Updates and Mapping: The MNF (soils group) has collaborated with the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and West Virginia University (WVU) Division of Plant and Soil Sciences (PSS) to facilitate research and field weeks with the intent of gathering site-specific soil physical and chemical data that could be used to update the NRCS soil survey maps in this region. These collaborate efforts to update soil surveys on the MNF help the forest to meet the NEPA requirements of best available science and are also used to inform landscape scale restoration. The objectives of these efforts help to move the soil resource towards the desired conditions outlined in the MNF Land and Resource Management Plan.

Ecological Site Description Development: Updated soil surveys as outlined above provide the foundation for ecological site description development. The MNF has been heavily impacted by historic anthropogenic activities which resulted in drastic changes to the landscape and ecosystem services the landscape can provide. These changes have made it challenging to identify areas to prioritize various types of restoration (red spruce, oak-hickory, etc). However, because in general the soil changes very slowly, it can be used as a record of historic conditions. Updated soil surveys used to develop ESDs have been used across the MNF to prioritize areas for both red spruce and oak-hickory restoration.

Terrestrial Liming Project: The soils group on the MNF recently executed the Lower Williams Liming project. This project was proposed to improve soil quality in an inherently acidic ecosystem. The soils group partnered with professors and graduate students at WVU Division of Plant and Soil Sciences to develop a monitoring protocol to evaluate effects of terrestrial liming on soil quality.

Trainings and Workshops:
The MNF soils group has historically hosted and participated in an annual soil inventory field week with USDA NRCS and WVU.

Gauley Healthy Forest Restoration Project
Meeting With Leadership, December 6, 2019

Attendees: Shawn Cochran (Forest Supervisor), Tami Conner (Ecosystem Staff Officer), Jay Martin (NEPA Specialist/Coordinator), Timothy Tolley (me, Hydrologist), Richard Raione (District Ranger, by phone), Jane Bard (Silviculturist, by phone).

The purpose of these meetings is for leadership (line officers) to meet individually with specialists (today was my meeting), [redacted]

(b)(5); Deliberative Process Privilege

I didn't have time to take notes during the meeting since I was actively engaged in the discussion, so I will try to capture the points of the meeting now. (Shawn and I were discussing the issue so it was not conducive to the flow of meeting for me to try and take notes simultaneously).

(b)(5); Deliberative Process Privilege

[redacted]

(b)(5); Deliberative Process Privilege

[redacted] The Forest Service has developed their national Best Management Practices (BMP) program (National Core BMP Technical Guide, annual national BMP monitoring targets, etc.) in order to address non-point source pollution and its impact on water, riparian, and aquatic resources.

(b)(5); Deliberative Process Privilege

[redacted]

There was considerable back and forth in the discussion and some points mentioned are listed below.

(b)(5); Deliberative Process Privilege

[redacted]

United States Department of Agriculture | Forest Service | Monongahela National Forest | Gauley Ranger District
932 North Fork Cherry Rd.
Richwood, WV 26261

File Code: 1950/2400
Route To:

Date: November 4, 2019

Subject: Project Initiation Letter – Gauley Healthy Forest Restoration Project

To: Interdisciplinary Team Members

The Gauley Ranger District of the Monongahela National Forest proposes to implement ecosystem management activities within the Gauley Healthy Forest Restoration project area. This project is categorically excluded from the administrative review process under Section 603 of the Healthy Forest Restoration Act (16 U.S.C. 6591b) for projects that reduce the risk or extent of, and increase the resilience to, insect or disease infestation or that reduce hazardous fuels. To be categorically excluded from documentation in an EA or EIS, a proposed hazardous fuel reduction action must meet the following requirements:

- Hazardous fuel reduction activities using prescribed fire can be categorically excluded if they do not include more than 3,000 acres. (The project area may be greater than 3,000 acres if the actual treatment areas are 3,000 acres of less.). Such activities:
  - Shall be limited to areas in the wildland-urban interface or to areas in Condition Classes 2 or 3 in Fire Regime Groups I, II, or III outside the wildland-urban interface.
  - Shall be identified through a collaborative framework such as described in A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the environment: 10-Year Comprehensive Strategy Implementation Plan, or is developed and implemented through a collaborative process that includes multiple interested persons representing diverse interests and is transparent and nonexclusive; or meets the requirements for a resource advisory committee under subsections (c) through (f) of section 205 of the secure rural School and Community Self-Determination Act of 2000 (16 U.S.C;7125).
  - Shall be consistent with agency and departmental procedures and applicable resource management plans.
  - Shall not be in wilderness areas or impair the suitability of wilderness study areas for preservation as wilderness.
  - Herbicides, insecticides, and pheromones may be used, but their use must be consistent with the applicable Forest Plan.
  - Shall not include the construction of new permanent roads or other new permanent infrastructure but may include the construction of temporary roads if they are decommissioned and restored within 3 years of the end of project activities.
  - Treatments may include the sale of vegetative material if the primary purpose of the activity is to reduce hazardous fuels.
  - Maximizes the retention of old-growth and large trees, as appropriate for the forest type, to the extent that the trees promote stands that are resilient to insects and disease,

- Considers the best available scientific information to maintain or restore the ecological integrity, including maintaining or restoring structure, function, composition, and connectivity.

Section 603 (a)(1) constitutes and exemption from the requirements of NEPA (Public Law 91-190 (42 U.S.C. 4321 *et seq.*)). Evaluation and documentation of extraordinary circumstances is not required for activities carried out under section 603. This project is categorically excluded by Statute as outlined in the Forest Service Handbook 1909.15 Section 32.3., however, no decision memo will be written for this project. This project initiation letter will provide guidance for collecting enough documentation to inform the authorized officer of any extraordinary circumstances that would preclude the use of this categorical exclusion. As planning proceeds, this guidance may be amended, as appropriate.

Interdisciplinary Team Members and Roles

The following specialists are assigned to the interdisciplinary team (ID Team):

Team Member	Role
Jay Martin	NEPA Coordinator, ID Team Leader
Amy Torres	Enterprise support to IDT lead
Jane Bard	Timber, Silviculture
Kim Tarter	Wildlife Biologist
Kyle Tasker	Aquatics/Fisheries/ Watershed
Cheryl Tanner	Wildlife Technician / Pollinators
Amy Coleman	Ecologist/Botanist/NNIS
Adrienne Nottingham	Soil Scientist
WJ Cober / Matt Edwards	Visuals, Recreation, Wilderness
Tim Brake	Geographic Information, Maps
Tim Tolley	Hydrologist
Gavin Hale	Archeologist
Pete Tupis	Timber Sale Administrator
Walt Walter/ John Fry	Fire
Jeremy Ash	Air Quality Specialist – RO – support as needed

Location

The project area is adjacent to, and east of Richwood, and extends eastward to the Cranberry Mountain Nature Center. West Virginia Route 39/55 bisects the project area. County road 7/2, Forest Road 99 and the Cranberry River form the northern boundary of the project area, and private lands form the southern boundary. The general area is managed under Forest Plan management prescriptions 3.0 and 4.1.

Electronic files are located on Pinyon Box:

[redacted]

Forest Plan Direction

This project is generally located within 3.0 and 4.1 Forest Plan Management Prescriptions.

Management Prescription 3.0 emphasizes the following:

- Age class diversity and sustainable timber production
- A variety of forest scenery
- Habitat for wildlife species tolerant of disturbances, such as deer, grouse, and squirrel
- A primarily motorized recreation environment

Management Prescription 4.1 emphasizes the following:

- Active and passive restoration of spruce and spruce-hardwood communities;
- Recovery of threatened and endangered species and other species of concern associated with spruce and spruce-hardwood communities;
- Management of hardwood communities where spruce is negligible; and
- A mix of forest products.

The desired future condition and goals for portions of Management Prescription 4.1 area with little suitability for spruce restoration are to:

- Enhance diversity of wildlife habitat by managing for a variety of vegetation species, types, and age classes
- Create artificial water sources as needed in conjunction with other resource activities
- Use of vegetation management to enhance the variety of wildlife habitat on the Forest while favoring tree species and forest communities that are beneficial to wildlife.

The focus of the proposed action should be on improving forest stand health and composition as outlined in section 602 of HFRA and on the specific forest plan desired conditions for each management area. Providing commercial timber products will be a by-product of meeting the desired conditions.

Purpose and Need for Action

The 2014 Farm Bill (Agriculture Act of 2014) added sections 602 and 603 to HFRA for Insect and Disease Designations. This same year, the Governor of West Virginia requested that the entire Forest be designated as an insect and disease epidemic area under section 602 of HFRA (602(d)(3)). The 2018 Farm Bill (Agriculture Improvement Act of 2018) amended sections 602 and 603 to add hazardous fuels reduction projects to the types of project that may be carried out under sections 602 and 603.

The purpose of the project is to reduce the expansion and threat of significant, damaging forest insects and disease on the Monongahela National Forest and reduce fuels buildup that cause uncharacteristic wildfire conditions. There is a need to address these conditions are as follows:

- Beech bark disease is inhibiting ecological restoration throughout the Forest. Management efforts to improve forest resiliency are needed.
- The continued spread of hemlock woolly adelgid is devastating a species of unique ecosystem value. Areas of particularly high value hemlock have been identified. Substantial tree mortality is likely to occur, if not treated.
- The recurrence of destructive gypsy moth outbreaks throughout the Forest is presently the most significant threat. Gypsy moth defoliation is a significant cause of oak tree mortality affecting forest health and public safety.
- There is a high probability of emerald ash borer eliminating the ash component of the Forest. Emerald ash borer has been detected near the Forest. Substantial ash mortality is likely to occur posing imminent risk to forest health, infrastructure, and public safety.
- The northern hardwoods that comprise 22 percent of the Forest, dominated by beech, hemlock, and sugar maple, are particularly susceptible to beech bark disease, hemlock woolly adelgid and sugar maple decline.

Possible Actions

Allowable treatments under this categorical exclusion category are those that reduce the risk or extent of, or increase the resilience to, insect or disease infestation or reduce hazardous fuels in designated treatment areas. Treatments may include:

- herbicides, insecticides and pheromones (must be consistent with the Forest-wide Nonnative Invasive Plan Management Project decision (March 2010);
- pesticides;
- prescribed fire;
- timber harvesting, including salvage (commercial harvest); and
- temporary road construction.

Public and Partner Involvement

This project was listed in the Monongahela National Forest's FY 2019 4th quarterly Schedule of Proposed Actions (SOPA) on July 1, 2019 and will continue to be listed until project implementation. No decision memo will be written prior to the implementation of project activities. Internal and external scoping is reoccurring and will continue throughout the NEPA process and includes cooperative agencies such as WV DNR, WV DOF, USFWS and NRCS in addition to non-profits and local communities. The area is also managed cooperatively under a Memorandum of Understanding with the West Virginia Division of Natural Resources as part of the Cranberry Wildlife Management Area. Local and regional partners have already expressed their desire to see spruce restoration, trail connectivity and access and wildlife habitat in the project. Field meetings with partners are encouraged.

Estimated Timeline[1]

Timeframe	Task	Lead
November 22, 2019	Proposed action finalized with complete mapping	ID Team
	Coordination with Partners (on-going)	ID Team
Timeline Based on 14-day Comment Period		
November 26, 2019	Proposed action out for optional 14-day comment period	IDT Leader
December 10, 2019	End of optional 14-day comment period	
December 20, 2019	Proposed Action Updated	IDT Leader
November 7-January 17	CE Resource Review Document Complete	ID Team
December 21-January 5	Holiday Break	All
November 7-January 17	BA/BE complete and initiate FWS consultation	Resource Spec.
January 6, 2020	SHPO Consultation Started (if needed)	Resource Spec.
May 29, 2020[2]	Fish and Wildlife Service Consultation Complete	Resource Spec.
June 1, 2020	Project Implementation	

Responsible Official

As the District Ranger, I will be the Responsible Official for the Gauley Healthy Forest Restoration Project management. Given the information collected so far, I anticipate that a categorical exclusion is the appropriate format for documenting this project's possible environmental impacts based on my review of existing resource information and preliminary issues.

Leadership Guidance for Gauley Healthy Forest Restoration Project

Discussions with the Forest Supervisor on the direction this project should take indicate that we will:

(b)(5); Deliberative Process Privilege

[redacted]

Team Member Responsibilities

[1] Timeline assumes all required field data has been collected and no new field work is required.

[2] Timeline is approximate based on U.S. Fish and Wildlife Service workload.

The goal of the ID Team is to work together to identify issues and document possible impacts. It is important that team members interact early and often throughout the process and involve me, or my designated official, in the deliberations. Disputes needing resolution should be brought to me through the ID Team Leader.

I expect most ID Team meetings will be held at the Gauley Ranger District. I will attend ID Team meetings or designate an "Acting" to speak for me and make decisions. Meetings will start and end on time. IDT members are expected to attend these meetings and represent their resource area.

The following are some of my expectations of each team member:

- Help identify objectives for each meeting and adhere to them.
- Communicate your needs or changes prior to meetings.
- Give advance notice regarding your presence at meetings and honor your commitments.
- Come to meetings prepared, having completed all agreed-upon pre-work. If providing information for the group, bring ample copies to share with all participants or send out information in advance.
- Provide objective information needed for the Responsible Official to make an informed decision. Identify concerns and make timely contributions. Offer recommendations and options. Focus on solutions.
- At the end of each meeting, identify action items, those responsible, and deadlines; provide products on agreed-to timelines.
- Provide ID Team Leader with weekly or biweekly updates on status. Team members will be held accountable for timelines and be responsive to IDT leader requests.
- Consider use of adaptive management strategies – implement, monitor and adapt (FSH 1909.15 Ch 10 sec 14.1).
- Provide all needed documents for the project record.
- Backup data regularly to the T:/ drive and Pinyon project workspace.
- Refrain from including personal opinions, biases, and non-scientific assumptions in documentation related to this project.
- Respect the decisions of the Responsible Official regarding each phase of the process and refrain from modifying any proposed actions in the specialist reports or other documents.
- Utilize national BMPs as a foundation for mitigation measures and design criteria and obtain Responsible Official approval for inclusion of more stringent measures with documented rationale.
- Seek to apply NEPA process efficiencies by modeling the Forest Service Environmental Analysis and Decision Making (EADM) effort and templates.

I expect the ID Team leader to serve as a liaison to me - coordinating the entire analysis process and tracking timelines. The ID Team Leader will manage the Pinyon folders, send permissions to all ID Team members, and provide workspaces for each specialist to save files. Additionally, all project files will be backed up on an external hard drive regularly by the ID Team leader. The Responsible Official and Forest Environmental Coordinator will have complete owner/edit roles for the Pinyon project workspace.

Roles and Responsibilities of the Responsible Official

My role as the Responsible Official is to listen and provide the team with leadership and direction as necessary to keep the environmental analysis on track and on schedule. The following are some of the key points in which I, or my designated official, will make decisions, which will be documented and adhered to by ID Team members:

- Identification of an initial proposed action and finalize project boundary
- Development and changes to project timeline
- Approval of final purpose and need statements and proposed action
- Approval of public involvement plan proposed by
- Making key public contacts, which may include an open house/public meeting
- Approval of all proposed design criteria, mitigation measures, and monitoring requirements
- Review of effects analysis and BA/BE written by specialists to ensure adherence to protocols described above and determining what information and what level of detail I will need to make a decision
- Approval of all contents of the project record and official review of the record before being finalized

Richard Raione

RICHARD RAIONE
District Ranger

cc:

Monongahela National Forest Gauley Healthy Forest Restoration Project CE

Agenda for Tuesday, November 5, 2019 IDT Planning Meeting and Notes

Attendees: Richard Raione, Jane Bard, Kim Tarter, Tami Conner, John Fry, Kelly Bridges, Jay Martin and Amy Torres

Handouts:

- Healthy Forest Initiative and Healthy Forest Restoration Act Interim Field Guide
- Using Decision diagrams with the Field Guide
- FAQs Healthy Forest Restoration Act of 2003, amended as of December 20, 2018
- FS handbook
- Collaboration Discussion Handout
- Revised NEPA Triangle
- CE Review Form
- Review PIL

Roll call and introductions (Amy, all) 1000-1015

Project background – what got us to this point (Tami, all) 1015-1030

NEPA Quick Review (Amy) 1030-1045

- How a CE is created
- NEPA requirements for a CE (handout)
- NEPA Triangle (Revised NEPA Triangle handout)
- Other requirements – ESA, NHPA, tribal consultation

Farm Bill (Amy) 1045-1200

Requirements

(Three Handouts – 1. Healthy Forest Initiative and Healthy Forest Restoration Act Interim Field Guide; 2. Using Decision diagrams with the Field Guide; and 3. FAQs HFRA of 2003 Handouts)

- When it might be the best option
    - High level of collaboration required
    - Connected actions issues if used multiple times on the same forest?
- Decision Memo Requirements?
- Documentation!

Why here, why now discussion (all)

- Need for treatment / existing conditions
- Were connected actions considered? Why/why not?
- Why Farm Bill?

Collaboration (Amy, all) (One Handout - Collaboration Discussion)

- Collaboration and results so far
- Collaboration documentation ½ hour
- Additional insights
- Scoping - what's the plan?

Break (1200-1300)

Proposed Action Discussion and Revised Timeline (All) (Two Handouts – 1. Tamarack Project, 2. Walker County Farm Bill Project and 3.) (1300-1500)

- Tamarack Example
- Walker County Farm Bill Example
- Eastern Divide Insect and Disease Example
- Identify potential options for our project
- Should have regular IDT meetings (weekly, bi weekly, monthly?)

Notes:

Amy – only 5 projects litigated, FS won all – documentation was key
Looking at Farm Bill Act sections 602, 603, 605 CE categories for this project

PIL Review – **605 requires DM and extraordinary circumstances, 603 does not**
(b)(5); Deliberative Process Privilege [redacted]
PIL is fluid and ever-changing
Can do up to 3000 acres of physical treatment; project boundary can be larger
Wildlife and recreation included in the CE?
Wildlife habitat enhancement (not for a specific species) is an authorized by-product; Amy will add this to PIL and also add TNC as partner, monthly IDT meetings [dates TBD], insect and disease language, and send to Jay – Richard will sign at noon)
Tami says recreation will be included in other CEs like watershed
Tami will follow up with Shawn about 14-day comment period

Amy: Appendix B – Farm Bill CE Collaboration Plan (example) to show collaboration included in project file; format variable

RAC would be included as collaborative (b)(5); Deliberative Process Privilege [redacted]

John: Hoping to start prescribed fire council in WV

(b)(5); Deliberative Process Privilege [redacted]

Agenda items
Modified NEPA triangle for EIS and EA
CE not subject to appeals?
If T&E, you can start work in areas without them and hold off on others

First project in nation to not look at extraordinary circumstances; still want very short write-up form specialists (not a report, just what resources will be affected and design features w/ proposed action to get to level of insignificant effects); NEPA effects=pop, ESA=individuals; if find sig. effects in this CE, automatically triggers EIS; EA is if you don't know if there are sig. effects

Amy will post 2018 version of handbook for group

Looking at category 603 for the project (insect & disease infestation); policy says DM, law says no; no permanent new roads, must decommission new ones within 3 years (handbook)

Segmentation (connectivity) issue – if can show not connected and not taking larger project and chunking it up to get around it, you're ok (can have multiple CEs)

Amy will get with Jay about SOPA wording for addition

HFRA CE crosswalk for differences btwn/ CE categories

No mileage limit for temporary roads – based on LMP direction

CE review document checklist; [redacted]

(b)(5); Deliberative Process Privilege [redacted]

Amy will add definition of temporary road (and other definitions) to Pinyon

Amy went over examples of a DM and a phase 1 scoping letter

Also Walker Co. example: no 14-day scoping period, but 2 public meetings to satisfy NEPA requirement

Eastern Divide example because of proximity

No example discussion tomorrow, but will provide them to IDT for review

<u>Proposed action development for this project (targeting fire and insect/disease)</u>

<u>Map development</u>

Archy covered, botany within original 20,000 acres but ok with some historical surveys, stand exams by January

Need project area w/ archy, botany, and stand exams (why not wildlife? Design criteria/mit?); so original boundary, newer boundary, or new boundary

Boundary Tami chose is newer boundary (~47,000 acres) with caveat to work within areas where botany is complete (will not be discussed tomorrow)

Design criteria table to be developed, including stream buffers

(b)(5); Deliberative Process Privilege [redacted]

<u>Slope/soil</u>

(b)(5); Deliberative Process Privilege [redacted]

Helicopter can do slopes over 50%, on-ground limited to under 50% (SW07)

GSE pulled out wet soils; Richard says acidic soils are an issue, not hydric; if hydric soils impact our acreage, we'll have to address it (design criteria)

<u>Wildlife</u>

(b)(5); Deliberative Process Privilege [redacted]

Only a sliver of a bat circle in project area

<u>Fire</u>

No CWPPs in WV cities, so no worries there

WUI = ½ mile buffer (pulled from HFRA)

Class 2 or 3 fire regimes outside of WUI
5 fire starts since 1976, 4 occurred around Richwood area (3.0 Desert Branch western section); John may be able to incorporate the areas not in WUI with 1.5-mile buffer for Richwood
Fire regimes – mostly 1, a little 2, no known 3, but John says need to ground truth
Whole forest is insect disease area, after that, priority has to be within WUI; outside of WUI, we must stay in fire regimes 2 and 3 to apply cat. 603 (no DM required)
John's map and Jay's are different for fire regimes, so John will talk to Melissa Thomas van Gundy
Assumptions for moving forward:

(b)(5); Deliberative Process Privilege [redacted]

Criteria for work include insect/disease, fire, and/or healthy forest in general as long as in WUI

1. Insects/disease in these areas might include wood-rotting fungi, gypsy moth, weevil, beech scale, hemlock wooly adelgid, cherry scallop scale moth, oak in general have more pests than others; they are here and there but nothing to the degree to have units to target them
2. Fire and fuels – units to target (is there a need?): town of Richwood (defensible space) by thinning to reduce overstory, also any other areas of WUI; achieve by canopy thinning, shrub removal, and Rx burn for fire
3. Forest health: additions – regen, possibly small patches of hemlock, maybe some TSI, possibly a grapevine patch treatment, add open, grassy habitat (might not fit)
4. Rx fire
5. NNIS removal/herbicide (covered under HFRA); mechanical and chemical

Jane will get volume estimate

For tomorrow: tell IDT we're thinning canopies, removing shrubs, regen, treating noxious weeds (mech/chem) to go write analyses

(b)(5); Deliberative Process Privilege [redacted]

Important tasks/dates:
John and Jane: clarify proposed action for specialists by end of week
Middle of January to finish effects

Monongahela National Forest Gauley Healthy Forest Restoration Project CE

Agenda for Wednesday, November 6, 2019 IDT Meeting and Notes

GIS File Location: T:\FS\NFS\Monongahela\Project\GauleyIntegratedSpruceRestoration

Pinyon File Handouts: (b)(4) [redacted]

Resources:

- Healthy Forest Initiative and Healthy Forest Restoration Act Interim Field Guide
- Using Decision diagrams with the Field Guide
- FAQs Healthy Forest Restoration Act of 2003, amended as of December 20, 2018
- FS handbook – 17-21
- Collaboration Discussion Handout
- Revised NEPA Triangle
- CE Review Form
- Tamarack Project
- Walker County Farm Bill Project
- Eastern Divide Insect and Disease Project
- Review Gauley Healthy Forest Project Options

Roll call and introductions (Amy, all) 0930-0945

Project background – what got us to this point (Tami, all) 930-945

Farm Bill (Amy) 945-1045

Requirements

(2 Handouts – *FS Handbook*, *FAQs HFRA of 2003 Handouts*)

Collaboration (Amy, all)

- Collaboration and results so far
- Collaboration documentation
- Additional insights
- Scoping

Break - 1045-1100

PIL / Timeline (Tami) 1100-1115

HFRA CE Checklist (Amy) 1115-1200

Break (1200-1245)

Proposed Action Discussion (All) 1245-1400

Assignments & Next Steps (Tami) 1400-1500

IDT meeting dates

December 10th 1030 – 1500 in person

Jan. 21st 100 - 1600 phone

Additional Meetings TBD

Notes:

Attendees: Tami Conner, Jay Martin, Kim Tarter, Richard Raione, Jane Bard, Tim Brake, Kyle Tasker, Amy Coleman, Adrienne Nottingham, Tim Tolley, Karen Stevens, Kelly Bridges, Gavin Hale (phone), Will Wilson (phone), WJ Cober (phone), Jeremy Ash (phone), Cheryl Tanner (notes)

Richard gave quick summary of CE category (3000-acre limit)
Tami gave agenda review

Homework/important dates:

1. **Read documents in Pinyon that were sent in Jay's email (handbook and FAQ docs are critical, also Farm Bill Act has definitions)**
2. **Send Jay documentation of interaction w/ partners (from yr. 2000 for now) by Dec. 13**
3. **Provide design criteria by Nov. 13 mtg. (will be designing a table if no place for it in checklist)**
4. **Nov. 14 @ 9:30 reduced group IDT to firm up proposed action**
5. **CE checklist documentation due by January 17**
6. **IDT mtg. Dec 10**

***Modified CE checklist will be the documentation tool that captures all documentation for effects (no EA)**

Farm Bill Act (FBA) Discussion

Within FBA are sections 602, 603, 605 - we are focusing on **603**

603: Has insect/disease and fire components – must be within WUI (fire is key driver for CE)

No new permanent roads

Temporary roads allowed as long as rehabbed (need definition) w/in 3 years

(b)(5); Deliberative Process Privilege

[redacted]

Proposed Action (TBC Nov. 14)

Jay gave recap of project development based on WUI

No roadless

WUI buffers will expand for evacuation routes (John working on this)

(b)(5); Deliberative Process Privilege

[redacted]

Worked on clipping timber units to WUI
We have FRCCs 1, 2, 3 – our focus is 2, 3 but we only have FRCC 2, so our focus is **FRCC 2**
Condition classes may change based on John's conversation w/ Melissa Thomas Van Gundy
If not enough acreage (regen, thinning, FRCC 2) in western (Desert Branch/Richwood) focus area, may expand to the WUI areas to the east
Also, mechanical/chemical noxious weed treatment and road mowing (tier to NNIS EA)
Will follow up with John about fire line disturbance levels
Wildlife openings will be by-product
Project area will be majority 3.0 but also possibly 4.1 and 6.1 additions (Jane's regen/thinning additions pending)

<u>Resource Area Discussions</u>

<u>Soils</u>
Most of area is high risk for acid deposition (based on chemistry); SW-08

(b)(5); Deliberative Process Privilege

[redacted]

SW-07 a.: 40-50% slope analyzed on case-by-case basis; dry areas not as worrisome, wet soils are riskier with mechanical equipment; design criteria = increase seeding/mulching, history shows not very successful, but depends on local factors
SW-07 b.: 50% slope prohibited without IDT approval (looking at helicopter to avoid this issue)
SW-07 c.: The majority of project area is Pottsville geologies, but there is a small portion of the eastern part of the project area underlain by Mauch Chunk. Mauch Chunk has shrink-swell clays that expand when wet and contract when dry. The soils that form from Mauch Chunk geologies are at increased risk of mass wasting and landslides. (particularly applies to areas with slopes greater than 15%)SW-07 d.: Equipment use is normally prohibited when soils are saturated. Cribbing as a design criterion if possible in wet areas.

Wildlife

Design criterion: 150' buffers around rocky habitat for 3 RFSS (WF-01 applies, 150' buffer based on conservation assessment); (b)(5); Deliberative Process Privilege [redacted]

Botany

VE-13: avoid negative effects of known populations (design criteria = avoidance w/ buffer based on species)
VE-22 = NNIS
VE-21, 23 design crit.
VE-24
If management actions in 4.1, guideline 4110 applies: restore, maintain, or enhance where spruce component (b)(5); Deliberative Process Privilege [redacted]

Watershed/fisheries

SW-34, 37 (maintain buffers along perennial and intermittent streams)
SW-35 (crossing – do it perpendicularly)
Can we put landings and roads outside WUIs?
FR-15
RFSS design crit. covered by other standards
WF-14 (brook trout avoidance)

Net steps

Meet Thursday (Nov. 14) to continue
Desire clear definition of temp roads from analysis (may not happen)
Update CE checklist by Thursday
Line out proposed actions and units by Thursday

Monongahela National Forest Gauley Healthy Forest Restoration Project CE

Agenda for Wednesday, November 14, 2019 IDT Meeting Agenda and Notes

GIS File Location: T:\FS\NFS\Monongahela\Project\GauleyIntegratedSpruceRestoration

Pinyon File Handouts: (b)(4) [redacted]

Project Area Refinement – (Amy Mullins) (0930-1130)

- Landings
- Roads
- Other areas that need to be excluded
- Areas that need to be included to increase project acreage?

Collaboration Documentation Brainstorming Session (All) 1030-1200

- December 13th deadline
- Information template?

CE Review Checklist (Amy, Jay, Tami) 1230-1330

- Specialist documentation is due January 17th
- Group checklist review
- Please save your version of the checklist on box as follows:
    - CE-ReviewCHFP_*YourName*
- All information collected from the group will be edited into one document the week following the 17th. There will be one week of review time for leadership and specialist editing.

Design Criteria – (Amy, Jay, Tami) 1330-1430

- Due December 10th
- Will be in table form (review template as a group)

GIS Layers 1430-1500

- Specialists needs for GIS layers
- Changes needed due to discussions with Amy Mullins?

Next Steps 1500-1530 (Tami, Jay, All)

- Informal discussions with DNR and DOF
- RAC involvement
- SOPA

Meeting Reminders!

- December 5th and 6th - in-person meetings for specialists to discuss effects analysis
- Next IDT Meeting is December 10th

Notes:

- Personnel Attendance – Tammi, Greg, Richard, Amy Mullen, Amy Coleman, John Frye, Kyle, Jane, Tim Tolley, Jay & me; via phone – Amy Torres & Gavin
- Tasks – Amy Mullen identify landings/roads/helicopter/conventional by next week to do refinement; All specialists effects analysis by January 17th; Jane list existing roads that need maintenance and grapevine design criteria, and check unit stand data; WJ units that fall in high scenic integrity; John Frye will provide shapefiles for his proposal to cut shrubs near WUI by next Monday and identify the WUI structures in Bear Run
- Focusing in GISR project boundary
- New temporary roads allowed but must be decommissioned; (b)(5); Deliberative Process Privilege [redacted] temporary roads can be constructed within the GISR project boundary
- Grapevines and camphor vines need cut for logging safety 3 growing seasons prior to logging operation; this treatment is also required in regen areas
- (b)(5); Deliberative Process Privilege [redacted]
- Stand 6922 (150 ac.) & 6901 (108 ac.) defer 10 years
- Slope greater than 40% pull back 200 ft., if we don't buffer than tree tops need removed from roadways and flaggers required during logging operation
- Stand 6311 drop lower half that's steep from the 2,800 feet contour down, road just east need maintenance
- Multiple units (5/6 plus) near stand 6307 along Cranberry Road need landing/road refinement
- John Frye – pile/burn Summit Lake's horse camp near Fisherman Trail head
- Gauley RD's collaborative projects are; (1) Gauley RD Red Spruce Restoration a 3,000 ac. 2014 Farm Bill EA project signed Dec. 2014 working with CASRI and WV TNC; (2) GISR project that was in 2017 was a collaborative with CASRI and the TNC; (3) WVDNR, CASRI and the Monongahela NF collaborated to produce a red spruce management recommendation map around 2010/2012?
- Resource review checklist is in Pinyon & BAE due January 17th; document Forest Plan, literature cited, methods, assumptions, design criteria
- Tammi – "no more added proposed actions as of today."
- Temporary roads and HFRA 603 – roads can go outside of the WUI areas and do not count as part of the 3,000 acres.
- Clearly7 state design
  - Cut 3 growing seasons prior to the timber harvest – not in forest plan

  - Grapevine – for safety concerns – wait three years to work on Grapevine
  - Next week Amy M will look on the ground to get a better sense of landings.
- Desert Branch North Area
  - Thinning will not regenerate oak acres, but all other areas would benefit wildlife.
- Roads can be temporarily constructed within the project area and not restricted to just the treatment area.
- Amy M. will write the design criteria for treatments in Grapevine area as it is not already in the FP.
- (b)(5); Deliberative Process Privilege [redacted]
- Collaboration Documentation
  - Outreach to diverse interests (from Jane)
    - Lower Willows?
    - Mailing lists, public mailings, public meetings
    - Field trips as part of past scoping
    - Not really had any public meetings for timber harvest
    - Stewardship public meetings
    - Gateway Communities Initiative (very diverse and collaborative) – rec and tourism
    - Joint field trip with industry and other forests and private lands
    - Partnerships with Wild Turkey Federation and Boy Scouts
    - Informal workshops
    - Community health initiative – not really focused on fire aspect but there is a degree of concern
    - Fire department
    - Trout Unlimited – downstream strategies for road decommissioning
    - ? Valley Institute
    - Youth Conservation Corp
    - AFHA Americorp
    - Municipal Watersheds?
  - Task – Amy/Jay add these as bullet points for Jane to flesh out (Due on December 13th)
- As a group we need to sort out the difference between skid trails and skid roads
- Temporary road construction and decommissioning will be done according to BMPs.
- Design Criteria
  - Standards and guidelines from each resource is not necessary
  - Add nonstandard and guideline DCs to the DC table
- Proposed Action
  - TSI – add to WUI boundary
  - North end of Summit Lake – add to WUI boundary
  - Will add structure buffer to PA for property protection – John F.
  - We need to get a list of roads that needs upgrading and put them in the PA.
- Scoping
  - There will not be a 14 day scopiong period as per Shawn
  - All meeting with the public will be added to the collaboration document

- RAC involvement coming up will be in the collaboration document
- Project is already in the SOPA

- Meetings
  - Going to be at the SO on December 5th and 6th so Shawn can also attend the meeting
  - These meetings will be to get the proposed action down and to work on the design criteria and effects analysis based on law and regulation
  - December 10th is the next IDT meeting

From:	Raione, Richard P -FS
To:	Conner, Tami -FS; Martin, Jay - FS; Fry, John - FS; Bard, Jane F -FS; Walter, Terry J -FS; Perrine, Kelly R -FS; Tarter, Kim - FS
Subject:	RE: Request for Meeting
Date:	Thursday, November 21, 2019 2:16:01 PM
Attachments:	image001.png image002.png image003.png image004.png

This meeting with Mr. McCurdy will occur on Dec. 12 at 900am at our office in Richwood. I talked with him this morning and provided the NEPA background under Section 603 and potential proposed actions under the Fire/Insect and Disease components. Backup plan if needed will be the use of a bridgeline which Kelly Perrine will establish shortly for 0900 to 1100 for 12 December.

Jay – please include this email as part of the Project Record, thanks.

Richard Raione, COR, PG, CPG, CGWP
District Ranger

Forest Service
Gauley Ranger District, Monongahela National Forest

p: 304-846-2695
f: 304-846-4307
richard.raione@usda.gov

932 North Fork Cherry Road
Richwood, WV 26261
www.fs.fed.us

Caring for the land and serving people

From: Cully McCurdy [mailto:cmccurdy@nwtf.net]
Sent: Thursday, November 21, 2019 9:25 AM
To: Raione, Richard P -FS <richard.raione@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Fry, John - FS <john.fry@usda.gov>; Bard, Jane F -FS <jane.bard@usda.gov>
Subject: Re: Request for Meeting

Hi Richard,
I could meet December 12 of the dates listed. January is hit or miss depending on what days you put out for consideration.

Thanks, Cully

On Thu, Nov 14, 2019 at 4:50 PM Raione, Richard P -FS <richard.raione@usda.gov> wrote:

> Good Afternoon:
>
> We are planning a few proposed actions on the district here, not to exceed 3000 acres, that

fall under the provisions of Section 603 of the Healthy Forest Restoration Act. These proposed actions relate to Wildland Urban Interface areas which are targeted to reduce the risk of insect and disease infestation, and reduce our hazardous fuels.

I'd like to schedule a meeting with you this coming December or in January 2020 for an hour or so to go over the highlights of this project. Would December 9, 11 or 12 work; are there any dates in January 2020 that would be more convenient?

Looking forward to hearing from you and introducing you to this particular project which we are calling the "Gauley Healthy Forest Restoration Project". Thanks.

Richard Raione, COR, PG, CPG, CGWP
District Ranger

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Caring for the land and serving people

--

Patrick "Cully" McCurdy

District Biologist - VA/WV

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Email: cmccurdy@nwtf.net

National Wild Turkey Federation

770 Augusta Road | Edgefield, SC 29824

803-637-3106 | www.nwtf.org

Monongahela National Forest
Gauley HFRA CE

Meeting Notes
IDT Member Meetings with Forest Supervisor and District Ranger
December 5 and 6, 2019

Meeting Objective: A subset of IDT members met in person with the Ranger and Forest Supervisor to review the parameters of their effects analyses before they began writing the documents. Specialists were asked to provide an overview of their planned design criteria, applicability of forest plan standards and guidelines, methods, assumptions, indicators to be analyzed, and the anticipated effects. The intent was for specialists to describe their anticipated analysis process and get feedback from the Responsible Officials so as to avoid any surprises later in the process.

Summary of Meetings Held: (1) Dec 5 Adrienne Nottingham (Soils); (2) Dec 5 Kyle Tasker (aquatics); (3) Dec 5 Amy Coleman (botany); (4) Dec 6 Tim Tolley (hydrology); (5) Dec 6 Kim Tartar and Cheryl Tanner (wildlife)

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(1). Soils

Attendees: Shawn Cochran, Tami Conner, Adrienne Nottingham, Jay Martin, Richard Raione (phone) and Jane Bard (phone)

Tami- provided an overview of meeting objectives (listed above)

Adrienne-

- Project Area – majority of geology is acidic sandstone on Pottsville soils. Most of the proposed actions are on acidic deposition soils – corresponds with red spruce ecosystems
- High acidic = poor nutrients = high risk for impacts
- Mauch Chunk – clay = slippage potential
- Soupy mess when disturbed
- Web soil survey map – colluvial areas are likely more wet than what is mapped
- Hydric – soils surveys for calcium, aluminum ratio
- Tier to the existing data – 95-100 risk to forest health
- If disturbed nutrient depletion will occur

(b)(5); Deliberative Process Privilege
[redacted]

Shawn-

- Natural events are an acceptable disturbance regime. (b)(5); Deliberative Process Privilege [redacted]

Adrienne-

Skid trail landings – soil quality detrimentally impacted – compaction decreased root penetration – ripping to mitigate this – subsoil has no nutrients to give.

Shawn-

- We need to focus on the scale across the project area of the temp roads – they are a very small percentage of the overall landscape we manage. [redacted] (b)(5); Deliberative Process Privilege [redacted]
- Rehab to BMP's, tank traps, seeding and water bars

Adrienne – BMP's would not meet mitigation for decompaction. Would need to pull the contour to get to neutral.

(b)(5); Deliberative Process Privilege [redacted]

Shawn

- Need to know scope and intensity of how we will be decommissioning roads for this project - not arbitrary decommissioning.
- Level of disturbance needs to be defined up front in the analysis
- Use models –find out level of disturbance.

Adrienne- Some models are not applicable for our location.

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(2) Aquatics

Attendees: Attendees: Shawn Cochran, Tami Conner, Amy Coleman, Kyle Tasker, Jay Martin, Amy Torres (phone), Richard Raione (phone) and Jane Bard (phone)

Tami – provided an overview of the meeting objectives (listed above)

Kyle -

The project area covers three watersheds; T&E species is candy darter and 4 aquatic RFSS

Baseline conditions – system of skid trails as historic features

Soil sensitivity, slopes, exposed soil- the existing effects set the disturbance threshold

Shawn-

(b)(5); Deliberative Process Privilege [redacted]

(b)(5); Deliberative Process Privilege

[redacted]

Richard – we need to incorporate the liming for trout streams into the baseline conditions because that improves the water quality in a measurable way

Amy T – Point of the Project is an ecologically healthy forest – minor or short term context – passive restoration – Forest health near term for advancing concern - scope is limited.

Shawn-

- Setting baseline – current conditions = existing conditions
- CE = no significant effect

(b)(5); Deliberative Process Privilege

[redacted]

Kyle-

Soils are the primary impact to aquatics from roads and landings – indicators include sediment production, hillslope mobility, stream temp, water quantity, riparian condition – these indicators are all qualitative – we don't measure any of these items – when sediment gets in a stream it raises the temp
Shawn-

- think about how sediment/runoff loses temp as it moves through the system to the river
- its very hard to make an effect determination based on these qualitative items – and very hard to make a basis of significance
- we need to set up long term monitoring sites to get quantitative data – need to be able to check water quality before and after project implementation over time

Kyle-

(b)(5); Deliberative Process Privilege

[redacted]

Shawn-

Plan for success – design features, implementation guide and national BMPs

(b)(5); Deliberative Process Privilege [redacted]

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(3) Botany

Attendees: Shawn Cochran, Tami Conner, Kyle Tasker, Amy Coleman, Jay Martin, Amy Torres (phone), Richard Raione (phone) and Jane Bard (phone)

Tami- provided an overview of the meeting objectives (listed above)

Amy C – there are 4 TES: Virginia spirea and rock cress have no occurrences, RBC is not known to occur but has potential suitable habitat (nearest location on white oak rd- erfo), small whorled pagonia is not known to occur but there is potential suitable habitat (watoga state park is nearest population)

(b)(5); Deliberative Process Privilege [redacted]

Amy C – there are 70 RFSS plants forest wide – many are eliminated due to lack of presence in the project area – of the 70, there are 14 in the project area

> There are 3 long stock holley's that have been found in one unit and the mitigation will be that no roads or landings can be in those places
>
> RFSS will be grouped by habitat for the effect analysis
>
> There are also rare communities – rock outcrops from the forest plan, in the project area (pg 3-115 on forest plan EIS – not in the forest plan itself) – VE14 applies
>
> There is also a minimum dynamic area – in the forest plan EIS – 10,000 acre tracts that wouldn't have management to preserve old growth – high elevation spruce.

---

(4) Hydrology

Attendees: Shawn Cochran, Tami Conner, Tim Tolley, Jay Martin, Amy Torres (phone), Richard Raione (phone) and Jane Bard (phone)

Tami- provided an overview of the meeting objectives (listed above)

(b)(5); Deliberative Process Privilege [redacted]

(b)(5); Deliberative Process Privilege [redacted]

Shawn -

The WEPP model looks at trails and roads within a watershed and percent sedimentation based on climate with regional coefficients – given precipitation and conditions on the ground, it gives an output you can use to develop mitigations

(b)(5); Deliberative Process Privilege [redacted]

Tim-

Flow volume won't change until you reach 20% basal area of a catchment - (b)(5); Deliberative Process Privilege [redacted]

Shawn -

(b)(5); Deliberative Process Privilege [redacted]

(b)(5); Deliberative Process Privilege

[redacted]

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(5) Wildlife

Attendees: Shawn Cochran, Tami Conner, Kim Tarter, Cheryl Tanner, Jay Martin, Richard Raione (phone), Jane Bard (phone) and Amy Torres (phone)

Tami- provided an overview of the meeting objectives (listed above)

BA – written by Kim; BE – written by Cheryl

Kim - Federally listed species – 2 bats (N.long eared and Indiana) and many RFSS species - the forest plan BO terms and conditions have been worked into the forest plan as stds/guides

(b)(5); Deliberative Process Privilege

[redacted]

RFSS Species –

Cheryl – there are some beneficial effects to birds but there are 2 mitigations

(b)(5); Deliberative Process Privilege

[redacted]

Cheryl – the limbs aren't helpful, but landings are good areas for planting; second mitigation:

- For green salamanders we need to buffer rock outcroppings – green salamanders can tolerate dryer conditions from other salamanders – buffer only in clear cuts and only the largest outcrops that also have needs for archy, timber rattlesnake, and green salamander

(b)(5); Deliberative Process Privilege [redacted]

(b)(5); Deliberative Process Privilege [redacted]

Cheryl – I have monitored over 100 occurrences of green salamander on the district finding adults, juveniles, and eggs – other districts aren't monitoring but they have dryer conditions and less suitable habitat. There is more high quality habitat on this district.

(b)(5); Deliberative Process Privilege [redacted]

Collaborative Relationships fostering resource management, connecting the public with the Mon National Forest and promoting outdoor and resource education:

Americorps in long term partnership, both AFNHA and Vetsworks, since 2009 has resulted in many important resource improvements in the local area, including pollinator plantings, environmental education, district cleanups, planting of American chestnut and butternut trees as well as important work throughout the Mon NF.

DNR, long term partnership with formal agreement to manage habitat.

The American Chestnut Foundation long term partnership that resulted in many progeny test plantings on forest, work of an intern they provided to monitor plantings forest wide, supervised out of Gauley RD. We had a formal Mon NF agreement for 5 years.

The National Wild Turkey Federation had several formal stewardship and other agreements with the Forest, including one in 2012 (?) within the GHFRA project area. NWTF worked with DNR and the Boy Scouts of America to establish small wetlands in the Desert Branch area. Scouts did volunteer work here, at Summit Lake, at Camp Caesar and Blue Bend during the first national jamboree held at Summit Bechtel.

Cherry River Elementary school long term informal partnership on environmental education, outdoor activities. Currently, they list us their major partner in their West Virginia Department of Education 21 Century Community Learning Center/Summer Boost Camp funded largely by Save the Children. The forest provides outdoor activities including bike riding, fishing, planting pollinators, establishing gardens and much environmental education.

CRE for many years has held school wide field trips to the CMNC, Falls of Hills Creek, the glades and more locations to provide outdoor guided education. Their 5th and 6th graders annually do a bike ride through the 16 mile Cranberry Backcountry which has been going on each year for about 8 years. On the first of these trips, Americorps and forest staff played a larger role in planning and safety, but school personnel, parents and volunteers have largely taken over in making this an event to build fitness, self confidence and environmental knowledge.

Richwood Area Chamber of Commerce long term informal collaboration to enhance local knowledge and use of the forest. District rangers and staff have long attended their monthly meetings and helped out with the long running Triathlon (under special use permit and hosted by many volunteers) and other activities.

District staff are currently working as active members in a series of informally organized community development groups that are affiliated with nation-wide development organizations, such as Mainstreet (?). The local groups are Blueprint, Hubcap, Richwood Rising. Many relatively small grants have been received for things like signs, main street lighting, attendance at development conferences such as the National Mainstreet Conference, business development workshops. Participation in these groups helped other beneficial projects to be funded, such as the building of new housing after the 2016 flood.

ENFIA, long term partnership with the CMNC which provides environmental education and other items for purchase at CMNC and the Gauley RD office. This entity has also provided many small grants to the forest/district for things like interpretive signs, including four historical displays connecting the forest with the town of Richwood. These displays are located at the Richwood Heritage Center on Main St. in Richwood.

Many groups and individuals participated in Stewardship collaborative meetings starting around 2007, which resulted in a series of IRTC Stewardship timber sales on the Gauley Ranger District, as well as enhancing communication that resulted in other needed work being done on private land as well. Retained receipts from these sales have funded many ecosystem restoration projects on the entire Mon NF.

Healthy Southern West Virginia is working to inventory needs related to healthy communities with FS help in the Richwood and Cowen areas.

Camp Caesar, long term partnership in helping to provide science and environmental education in their location in Webster County. This historic camp has a special use permit for Lake Caesar.

The Richwood Heritage Center is helping to increase understanding of the rich forest history of the area, in informal partnership with the FS. This partnership got off the ground (in 2016?) when the district held a series of "Lunch and Learn at the FS" at the RD office, where forest heritage program manager, a volunteer historian and the district ranger provided a series of lectures about forest history and management and brought local history buffs and others together to get started on the project and begin planning for the historic displays.

Cranberry Tri-Rivers Rail Trail is located partly on NF lands and local managers are beginning to work more closely with the NF in remedying resource concerns and providing and increasing recreation access to the Mon NF.

The Forest Supervisor, zone timber staff and district ranger have participated in the Forestry Forum in the Summersville area for 3 years or so.

Weyerhaeuser Corporation became aware of forest health concerns in the local area in black cherry. A collaborative joint tour was arranged by their staff and the zone silviculturist in June of 2018 that brought FS research, forest health protection and national forest staff from 2 national forests together with industry reps from two corporations and several states to view and discuss these issues and begin to address them through management and research.

Described and compiled by Jane Bard

12/6/2019

Summary of MNF Recreation Group Collaboration Efforts

Recreation Staff of the Monongahela National Forest has not collaborated with partners specifically on the Gauley Healthy Forest Restoration Project; however, Recreation Staff has previously collaborated with partners in trail maintenance, campground volunteer campground host program, Youth Conservation Corps, and other volunteers in trail and recreation site maintenance and promotion activities. The groups in particular that have collaborated with the Forest include:

Monongahela Outdoor Volunteers (MOV: This group has provided several hundred hours of volunteer service to maintain trails as well as promote trail use, specifically mountain bike use, of trails. They have hosted youth field days in which they have provided bicycles and safety equipment as well as instruction on riding.

New River Gorge Trails Alliance: This group has provided several hundred hours of volunteer service to maintain trails within the area.

Campground Host Program: Volunteers are integral to the operation of Forest Service campgrounds. Summit Lake Campground has hosts assist with maintenance as well as serve as ambassadors to the site.

Youth Conservation Corps: The Forest has hosted both local and residential YCC crews. Crews conduct restoration work on trails and maintenance of campground facilities each year.

Summary of MNF Watershed Group Collaboration Efforts

The Watershed Group of the Monongahela National Forest has not collaborated with partners specifically on the Gauley Healthy Forest Restoration Project; however, the Watershed Group has previously collaborated with partners on stream and watershed restoration activities as a part of various integrated projects. Some of these integrated projects are Upper Greenbrier North, Big Mountain, Upper Williams River Watershed Restoration, and others. These activities include 1) road decommissioning, 2) aquatic organism passage (AOP) barrier removal through road-stream crossing replacement, 3) large woody material (LWM) stream enhancement, 4) riparian enhancement (e.g. fencing, reforestation), 5) forest-wide stream liming.

Road decommissioning: The MNF (watershed group) has collaborated (partnered?) with Trout Unlimited (TU) and Canaan Valley Institute (CVI) to decommission roads and thereby restoring the sites to more natural conditions. The activities of these partnerships have also included surveying legacy roads, unneeded system roads, temporary roads, etc., to determine their potential to impact aquatic and hydrologic resources as well as implementing the treatment of the site. The objectives of these efforts are aligned with the Forest Plan, the Forest Service Handbook, and the National Core BMP Technical Guide (FS-990a) in that they help restore hydrologic function and flow regimes, reduce erosion and sedimentation (especially long-term), and help restore resource production where roads have compromised stream channels and upland areas.

Aquatic Organism Passage (AOP): The MNF (Watershed Group) has partnered with TU and CVI to survey road-stream crossings for their potential to create passage barrier to aquatic organisms as well as inhibit the passage of storm flows and associated sediment and bedload material. Crossings that presented concern as passage barriers were prioritized for replacement. This collaborative effort included the design and implementation of crossings selected and funded for replacement. An AOP workshop was held on the Forest in 2013 and was attended by West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR), West Virginia Division of Highways (WVDOH), US Fish and Wildlife Service (FWS), Army Corp of Engineers (COE), and others

Large Woody Material (LWM): The MNF (watershed group) has partnered with Trout Unlimited (TU) to improve stream habitat quality by the strategic addition of LWM to the streams using both mechanical equipment such as excavators and spider hoes, as well as by using hand equipment.

Trainings and workshops: AOP workshop in 2013 and LWM workshop in 2014 were held on the Forest and were attended by West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR), US Fish and Wildlife Service (FWS), Army Corp of Engineers (COE), and others.

Summary of MNF Soils Resource Program Collaboration Efforts

The Soils Resource Program of the Monongahela National Forest (MNF) has not collaborated with partners specifically on the Gauley Healthy Forest Restoration Project. The development of this project did not utilize products derived from the long-term collaborative efforts between the Forest and the primary partners of the Soil Resource Program – West Virginia University, USDA Natural Resource Conservation Service – National Cooperative Soil Survey, and the USFS Northern Research Station (NRS01).

However, the Soils Resource Program has and is currently collaborating with partners on soil survey mapping updates, ecological inventory mapping in the red spruce and oak hickory ecosystems, landscape scale restoration techniques for soil quality improvements, and outreach and education in a general forest-wide concept. This combined collaborative effort has benefited many of the Forest's projects including Mower Tract, Upper Greenbrier North, the Big Mountain, Sharp Knob, Greenbrier South East, and the Lower Williams Liming projects. Data was collected in all of these project areas and across the forest to develop land management tools to inform project development, integrate landscape level resource connections, and provide recommendations for mitigations, design criteria and restoration recommendations. These activities include 1) soil survey inventory and updates, 2) ecological site description (ESD) development, 3) soil carbon BMPs for red spruce restoration efforts and 4) soil nutrient restoration.

Soil Survey Updates and Mapping: The MNF Soil Resource Program has collaborated with the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and West Virginia University (WVU) Division of Plant and Soil Sciences (PSS) to facilitate research and field weeks with the intent of gathering site-specific soil physical and chemical data that could be used to update the NRCS soil survey maps in this region. These collaborative efforts to update soil surveys on the MNF have helped the forest to meet the NEPA requirements of best available science and are also used to inform landscape scale restoration. The objectives of these efforts are to help move the soil resource towards the desired conditions outlined in the MNF Land and Resource Management Plan.

Ecological Site Description Development: Updated soil surveys as outlined above provide the foundation for ESD development. The MNF has been heavily impacted by historic anthropogenic activities which resulted in drastic changes to both the landscape as well as the ecosystem services which the landscape can provide. These landscape alterations have made it challenging to identify areas to prioritize various types of restoration (red spruce, oak-hickory, etc.). However, because the soil changes very slowly with time, it can be used as a record of historic conditions. Soil physical and chemical properties can be used to determine historic vegetative communities present at a given location- especially for the red spruce ecosystem. For the past decade, partners have been working to develop methodologies to create ESDs. These ESDs can be used across the MNF to prioritize areas for both red spruce and oak-hickory restoration.

Terrestrial Liming Project: The Soil Resource Program recently executed the Lower Williams Liming project (2017-2018). This project was proposed as a restoration project to improve soil quality in an inherently acidic ecosystem that has historically received high levels of acid deposition in the past century. The Forest partnered with professors and graduate students at WVU Division of Plant and Soil Sciences to develop a monitoring protocol to evaluate effects of terrestrial liming on soil quality.

Holcomb Vernal Pool Study: Dr. James Thompson, West Virginia University Soil Science Professor, is collaborating with the MNF and NRCS to conduct research on the Hydropedology of Vernal Pool Systems (NE-1438). The objectives of this project are to (i) improve the understanding at regional scales of how vernal pool ecosystems differ in distribution, hydrology, hydroperiod, redox chemistry, and carbon storage flux, (ii) identify the need for additional hydric soil indicators for northeast vernal pools, (iii) develop morphometric indices of the hydroperiod within vernal pools, and (iv) estimate the current density of vernal pools within each of the subregions and develop predications of the numbers that have been lost because of disturbance. The study location is located on the Gauley Ranger District in the northern hardwood landscape in the vicinity of Holcomb Run.

Trainings and Workshops: Each year the MNF Soils Resource Program cohosts trainings and workshops with their partners (NRCS, WVU and other universities and national forests within the region). These trainings and workshops are meant to introduce new technologies and science to both current and new staff. These events also offer the opportunity to have soil scientists from the region to collaborate while simultaneously gathering data for specific and defined goals and objectives.

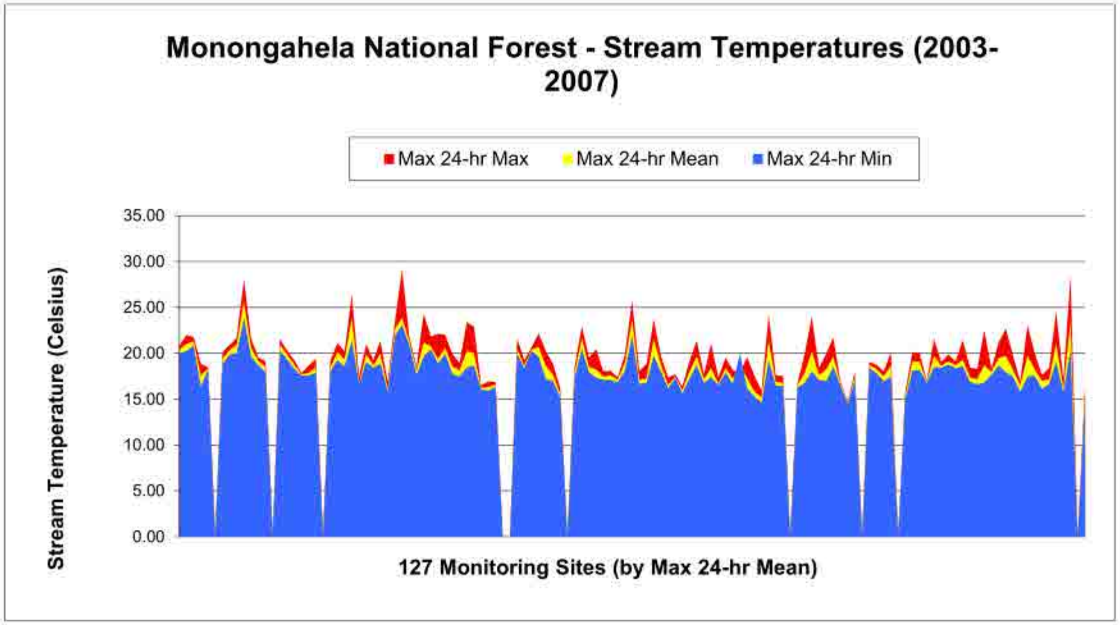
Summary of MNF Ecology Program Collaboration Efforts

Central Appalachian Spruce Restoration Initiative (CASRI) – a partnership of diverse interests with a common goal of restoring historic red spruce-northern hardwood ecosystems across the high elevation landscapes of Central Appalachia. It is comprised of private, state, federal, and non-governmental organizations which recognize the importance of this ecosystem for its ecological, aesthetic, recreational, economic, and cultural values.

Rivers and Gorges Cooperative Weed and Pest Management Area (RGCWPMA) – a partnership between federal, state, and local agencies, community associations, non-profits organizations, and private landowners aimed at coordinating efforts and programs for addressing the threat of non-native invasive species in south-eastern West Virginia.

West Virginia Division of Natural Resources, Good Neighbor Agreement – cooperative effort between the State of West Virginia and the Forest Service to conduct botanical surveys for federally threatened and endangered species and Region 9 Regional Forester's Sensitive Species for the Monongahela National Forest as well as non-native invasive species. The Monongahela hosted a WVDNR botanist in 2018 at the Marlinton Ranger Station and some surveys were conducted in the Gauley Healthy Forest Restoration project area.

Chicago Botanic Garden, Conservation and Land Management (CLM) internship program – places early-career scientist in five-month paid internships to assist professional biologist with land management and conservation projects. The Monongahela hosted one intern in 2018 and two interns in 2019 on the Marlinton-White Sulphur District.



Monongahela National Forest - Stream Temperatures (2003-2007)
Max 24-hr Max
Max 24-hr Mean
Max 24-hr Min
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Stream Temperature (Celsius)
127 Monitoring Sites (by Max 24-hr Mean)

Project Name: Gauley Healthy Forest Restoration
Analysis Area: Richwood Wildland Urban Interface
Threatened, Endangered, and Sensitive Plants – Likelihood of Occurrence Table
Monongahela National Forest

Threatened and Endangered PLANTS

Shale Barren Rock Cress *Arabis serotina* *Status:* LE/G2/S2

Habitat: Biennial herb in the mustard family endemic to shale deposits, occurring only on sparsely-vegetated xeric, south or west-facing shale slope openings (barrens) and shale woodlands adjacent to the shale openings at elevations from 1300 to 2000 ft. (NatureServe 2011).

MNF Range: Shale barrens and shale woodlands in the White Sulphur Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No shale barren habitat**

Small-whorled pogonia *Isotria medeoloides* *Status:* LT/G2/S1

Habitat: A small perennial herb in the orchid family that grows up to 11 in. in height and has a whorl of 5 or 6 leaves near the top of the stem and beneath the flower(s) (NatureServe 2011). Prefers deciduous or mixed-deciduous/coniferous forest in generally second or third growth successional stages, and occurring in both fairly young forests and in maturing stands. Majority of occupied sites have: sparse to moderate ground cover, relatively open understory, proximity to logging roads, streams or other features that create long persisting breaks in canopy, and highly acidic nutrient-poor soil (USFWS 1992).

MNF Range: Known from a site in Greenbrier County, White Sulphur Ranger District, but has not been seen in recent revisits (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Virginia Spiraea *Spiraea virginiana* *Status:* LT/G2/S1

Habitat: Clonal shrub found on damp, rocky banks of larger high gradient streams, flood-scoured mouths of side streams, rocky isles, and seasonally flooded side channels, in shrub thickets between the river and forest. WV occurrences are among large boulders, flat rock, and flood debris along scoured stream-sides. Soils are silt and sand. The elevation ranges from 1000-1800 ft. (NatureServe 2011).

MNF Range: Known from one site in White Sulphur Ranger District, Greenbrier Co., near Greenbrier Youth Camp (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Running Buffalo Clover *Trifolium stoloniferum* *Status:* LE/G3/S2

Habitat: A perennial clover with long basal runners and creamy-white flower heads on ascending stems found on fertile soils in semi-shaded habitats. Most often found on landscapes underlain with limestone or other calcareous bedrock, but not exclusively. Reported from a variety of moderately disturbed woodland habitats, including floodplains, stream banks, grazed woodlots, savanna-like forests, mowed paths, jeep and skidder trails, mowed wildlife openings within mature forests, old farmsteads, cemeteries, and steep, weedy ravines (NatureServe 2011).

MNF Range: The most numerous occurrences of this clover are on limestone soils on the Cheat and Greenbrier Ranger Districts, however there are a few sites on Marlinton, Potomac, and Gauley Districts as well (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Regional Forester's Sensitive Species PLANTS

Northern Bentgrass *Agrostis mertensii* *Status:* G5/S1

Habitat: A northern circumboreal grass preferring open riparian areas or peaty or rocky soil at high elevations (Strausbaugh and Core 1977, B. McDonald pers. comm. 2000, Gleason and Cronquist 1991). Known from dry-mesic heath alpine meadows in New England (St. Hilaire and Burbank 2003).

MNF Range: Known along the upper Shavers Fork in Pocahontas and Randolph Counties, also Laurel Fork in Randolph County (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no high elevation riparian habitat**

Allegheny Onion *Allium allegheniense* *Status:* G3?/S2

Habitat: Occurring on thin soils around mafic or calcareous rock outcrops (NatureServe 2011) in mature oak and pine-oak forests at higher elevations east of the Greenbrier River (R. Bartgis, pers. comm. 2006).

MNF Range: Occurrences known on North Fork Mountain, near Bickle Knob, and Chestnut Ridge near Green Bank (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; typical high elevation dry oak habitat does not occur**

Lillydale Onion *Allium oxyphilum* *Status:* G2/S2

Habitat: Odiferous herb with a bulb and white flowers in a terminal umbel. Endemic to acidic shale or sandstone geology, mainly on glades and shale barrens. Most occurrences in West Virginia are on shale barrens, but this species has been noted on sandstone outcroppings as well (NatureServe 2011).

MNF Range: Endemic to eastern WV, found in numerous locations on the White Sulphur Ranger District (WV Natural Heritage Program unpublished data) and one location in the Smoke Hole (on private land), Potomac Ranger District (USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no shale barren habitat**

Oblongfruit Serviceberry *Amelanchier bartramiana* *Status:* G5/S2

Habitat: On the Monongahela, occurrences appear to be limited to high elevations, generally in moist to wet sites (Strausbaugh and Core 1977).

MNF Range: A widespread northern species at the southern end of its range (NatureServe 2011). Extant occurrences known from Dolly Sods, Sinks of Gandy, Glade Run Botanical Area, Blister Swamp, and Cranberry Glades (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Spreading Rockcress *Arabis patens* *Status:* G3/S2

Habitat: Moist, rocky woods, limestone outcrops, and shady riverbanks (NatureServe 2011).

MNF Range: Known locations on the Monongahela occur near the South Branch of the Potomac in the Smoke Hole area (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no limestone habitat**

Ozark Milkvetch *Astragalus distortus var. distortus* *Status: G5T5?/S2*

Habitat: A low (1-3 dm) much branched perennial herb in the bean family with purple, blue, or violet flowers (rarely white) and pinnately compound leaves with oval leaflets favoring the dry soil of shale barrens (Gleason and Cronquist 1991).

MNF Range: Two occurrences outside the Forest boundary near Upper Tract (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no shale barren habitat**

Cooper's Milkvetch *Astragalus neglectus* *Status:* G4/S1

Habitat: A tall, erect, hollow-stemmed perennial herb with white flowers in the bean family, found on drier, limestone-based soils with a periodic disturbance regime. Occurs in glades and barrens, open, calcareous, rocky ridges and bluffs, powerline rights-of-way, roadsides, and railroad beds in the eastern part of the state (NatureServe 2011).

MNF Range: Known from Smoke Hole and Cave Mt., Grant Co. (WVDNR and USDA Forest Service unpublished data)
.
Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone glade/barren habitat**

Blue Wild Indigo *Baptisia australis var. australis* *Status:* G5T3T4/S3

Habitat: Moist early successional habitats. Open woodland, moist soil and gravel bars along rivers, roadside ditches and meadows (NatureServe 2011).

MNF Range: One occurrence known from the Greenbrier River (WV Natural Heritage Program unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Lanceleaf Grapefern *Botrychium lanceolatum var. angustisegmentum* *Status:* G5T4/S1

Habitat: Subarctic and boreal fern of mountain slopes and meadows. Occurs in moist shady woods, margins of swamps, on hummocks in swamps, and in cool to warm, mostly rich, subacid soils. In WV associated with rich maple-yellow birch woods, choke cherry, crataegus, and B. matricariifolium (NatureServe 2011).

MNF Range: Occurrences include sites at Camp Pocahontas (Greenbrier District), Cranberry Glades (Gauley District), and Camp Kidd (Cheat District) (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Blue Ridge Sedge *Carex lucorum var. austrolucorum* Status: G5T3T4/S1

Habitat: Dry, open places or open woods of oak or pine, leaves 1-3 mm wide, stems 2-5 dm, tufted in small to large, basally fibrillose clumps, with long rhizomes, much like *Carex pensylvanica* but having longer perigynia, the beak (1-2 mm) nearly as long as the body (Gleason and Cronquist 1991).

MNF Range: One occurrence on the Forest near Dolly Sods Picnic Area (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area Not known from the area, but difficult to rule out based on habitat**

Roan Mountain Sedge *Carex roanensis* *Status:* G2G3/S2

Habitat: Rich soils of mid-to high-elevation mesic forests in the southern Appalachians, including rich cove and northern hardwood forests. Most abundant on moderate to steep, rocky, wooded but generally more sparsely vegetated slopes. Often co-occurs with *C. aestivalis* and *C. virescens,* 2540 - 4260 ft. (Smith and Waterway 2008).

MNF Range: A southern and central Appalachian endemic (NatureServe 2011). Known occurrences are near the Highland Scenic Highway in Pocahontas County and near Big Run in Pendleton County (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Western Blue Virginsbower *Clematis occidentalis var. occidentalis* *Status:* G5T5/S2

Habitat: Rocky sites with partial shade (Pringle 1971, Strausbaugh and Core 1977).

MNF Range: A widespread northern species reaching the southern end of its range in the central and southern Appalachians (NatureServe 2011). High elevations on the eastern side of the Forest; Bear Rocks, Pike Knob and Panther Knob on North Fork Mountain, Paddy Knob (Pocahontas Co.), Meadow Creek Mountain (Greenbrier Co.) (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Bentley's Coralroot *Corallorhiza bentleyi* *Status:* G2/S1

Habitat: A small (to 20 cm.) reddish to yellowish orchid flowering in late July having 2-20 flowers arranged in a lax raceme occurring in Appalachian deciduous forest, often at edges of forest in somewhat disturbed sites (NatureServe 2011). Habitats are not well understood.

MNF Range: One known site on the Greenbrier Ranger District near Lake Buffalo (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area** **Not known from the area, but difficult to rule out based on habitat**

Roundleaf Dogwood *Cornus rugosa* *Status:* G5/S1

Habitat: A loose branching shrub 2-3 m tall with green twigs becoming purplish and having a silky-downy or rusty pubescence, leaves broadly ovate or orbicular, flowers white in cymes, fruit blue. Rich or shady soil in rocky places in the mountains (Strausbaugh and Core 1977).

MNF Range: Known from one occurrence in the Smoke Hole area, but also found on North Fork Mountain just outside the Forest boundary (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area** **Not known from the area, but potential rocky habitat could exist**

Showy Lady's Slipper *Cypripedium reginae* *Status:* G4G5/S1

Habitat: Large perennial orchid (to 1m.) with large leaves and large showy white to rose-colored flowers, preferring full sun and the constant moisture of slightly acidic to slightly alkaline soils occurring in wetlands, woodland glades, ravines, and on damp calcareous slopes (NatureServe 2011).

MNF Range: Occurrences near Big Draft, White Sulphur Ranger District and Canaan Valley State Park, Cheat District (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Tall Larkspur *Delphinium exaltatum* *Status:* G3/S2

Habitat: A 2-6 ft. slender-stemmed, herbaceous perennial with blue, spurred flowers in the crowfoot family having deeply cleft leaves with 3-5 divisions and found in rich semi-open woodlands, rocky slopes, glades, road cuts, roadside ditches, old fields, powerline corridors, and wooded fence rows, preferring dry and rocky substrate consisting of limestone or other calcareous rock (NatureServe 2011).

MNF Range: Occurrences in the Smoke Hole, Reeds Creek, and Cave Mountain, Potomac Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No limestone habitat**

Shale Barren Buckwheat *Eriogonum allenii* *Status:* G4/S2

Habitat: Tomentose perennial 3-5 dm. tall with a thick woody root, and broad, flat-topped clusters of bright yellow flowers, an endemic of shale barrens (Gleason and Cronquist 1991).

MNF Range: Shale barren slopes on the White Sulphur Ranger District (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No shale barren habitat**

Sanddune Wallflower *Erysimum capitatum var. capitatum* Status: G5T5/S1

Habitat: Sand hills and open woods often on railroads, erect biennial or short-lived perennial of the mustard family, 2-10 dm tall, leaves entire or with a few teeth, and racemose flowers with bright yellow or orange-yellow with petals 1.5-2.5 cm long (Gleason and Cronquist 1991).

MNF Range: Smoke Hole and Cave Mountain (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Darlington's Glade Spurge *Euphorbia purpurea* *Status:* G3/S2

Habitat: Stout perennial spurge (to 1 m. tall) having a milky acrid juice and stem leaves elliptic to narrowly lance-oblong favoring seepage swamps to high-elevation, dry, upland pastures over limestone to circumneutral alluvium along high-elevation rivers (NatureServe 2011).

MNF Range: Occurrences in all ranger districts with the exception of White Sulphur RD (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No high elevation limestone habitat**

Box Huckleberry *Gaylussacia brachycera* *Status:* G3/S2

Habitat: A huckleberry with glabrous stems 2-4 dm. tall and leathery, evergreen, serrulate leaves found in acidic sandy soil within submesic forests & on woodland slopes under hardwoods with mixed pine, mountain laurel & other heaths (NatureServe 2011).

MNF Range: No known extant occurrences on the Forest, however this species has been reported just outside the Forest boundary near the Greenbrier Valley Airport at Lewisburg (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest**

Appalachian Oak Fern *Gymnocarpium appalachianum* *Status:* G3/S2

Habitat: A small, delicate fern with a broadly deltate blade occurring primarily in maple-birch-hemlock woods on mountain slopes and summits, on moist sandstone, talus slopes, or bouldery colluvium. This species requires a cool, moist microclimate and typically occurs on north-facing slopes with cold air seepage (algific) at elevations above 2000 ft. (NatureServe 2011).

MNF Range: Occurrences on Big Mountain and North Fork Mountain, Potomac Ranger District and in Canaan Valley State Park, Cheat Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

False Indian Plantain *Hasteola suaveolens* *Status:* G4/S3

Habitat: Smooth perennial (1-2.5 m. tall) with fleshy fibrous roots, large arrowhead shaped leaves, and large clusters of white flowers. Prefers low, moist ground, rich floodplain forests, thickets, or clearings, and calcareous fens (NatureServe 2011).

MNF Range: Occurrences on private land on Cheat River below Parsons, private land on Blackwater River at Davis, Canaan Valley National Wildlife Refuge, and FS land near Anthony on the Greenbrier River (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

White Alumroot *Heuchera alba* *Status:* G2Q/S2

Habitat: Erect perennial herb with rounded-reniform, broadly toothed basal leaves and a spike (to 40 cm. high) with about 20 yellow-white flowers. Favors rocky wooded ridgetops elevation 2200-4800 ft., rock outcrops, and road sides (NatureServe 2011).

MNF Range: Occurs mostly on the eastern side of the Forest; North Fork Mountain, Cave Mountain, Spruce Knob, and Big Run, Potomac Ranger District; Smokecamp Knob, Elleber Ridge, Guinn Ridge, Chestnut Ridge, Shock Run, and Stewart Run, Greenbrier Ranger District; Thorny Creek Mountain, Elk Mountain, Edray Fish Hatchery, and Town of Cass, Marlinton Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area** **Likelihood of occurrence may be low, but cannot rule out on rocks outcrops**

Spiked Crested Coralroot *Hexalectris spicata* *Status:* G5/S1

Habitat: A small orchid with a purplish, waxy bloom; flowers dull yellow striped with purple in the axils of lance-ovate bracts (NatureServe 2011), preferring limestone slopes, glades, and barrens dominated by sparse forest cover (WV Natural Heritage Program unpublished data).

MNF Range: On FS land in the Smoke Hole and Cave Mountain, and private land near Cabins, Potomac Ranger District (WVDNR unpublished data), approaching the northern limit of its range (Strausbaugh and Core 1977).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone glade/barren habitat**

Blue Ridge St. John's Wort *Hypericum mitchellianum* *Status:* G3/S1

Habitat: A sparingly branched perennial (4-8 dm. tall), leaves (4-6 cm. long) ovate-oblong clasping, flowers (8-11cm.long) yellow with black lines (seldom dotted) in crowded cymes. At higher elevations; favors seepage slopes, spray areas near falls, grassy balds, and grassy openings in forests (NatureServe 2011).

MNF Range: One occurrence near Cheat Bridge, Greenbrier Ranger District (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Longstalk Holly *Ilex collina* *Status:* G3/S2

Habitat: Deciduous shrub or tree with stalked red berries found at higher elevations in moist soil, especially riparian areas of high energy streams, but also present, though less common, in wet meadows, bogs, and seeps (NatureServe 2011; WVDNR and USDA Forest Service unpublished data, R. Polgar USFS field survey observations).

MNF Range: Numerous sites on Shavers Fork, Cherry, Williams, and Cranberry Rivers and many of their tributaries and headwater wetlands; also known from the Gauley River (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Known to Occur in Analysis Area**

Butternut *Juglans cinerea* *Status:* G4/S3

Habitat: Deciduous shade-intolerant tree occurring only singly or in small groups, with pinnately compound leaves and ovoid-oblong nuts, preferring rich loamy soils, especially limestone soils (Polgar, R. USFS field survey observation) and occurring in mixed hardwood forests, open fields, riparian zones, ridges, and edge habitats.

MNF Range: Most known occurrences are in the northern half of the Forest; Potomac, Cheat, and Greenbrier Ranger Districts; known occurrences in the south half of the Forest are limited to the Marlinton Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Thread Rush *Juncus filiformis* *Status:* G5/S2

Habitat: A circumboreal perennial rush occurring in wetlands and alpine meadows (NatureServe 2011); occurring at high elevations on the Monongahela NF (WVDNR and USDA Forest Service unpublished data).

MNF Range: Known occurrences near Davis, Canaan Valley, Dolly Sods, Upper Shavers Fork (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no high elevation wetland habitat**

Highland Rush *Juncus trifidus* *Status:* G5/S1

Habitat: A disjunct boreal rush forming tufts in rock crevices, rock outcrops, cliffs, and alpine meadows (Gleason and Cronquist 1991).

MNF Range: Known only from the rocky cliff tops on North Fork Mountain on both FS and private land (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest**

Turgid Blazing Star *Liatris turgida* *Status:* G3/S2

Habitat: Erect perennial herb up to 1 m tall with alternate lanceolate leaves and 9-20 rose-colored flowers occurring in xeric environments associated with clay soils, gravel, shale barrens, and rocky outcrops.

MNF Range: Known from the White Sulphur Ranger District near Hopkins Knob (historic) and Blue Bend (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No shale barren habitat**

Twinflower *Linnaea borealis ssp. americana* *Status*: G5T5/S1

Habitat: Moist or dry cold woods and cold bogs, a northern circumpolar species approaching its southern limit in WV, having slender, trailing, pubescent branches, small oval crenate leaves, and two nodding pink or white flowers at the summits of slender peduncles (to 10 cm) (Gleason and Cronquist 1991).

MNF Range: Blister Swamp, Pigs Ear, and Sinks of Gandy (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Grooved Yellow Flax *Linum sulcatum* *Status:* G5/S1

Habitat: In the east, occurs in a range of open, sunny communities on alkaline soils. It is found in cedar glades, oak-pine woods, serpentine barrens, and other calcareous slope communities (Zaremba 2003). Known occurrences in eastern WV are in dry limestone areas and on dry shaley banks (WVDNR unpublished data, Strausbaugh and Core 1977).

MNF Range: Cave Mountain and North Fork Mountain (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone glade/barren habitat or shale barren habitat**

Heartleaf Twayblade *Listera cordata* Status: G5/S2

Habitat: Typical habitat is peat-moss hummocks in forested swamps, moist mossy areas in conifer and mixed conifer-hardwood forests (Strausbaugh and Core 1977, Hoy 2002).

MNF Range: A widespread northern species that reaches the southern end of its range in the central and southern Appalachians (NatureServe 2011). On the MNF, known from Dolly Sods, Cheat Mountain, Williams River headwaters, Cranberry Glades, Falls of Hills Creek, and Cherry River (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Monongahela Barbara's Buttons *Marshallia grandiflora* *Status:* G2/S2

Habitat: Smooth perennial aster with a single stem that grows from 2 to 8.5 dm. tall, has entire leaves, and bears a solitary, pale purple or white, rayless flower head. Prefers full sunlight on flood-scoured sandy or rocky river banks of larger high-gradient streams in the mountains (NatureServe 2011).

MNF Range: Many sites on the upper Shavers Fork; also known from the Gauley River, Anthony Creek at Blue Bend, and by the town of Anthony on the Greenbrier River (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Bog Buckbean *Menyanthes trifoliata* *Status:* G5/S1

Habitat: A circumboreal perennial marsh herb with entire or wavy-margined elliptic leaves and crowded white flowers (Gleason and Cronquist 1991). Occurs in open, not forested, bogs, and marshy places (NatureServe 2011).

MNF Range: Big Run Bog, Cheat Ranger District; near Spruce Knob Lake, Potomac Ranger District; and Cranberry Glades, Gauley Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No high elevation bogs**

Wild (Smoke Hole) Bergamot *Monarda fistulosa ssp. brevis* *Status:* G5T1/S1

Habitat: A perennial, aromatic herb in the mint family occurring in Mid-Appalachian cedar glades, dry limestone outcrops and barrens, and thin, unstable limestone slopes (NatureServe 2011).

MNF Range: Endemic to the South Branch valley in eastern West Virginia and adjacent areas in Virginia (NatureServe 2011). Many sites on dry sideslopes in the Smoke Hole/Cave Mountain; a few sites in the western foothills of North Fork Mountain (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no limestone glade/barren habitat**

Limestone Adder's-tongue *Ophioglossum engelmannii* *Status:* G5/S1

Habitat: A small fern with two or more trough-shaped, veiny leaves acute at each end, preferring woods, pastures, and ledges with calcareous soils (Gleason and Cronquist 1991). In West Virginia, known from dry limestone barrens (WVDNR and USDA Forest Service unpublished data).

MNF Range: One known occurrence on Cave Mountain above Big Bend Campground (USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no limestone glade/barren habitat**

Silvery Nailwort *Paronychia argyrocoma* *Status:* G4/S3

Habitat: A low perennial herb having silky leaves and silvery bracts and forming tufts or mats on rocky slopes, rock outcrops, ridges, or ledges usually high in the mountains (Gleason and Cronquist 1991). In West Virginia, typically occurs on glades and barrens formed from the Tuscarora, Juniata, and Oriskany sandstones (WVDNR and USDA Forest Service unpublished data, WV Geological Survey 1927).

MNF Range: Most known occurrences are on North Fork Mountain on both FS and private land, but additional sites are on sideslopes in the Smoke Hole and on Cave Mountain (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no sandstone barrens**

Yellow Nailwort *Paronychia virginica* *Status:* G4/S1

Habitat: A perennial mat-like, wiry plant with yellowish-green foliage, branching at the base, occurring in both open and wooded landscapes, in crevices, on ledges, or in rocky places (Gleason and Cronquist 1991). In West Virginia, typically found on glades and barrens formed from the Tonoloway and Helderberg limestones (WVDNR and USDA Forest Service unpublished data, WV Geological Survey 1927).

MNF Range: Most occurrences are on FS land on sideslopes in the Smoke Hole and Cave Mountain (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone glade/barren habitat**

Canby's Mountain-lover *Paxistima canbyi* *Status:* G2/S2

Habitat: Low evergreen shrub with shiny, leathery leaves borne oppositely on prostrate stems that root below. Found in dry, open woods, often on calcareous rocks and slopes in the mountains (NatureServe 2011).

MNF Range: Smoke Hole area, River Knobs area near Circleville (Potomac District); also Beaver Lick Mountain near Camp Wood (White Sulphur Ranger District) (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone woodland habitat**

Swamp Lousewort *Pedicularis lanceolata* *Status:* G5/S2

Habitat: A lousewort with opposite, short-petioled or sessile leaves occurring in swamps and wet places, often calcareous (Strausbaugh and Core 1977).

MNF Range: Historical occurrences on private land in Elkins, Bartow, Dunmore, Minnehaha Springs, and Buckeye (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Swordleaf Phlox *Phlox buckleyi* *Status:* G2/S2

Habitat: A perennial phlox with an erect stem, leaves linear to lanceolate, and glandular-hairy purple flowers in compact cymes (Gleason and Cronquist 1991). Rarely occupies shale barrens proper, but may be found in open woods bordering shale barrens and disturbed areas such as shaley road banks (Norris and Sullivan 2002 and references therein).

MNF Range: Known from Ryder Gap (Marlinton Ranger District), Lake Sherwood area, and Sulphur Lick Run (White Sulphur Ranger District).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no shale barren habitat**

Canadian Ricegrass *Piptatherum canadense* *Status:* G5/S1

Habitat: A northern perennial grass with narrow blades (1-2 mm. wide) and open panicles growing in loose tufts in dry sandy or rocky woods (Gleason and Cronquist 1977).

MNF Range: Known from North Fork Mountain and Flatrock Plains (Potomac District) (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Shriver's Purple Fringed Orchid *Platanthera shriveri* *Status:* G1/S1

Habitat: A newly described orchid having light purple, frilly florets with long spurs arranged in an open raceme. Typically found in the partial to full shade of damp, open, mixed deciduous and coniferous woods, often along seepages in the mountains (Brown et al. 2008).

MNF Range: Known from Upper Shavers Fork, Fivemile Run, Span Oak Run, Long Run, Middle Mountain, and Hawchen Hollow (Greenbrier Ranger District) (Polgar, R. USFS field survey); also Williams River Road (FR 216) (Marlinton Ranger District); and Cranberry Glades (Gauley Ranger District) (Brown et al. 2008).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Bog Bluegrass *Poa paludigena* *Status*: G3/S1

Habitat: A perennial bluegrass with weak stems and loose open panicles occurring solitary or in small tufts. Occurs in sphagnum or other moss, hummocks, or fallen rotting trees in open to partially shaded wetlands (NatureServe 2011, Ohio DNR 1985).

MNF Range: Known only from Cranberry Glades (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Vanbrunt's Polemonium *Polemonium vanbruntiae* *Status:* G3G4/S2

Habitat: An erect perennial (to 1 m. tall) with odd-pinnately compound leaves and blue flowers with exserted stamens occurring in wooded swamps, bogs, mossy glades, seeps, and riparian areas at higher elevations (2000-4000 ft.) (NatureServe 2011).

MNF Range: Known from Canaan Valley (CVNWR and Canaan Valley State Park), near the head of Laurel Fork (Greenbrier District), near the mouth of Glady Fork (Cheat District), and Cranberry Glades (Gauley District) (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **No high elevation wetlands**

Tennessee Pondweed *Potamogeton tennesseensis* *Status:* G2G3/S2

Habitat: Aquatic herb with jointed stems and alternate leaves of two different shapes, submerged (linear) and floating (ovate) (Strausbaugh and Core 1977). Occurs in streams, ponds, and shallows of rivers (NatureServe 2011).

MNF Range: One historical occurrence on private land within Forest boundary at the mouth of Robbins Creek, a tributary of Anthony Creek in the White Sulphur Ranger District (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Beadle's Mountainmint *Pycnanthemum beadlei* *Status:* G2G4/S1

Habitat: A mountainmint with simple or sparingly branched stem (to 8 dm.) with serrulate lance-ovate leaves and a somewhat loose inflorescence (Gleason and Cronquist 1991). Occurs on rocky substrate, rock outcrops, and cliffs; however, habitat requirements uncertain – found in oak forest further south, but the one known MNF occurrence is in spruce and northern hardwoods (NatureServe 2011, R. Bartgis pers. comm. 2006).

MNF Range: One occurrence known in the upper Shaver's Fork basin (R. Bartgis pers. comm. 2006).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Pennsylvania Buttercup *Ranunculus pensylvanicus* *Status*: G5/S1

Habitat: Grows in a variety of areas that tend to have open to filtered light and that are wet to periodically flooded, including marsh edges, vernal pools, seasonally flooded riverbanks, powerline rights of way through alluvial wetlands, etc. (MA Div. of Fisheries and Wildlife 2008).

MNF Range: A widespread northern species that reaches the southern end of its range in WV (NatureServe 2011). Only known MNF occurrence is on private land near Dunmore (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Lanceleaf Buckthorn *Rhamnus lanceolata ssp. lanceolata* *Status*: G5T4T5/S1

Habitat: A shrub (1-2 m. tall) with alternate leaves permanently pubescent beneath favoring moist calcareous soils in glades and woodlands (Gleason and Cronquist 1991).

MNF Range: Historic location on FS land in the Smoke Hole, and on private land on Cave Mountain (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no limestone glade/barren habitat**

Bristly Currant *Ribes lacustre* *Status:* G5/S2

Habitat: Wetlands in partial shade or full sun (Strausbaugh and Core 1977, Hamilton and Yearsley 1988).

MNF Range: A widespread northern species that reaches the southern end of its range in WV and VA (NatureServe 2011). Known from Mt. Storm and Backbone Mtn. Historic occurrence at Blister Swamp (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Smooth Rose *Rosa blanda var. blanda* *Status*: G5T5/S2

Habitat: Dry woods and hills, thornless on flowering branches, but with few to many slender prickles near the base of the plant. The leaves are pinnately divided into five to seven egg-shaped leaflets, yellowish-green above and pale green below. The stipules are rather broad and usually lightly woolly. The flowers are large with pink petals and numerous stamens. (Gleason and Cronquist 1991, University of Saskatchewan Herbarium).

MNF Range: Two occurrences on the Forest, Marlin Mtn., Marlinton RD and North Fork Mtn., Potomac RD (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Dwarf Red Blackberry *Rubus pubescens var. pubescens* *Status*: G5T5/S1

Habitat: Bogs and cool lands at high elevations in the mountains, a northern species reaching its southern limits in WV. Extensively running practically herbaceous unarmed plant with few inconspicuous greenish-white flowers on short basal leafy shoots, leaflets 3 or 5 thin, much longer than broad, acuminate, coarsely toothed, fruit red, 5-12 mm across, adhering to the receptacle (Strausbaugh and Core 1977).

MNF Range: Several occurrences within the Forest Boundary on non-USFS land in Canaan Valley (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Michaux's Saxifrage *Saxifraga michauxii* *Status:* G4G5/S1

Habitat: Moist or wet ledges and rocky woods in the mountains. Stems 1-5 dm branched above, basal leaves coarsely serrate with 4 to 8 teeth on each side, flowers irregular, the three larger petals spotted with yellow, and the two smaller petals unspotted (Gleason and Cronquist 1991).

MNF Range: One occurrence on Strader Run, a fork of Seneca Creek, Potomac RD (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Smooth Rock Skullcap *Scutellaria saxatilis* *Status:* G3/S2

Habitat: A rhizomatous herbaceous perennial in the mint family with creeping stems and violet-blue flowers preferring rocky wooded hillsides, moist talus slopes, and stream sides at higher elevations in the mountains (NatureServe 2011). On the Monongahela, generally occurs on the richer sandstones of the Hampshire, Chemung, and Mauch Chunk formations (WVDNR and USDA Forest Service unpublished data, WV Geological Survey 1927).

MNF Range: Several sites in northeastern Pocahontas County (Greenbrier and Marlinton Districts) and the Upper Williams River area (Marlinton District); also occurs near Leadmine (Cheat District) and near Reeds Creek (Potomac District) (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Fire Pink *Silene virginica var. robusta* *Status:* G5T1Q/S1

Habitat: A perennial herb (3-6 dm. tall), this variety with large leaves (7-15 cm x 2-4 cm), and deep crimson flowers in loose cymose-panicles. Favors dry open woods; may prefer limestone (Strausbaugh and Core 1977, NatureServe 2011).

MNF Range: Occurs in the Smoke Hole and near Vance Run, Potomac Ranger District (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone woodland habitat**

Hyssopleaf Hedgenettle *Stachys aspera* *Status:* G4?/S1

Habitat: In wet ground, stems erect, 5-10 dm tall, the angles beset with long reflexed bristles, leaves oblong, sub sessile or short-petioled, calyx-tube 3-4 mm long, glabrous or nearly so, the calyx teeth deltoid, flowers reddish-purple (Strausbaugh and Core 1977).

MNF Range: One occurrence within the Forest Boundary on non-USFS land in Canaan Valley (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest**

Boreal Starwort *Stellaria borealis ssp. borealis* *Status:* G5T5/S1

Habitat: Wetlands (Strausbaugh and Core 1977).

MNF Range: Widespread northern and western species that reaches the southern end of its eastern range in WV (NatureServe 2011). Known from Dolly Sods and near Davis (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Mountain Pimpernel *Taenidia montana* *Status:* G3/S3

Habitat: A smooth perennial (to 80 cm tall) smelling of anise with ternately or pinnately compound leaves, terminal umbels of small yellow flowers. Prefers calcareous shale barrens, limestone, rock outcrops, narrow ridges, and open woods (NatureServe 2011).

MNF Range: Several occurrences in and near the shale barren areas of the White Sulphur Ranger District; also near St. George (Cheat Ranger District), Smoke Hole (Potomac Ranger District), and the Shock Run area (Marlinton Ranger District) (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area** **Outside known range on the Forest; no limestone glade/barren or shale barren habitat**

Canada Yew *Taxus canadensis* *Status*: G5/S2S3

Habitat: A slow-growing, evergreen shrub (1-3 ft. tall) preferring shade in cool, rich, damp woods and wooded swamps, on banks, along bog margins, and in ravines (Sullivan 1993). On the MNF, known from spruce/northern hardwood forest, wetlands, riparian areas, and damp rock outcrops and talus (WVDNR and USDA Forest Service unpublished data).

MNF Range: Known from Big Run drainage (Potomac District), Big Run Bog (Cheat District), upper Shavers Fork (Greenbrier District), Upper Williams River and Tea Creek (Marlinton District), Cranberry Glades (Gauley District), and one historical occurrence at Camp Wood (White Sulphur District) (WVDNR and USDA Forest Service unpublished data, Muzika et al. 1996, Mueller 2001).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Sticky Tofieldia *Tofieldia glutinosa* Status: G5/S1

Habitat: Moist or wet places, a northern species extending into the southern Appalachians, several basal leaves 8-20 cm long and up to 8mm wide, scape 2-5 dm, very sticky-hairy upwards, raceme 2-5 cm, flowers white (Gleason and Cronquist 1991).

MNF Range: Six occurrences on the Forest along Shavers Fork near Cheat Bridge (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Ammons' Tortula Moss *Tortula ammonsiana* *Status:* G1G3/S1

Habitat: A small moss (5-15 mm high, dark green when wet to red-brown when dry) growing singly or in loose tufts on wet, sandstone walls, outcrops, or cliff overhangs adjacent to waterfalls (Crum and Anderson 1979).

MNF Range: Falls of Hills Creek and Darnell Hollow, Pocahontas Co (Risk and Kiser 1991).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Bristle-fern *Trichomanes boschianum* *Status:* G4/S1

Habitat: A small fern with delicate light green fronds on a long creeping rhizome. Favors moist overhanging sandstone outcrops and cliffs (Gleason and Cronquist 1991).

MNF Range: Historical occurrences at Falls of Hills Creek and Back Fork of the Elk River near Webster Springs (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Narrowleaf Bluecurls *Trichostema setaceum* *Status*: G4/S1

Habitat: A weedy, much branched annual with linear leaves in the mint family. Prefers shale barrens, sandstone woodlands, glades, and dry oak forests (NatureServe 2011).

MNF Range: One occurrence just outside the Forest boundary near Petersburg (WVDNR unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no shale barrens**

Kate's Mountain Clover *Trifolium virginicum* *Status:* G3/S3

Habitat: A non-stoloniferous perennial clover with a stout taproot and prostrate pubescent stems, having linear to oblanceolate leaflets. Prefers the xeric conditions of shale barrens, cedar glades, dry limestone woods with thin canopies, and roadsides with dry sideslopes (NatureServe 2011).

MNF Range: Eastern side of the Forest, occurring in Potomac District on Cave Mountain, Smoke Hole, and Northfork Mountain; also in and around the shale barren areas of the White Sulphur District.

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area Outside known range on the Forest; no limestone glade/barren or shale barren habitat**

Threebirds Orchid *Triphora trianthophora* *Status:* G3G4/S2

Habitat: A small attractive orchid with purple to green stems (10-30 cm tall), nodding at first but straightening with age, having 1-3 white tubular, magenta-rimmed flowers that turn pink with age. Favors deep leaf litter with humus in mesophytic forests and leaf-lined depressions on gentle slopes in older forests dominated by beech and hemlock (NatureServe 2011).

MNF Range: Occurrences are known from the Gauley District in the lower Williams River and Cranberry River watersheds (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

American Cranberrybush *Viburnum opulus var. americanum* Status: G5T5/S1

Habitat: A northern species reaching its southern limits in the higher mountains of WV, in wet woods and along streams, shrub to 4 m, leaves deeply 3-lobed and coarsely dentate, fruit red (Strausbaugh and Core 1977).

MNF Range: One native occurrence in Canaan Valley State Park, but also may be seen as plantings in wildlife openings at higher elevations on the Forest (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Not Likely to Occur in Analysis Area**

Appalachian Violet *Viola appalachiensis* *Status:* G4/S2S3

Habitat: A low-growing, mat-forming violet with small heart-shaped, scalloped leaves and spurred, pale violet flowers. Occurs on rich, moist soils found on stream banks, floodplains, glades, clearings, forest edges, roadsides, old railroad grades, old fields, and pastures; often associated with some form of human disturbance (NatureServe 2011).

MNF Range: Known to occur on all districts except the dry White Sulphur District. Cheat District has the greatest distribution and numbers, particularly around Horseshoe Run and tributaries, Clifton Run, and Canaan Valley State Park (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Sand Grape *Vitis rupestris* *Status:* G3/S2

Habitat: A large perennial, shrub-like grape that rarely climbs and rarely has tendrils. It has short, wide, alternate leaves which are pubescent underneath and stems with pith interrupted by a diaphragm at each node. It prefers open or partial light and saturated to moist soil occurring in calcareous or gravelly banks, river bottoms, stream beds, washes, and scoured boulders and cobbles, but also may be found along the edges of limestone glades and barrens (NatureServe 2011).

MNF Range: One historical occurrence at Camp Wood, White Sulphur Ranger District. Other occurrences are on private land just outside the Forest boundary in the town of White Sulphur Springs (WVDNR unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Netted Chainfern *Woodwardia areolata* *Status:* G5/S2

Habitat: A fern with both sterile deltoid-ovate, pinnatifid fronds and fertile shiny, purple-black fronds with linear pinnae. Common on the coastal plain, but rare in the mountains, where it occurs in swamps and wet woods in acid soil (Strausbaugh and Core 1977).

MNF Range: Historically, known from Cranberry Glades (Gauley District) and Little Creek, a tributary of Anthony Creek on the White Sulphur District. Also occurs just outside the Forest boundary near the town of Droop (WVDNR and USDA Forest Service unpublished data).

Likelihood of Occurrence: **Potential Habitat in Analysis Area**

Key to species ranks: Federal/Global/National/State

LE= Federal listing as Endangered
LT= Federal listing as Threatened

Global rank:

- G = Global conservation status rank indicator
- T = Subspecies, varieties, and populations
- GX or TX = Presumed Extinct
- GH or TH = Historical
- G1 or T1 = Critically imperiled
- G2 or T2 = Imperiled
- G3 or T3 = Vulnerable
- G4 or T4 = apparently Secure
- G5 or T5 = Secure
- GU or TU = Unrankable
- GNR or TNR = Unranked

State rank:

- SX = Presumed extirpated
- SH = Historical
- S1 = Critically imperiled
- S2 = Imperiled
- S3 = Vulnerable
- S4 = Apparently secure
- S5 = Secure
- SU = Unrankable
- SR = Reported
- SNR = Unranked

Rank Qualifiers:

- ? = Inexact Numeric Rank—Denotes inexact numeric rank; this should not be used with any of the Variant Global Conservation Status Ranks or GX or GH
- Q = Questionable taxonomy that may reduce conservation priority— Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. The “Q” modifier is only used at a global level and not at a national or subnational level.
- C = Captive or Cultivated Only—Taxon at present is extinct in the wild across their entire native range but is extant in cultivation, in captivity, as a naturalized population (or populations) outside their native range, or as a reintroduced population not yet established. The “C” modifier is only used at a global level and not at a national or subnational level. Possible ranks are GXC or GHC.

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Species	Latin	No Suitable Habitat or PA exceeds species range	Occupied Habitat in or around Project Area	Suitable Habitat in Project Area	Brought forward into Effects Analysis	Comments
Eastern Hellbender	*Cryptobranchus alleganiensis*		X	X	X	Suitable habitat exists in PA. Species has been confirmed in the Cherry River as recently as 2018 (Wineland).
Redside Dace	*Clinostomus elongatus*	X				Outside of species range. Only occurs in the Cheat and Potomac drainages.
Tonguetied Minnow	*Exoglossum laurae*		X	X	X	Possible; within known range and suitable habitat is present in watershed. Surveys have collected this species in the Gauley drainage.
Pearl Dace	*Margariscus margarita*	X				Outside species range. Only occurs in Cheat and Potomac drainages.
New River Shiner	*Notropis scabriceps*			X	X	Species range has contracted to only Greenbrier River drainages.
Cheat Minnow	*Pararhinichthys bowersi*	X				Outside species range. Only occurs in Cheat River drainage.
Appalachia Darter	*Percina gymnocephala*	X				Occurs in Gauley watershed. Surveys have not indicated presence in the Cranberry River, though presence is noted in Williams and Cherry Rivers.
Kanawha Minnow	*Phenacobius teretulus*	X				Outside of species range. Occurs in Gauley and Greenbrier River drainages. Species has not been identified in the North Fork Cherry River sub-watershed, however, species has been found in the Cherry and Williams River of the Gauley watershed.
Elktoe	*Alasmidonta marginata*	X				Outside of species range. Present only in Greenbrier R. on Forest.
Green Floater	*Lasmigona subviridis*	X				Species historically occurred in New River drainage. Current distribution restricted to the Greenbrier River drainage
Elk River Crayfish	*Cambarus elkensis*	X				Outside species range. Endemic to the Elk River drainage.

Greenbrier Cave Crayfish	*Cambarus nerterius*	X				Outside of species range. Generally found in subterranean streams.
Greenbrier River Crayfish	*Cambarus smilax*	X				Outside of species range. Endemic to Greenbrier River basin.
Green-faced Clubtail	*Gomphus viridifrons*		X	X	X	Dragon fly found in streams and along riparian areas. Recorded occurrence near Cranberry Glades.
Rapids Clubtail	*Gomphus quadricolor*			X	X	Dragon fly found in streams and along riparian areas. Project area within species range.

Gauley Healthy Forest Restoration Project Collaboration Overview

March 2020

The responsible official for the Gauley Healthy Forest Restoration Project is using a collaborative process that includes multiple interested persons representing diverse interests and is transparent and non-exclusive, as required by the Healthy Forest Restoration Act, Section 603(b)(1)(C)(i) and (ii)(I).

The following information demonstrates how the responsible official identified and involved relevant stakeholders early in the process, developed a strategy to conduct an inclusive and transparent collaboration process, and planned for development and implementation of the project as part of the collaborative effort.

This project is categorically excluded from the administrative review process under Section 603 of the Healthy Forest Restoration Act (16 U.S.C. 6591b) for projects that reduce the risk or extent of, and increase the resilience to, insect or disease infestation or that reduce hazardous fuels. This categorical exclusion category provides for up to 3,000 acres of restoration treatments in a project area. The overall project area boundary is large, at around 40,000 acres; however, this project boundary was originally created for a proposal that was being considered under an environmental assessment. Formally designated as the Gauley Integrated Spruce Restoration project, it is no longer considered for analysis. This project was in the pre-NEPA planning stage when it was abandoned and did not go out for a 30-day public comment period; however, much collaboration was completed with the public, partners, and other agencies in development of that proposal. As such, those collaboration efforts were used to develop the much smaller 3,000-acre categorical exclusion for which this collaboration documentation applies.

Outreach to Diverse Interests

What agencies/organizations/individuals are being invited to participate early in the process to ensure diverse interests are represented and how will these entities be contacted?

This project was developed in partnership with West Virginia Division of Natural Resources and the West Virginia Division of Forestry in collaboration with a wide range of interested parties. We continue to engage these existing partners in the project-level collaboration. These partners work directly with District staff in project development.

In addition, the forest maintains a list of interested parties (individuals, non-governmental organizations, local government, Tribes, private landowners etc.) that were invited to participate in early collaboration of the original Gauley Integrated Spruce Restoration project.

Collaborative Process

What method is used for facilitating the collaborative process and how will this method promote inclusiveness and transparency? The collaborative process for this project is a continuation of regular communication with interested stakeholders for projects throughout the Forest, including the following:

<u>Watershed</u>

The forest has collaborated with partners on stream and watershed restoration activities as a part of various integrated projects across the forest. Some of these integrated projects include Upper Greenbrier

North, Big Mountain, and Upper Williams River Watershed Restoration. These activities include 1) road decommissioning, 2) aquatic organism passage barrier removal through road-stream crossing replacement, 3) large woody material (LWM) stream enhancement, 4) riparian enhancement (e.g. fencing, reforestation), and 5) forest-wide stream liming.

Road decommissioning: The forest has collaborated (partnered) with Trout Unlimited (TU) and Canaan Valley Institute (CVI) to decommission roads and thereby restoring the sites to more natural conditions. The activities of these partnerships have also included surveying historic features, unneeded system roads, temporary roads, etc., to determine their potential to impact aquatic and hydrologic resources as well as implementing the treatment of the site. The objectives of these efforts are aligned with the Forest Plan, the Forest Service Handbook, and the National Core Best Management Practices (BMP) Technical Guide (FS-990a).

Aquatic Organism Passage (AOP): The forest has partnered with TU and CVI to survey road-stream crossings for their potential to create passage barrier to aquatic organisms as well as inhibit the passage of storm flows and associated sediment and bedload material. Crossings that presented concern as passage barriers were prioritized for replacement. This collaborative effort included the design and implementation of crossings selected and funded for replacement. An AOP workshop was held on the Forest in 2013 and was attended by West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR), West Virginia Division of Highways (WVDOH), US Fish and Wildlife Service (FWS), Army Corp of Engineers (ACOE), and others.

Large Woody Material (LWM): The forest has partnered with TU to improve stream habitat quality by the strategic addition of LWM to the streams using both mechanical equipment such as excavators and other specialized equipment, as well as by using hand equipment. Trainings and workshops: AOP workshop in 2013 and LWM workshop in 2014 were held on the Forest and were attended by West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR), US Fish and Wildlife Service (FWS), Army Corp of Engineers (ACOE), and others.

Recreation

The forest has previously collaborated with partners in trail maintenance, campground volunteer campground host program, Youth Conservation Corps, and other volunteers in trail and recreation site maintenance and promotion activities. The groups that have collaborated with the Forest include:

Monongahela Outdoor Volunteers (MOV): This group has provided several hundred hours of volunteer service to maintain trails as well as promote trail use, specifically mountain bike use, of trails. They have hosted youth field days in which they have provided bicycles and safety equipment as well as instruction on riding.

New River Gorge Trails Alliance: This group has provided several hundred hours of volunteer service to maintain trails within the area.

Campground Host Program: Volunteers are integral to the operation of Forest Service campgrounds. Summit Lake Campground has hosts that serve as ambassadors to the site and assist with maintenance.

Youth Conservation Corps: The Forest has hosted both local and residential YCC crews. Crews conduct restoration work on trails and maintenance of campground facilities each year.

Ecology and Botany

Central Appalachian Spruce Restoration Initiative (CASRI): A partnership of diverse interests with a common goal of restoring historic red spruce-northern hardwood ecosystems across the high elevation landscapes of Central Appalachia. It is comprised of private, state, federal, and non-governmental organizations which recognize the importance of this ecosystem for its ecological, aesthetic, recreational, economic, and cultural values.

Rivers and Gorges Cooperative Weed and Pest Management Area (RGCWPMA): A partnership between federal, state, and local agencies, community associations, non-profits organizations, and private landowners aimed at coordinating efforts and programs for addressing the threat of non-native invasive species in south-eastern West Virginia. The Nature Conservancy ecological restoration crew completed 250 acres of non-commercial spruce restoration two years ago. This effort furthers forest plan goals and the CASRI mission.

West Virginia Division of Natural Resources, Good Neighbor Agreement: Cooperative effort between the State of West Virginia and the Forest Service to conduct botanical surveys for federally threatened and endangered species and Region 9 Regional Forester's Sensitive Species for the Monongahela National Forest as well as non-native invasive species. The Monongahela hosted a WVDNR botanist in 2018 at the Marlinton Ranger Station and some surveys were conducted in the Gauley Healthy Forest Restoration project area.

Chicago Botanic Garden, Conservation and Land Management (CLM) internship program: Places early-career scientist in five-month paid internships to assist professional biologist with land management and conservation projects. The Monongahela hosted one intern in 2018 and two interns in 2019 on the Marlinton-White Sulphur District.

<u>Soils</u>

The forest collaborates with partners on soil survey mapping updates, ecological inventory mapping in the red spruce and oak hickory ecosystems, landscape scale restoration techniques for soil quality improvements, and outreach and education in a general forest-wide concept. This combined collaborative effort has benefited many of the Forest's projects including Mower Tract, Upper Greenbrier North, the Big Mountain, Sharp Knob, Greenbrier South East, and the Lower Williams Liming projects. Data was collected in all these project areas and across the forest to develop land management tools to inform project development, integrate landscape level resource connections. These activities include 1) soil survey inventory and updates, 2) ecological site description (ESD) development, 3) soil carbon BMPs for red spruce restoration efforts and 4) soil nutrient restoration.

Soil Survey Updates and Mapping: The forest has collaborated with the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and West Virginia University (WVU) Division of Plant and Soil Sciences (PSS) to facilitate research and field weeks with the intent of gathering site-specific soil physical and chemical data that could be used to update the NRCS soil survey maps in this region. These collaborative efforts to update soil surveys on the Monongahela National Forest (MNF) have helped the forest to meet the NEPA requirements of best available science and are also used to inform landscape scale restoration. The objectives of these efforts are to help move the soil resource towards the desired conditions outlined in the MNF Land and Resource Management Plan.

Ecological Site Description Development: Updated soil surveys as outlined above provide the foundation for ESD development. Soil physical and chemical properties can be used to determine historic vegetative communities present at a given location, especially for the red spruce ecosystem. For the past decade, partners have been working to develop methodologies to create ESDs. These ESDs can be used across the MNF to prioritize areas for both red spruce and oak-hickory restoration.

Terrestrial Liming Project: The forest recently implemented the Lower Williams Liming project (2017 to 2018). This project was proposed as a restoration project to improve soil quality in an inherently acidic ecosystem that has historically received high levels of acid deposition in the past century. The Forest partnered with professors and graduate students at WVU Division of Plant and Soil Sciences to develop a monitoring protocol to evaluate effects of terrestrial liming on soil quality.

Holcomb Vernal Pool Study: Dr. James Thompson, West Virginia University Soil Science Professor, is collaborating with the MNF and NRCS to conduct research on the Hydropedology of Vernal Pool Systems (NE-1438). The objectives of this project are to 1) improve the understanding at regional scales of how vernal pool ecosystems differ in distribution, hydrology, hydroperiod, redox chemistry, and carbon storage flux, 2) identify the need for additional hydric soil indicators for northeast vernal pools, 3) develop morphometric indices of the hydroperiod within vernal pools, and 4) estimate the current density of vernal pools within each of the subregions and develop predications of the numbers that have been lost because of disturbance. The study location is located on the Gauley Ranger District in the northern hardwood landscape in the vicinity of Holcomb Run.

Trainings and Workshops: Each year the forest cohosts trainings and workshops with their partners (NRCS, WVU and other universities and national forests within the region). These trainings and workshops are meant to introduce new technologies and science to both current and new staff. These events also offer the opportunity to have soil scientists from the region to collaborate while simultaneously gathering data for specific and defined goals and objectives.

<u>General</u>

The Forest has held numerous meetings with cooperators related to wildfire preparation and response. These meetings have facilitated dialog around fuel conditions on the forest and the need to proactively treat through prescribed fire and fuels reduction efforts. In September 2019, a fire cooperators meeting was held with the Forest, West Virginia Division of Forestry, the Nature Conservancy, the National Park Service and the West Virginia Division of Natural Resources. Also, in September 2019 the Appalachian Fire Learning Network held a workshop and field trip, which the Forest attended and participated in.

AmeriCorps in long term partnership, both Appalachian Forest National Heritage Area (AFNHA) and Vetsworks, since 2009 has resulted in many important resource improvements in the local area, including pollinator plantings, environmental education, district cleanups, planting of American chestnut and butternut trees as well as important work throughout the MNF.

The WVDNR is in a long-term partnership with formal agreement to manage habitat across the forest.

The American Chestnut Foundation long term partnership that resulted in many progeny test plantings on forest, work of an intern they provided to monitor plantings forest wide, supervised out of Gauley Ranger District and a formal agreement for 5 years.

The National Wild Turkey Federation had several formal stewardship and other agreements with the Forest, including one around 2012 within the Gauley Healthy Forest Restoration project area. This group worked with WVDNR and the Boy Scouts of America to establish small wetlands in the Desert Branch area. Scouts did volunteer work at this location, Summit Lake, Camp Caesar, and Blue Bend during the first national jamboree held at Summit Bechtel Reserve in Fayette and Raleigh Counties.

Cherry River Elementary School long term informal partnership on environmental education, outdoor activities. Currently, the Forest Service is a partner in the West Virginia Department of Education 21st Century Community Learning Center/Summer Boost Camp funded largely by Save the Children. The forest provides outdoor activities including bike riding, fishing, planting pollinators, establishing gardens and environmental education.

For many years the Cherry River Elementary School has held school wide field trips to the Cranberry Mountain Nature Center (CMNC), Falls of Hills Creek, Cranberry Glades, and other District locations to provide outdoor guided education. Their fifth and sixth graders annually do a bike ride through the 16-mile Cranberry Backcountry which has been a yearly event for the past 8 years. On the first of these trips, AmeriCorps and forest staff played a large role in planning and safety. Since that time, school personnel, parents, and volunteers have provided oversight for this event to build fitness, self-confidence, and environmental knowledge.

Richwood Area Chamber of Commerce long term informal collaboration to enhance local knowledge and use of the forest. District rangers and staff have attended their monthly meetings and helped with the long running Triathlon (under special use permit and hosted by many volunteers) and other area activities.

District staff are currently working as active members in a series of informally organized community development groups that are affiliated with nationwide development organizations. The local groups are Blueprint, Hubcap, and Richwood Rising. Many relatively small grants have been received for signs, main street lighting, attendance at development conferences such as the National Mainstreet Conference, and business development workshops. Participation in these groups helped fund other beneficial projects such as the construction of new housing after the 2016 flood.

The Eastern National Forest Interpretive Association (ENFIA), long term partnership with the CMNC which provides environmental education and other items for purchase at CMNC and the Gauley Ranger District office. This entity has also provided many small grants to the forest such as four interpretive historical displays connecting the forest with the town of Richwood. These displays are located at the Richwood Heritage Center on Main Street in Richwood, WV.

Many groups and individuals participated in Stewardship collaborative meetings starting around 2007, which resulted in a series of Integrated Resource Timber Contract (IRTC) Stewardship timber sales on the Gauley Ranger District, as well as enhancing communication that resulted in other needed work being done on private land. Retained receipts from these sales have funded many ecosystem restoration projects throughout the MNF.

Healthy Southern West Virginia is working to inventory needs related to healthy communities with assistance from the forest in the Richwood and Cowen areas.

Camp Caesar has a long-term partnership used to provide science and environmental education in their location in Webster County, WV. This historic camp has a special use permit for Lake Caesar.

The Richwood Heritage Center is helping to increase understanding of the rich forest history of the area, in informal partnership with the MNF. This partnership began in 2016 when the district held a series of "Lunch and Learn at the Forest Service" programs at the district office. The forest heritage program manager, a volunteer historian, and the district ranger provided a series of lectures about forest history and management. This resulted in local history enthusiasts planning a variety of historic displays.

A portion of the Cranberry Tri-Rivers Rail Trail is located on MNF lands. Local managers are working with the MNF in remedying resource concerns while providing and increasing recreational access to the forest.

The Forest Supervisor, zone timber staff, and district rangers have participated in the Forestry Forum in the Summersville area for 3 years.

Weyerhaeuser Corporation became aware of forest health concerns in the local area in black cherry. A collaborative joint tour was arranged by their staff and the zone silviculturists in June 2018. This tour brought together industry representatives from two corporations, forest research, forest health, and national forest staff from two national forests. This venue was a forum to discuss forest health issues and an opportunity to address them through management and research.

The forest actively collaborates with Friends of Blackwater, WV Highlands Conservancy, and the Nature Conservancy on a wide variety of wildlife, watershed, climate, and spruce forest management.

- Specifically, the Friends of Blackwater focus on northern flying squirrel habitat, Cheat mountain salamander habitat, abandoned mine land restoration, stream chemistry, historic preservation, climate change, and visitor access/trail management.
- The Nature Conservancy focuses on red spruce restoration investing in planting, thinning and spruce tree release, land acquisition, and wildlife habitat plans.
- The WV Highlands Conservancy focuses on road decommissioning, northern flying squirrel habitat, and red spruce restoration.

Demonstrate how the responsible official will establish clear objectives, roles and responsibilities for all participants at the beginning of the collaborative process. What are the objectives of the collaborative process for this project?

The objectives of the collaborative process are both for the Forest Service to have a more in-depth opportunity to gather input from stakeholders and partners in the project and for stakeholders to engage with each other on issues of concern with the project area and forest resiliency in general. The Responsible Official, or his representatives, have shared these objectives with the participants in the various meetings.

Demonstrate how the responsible official will clearly define project objectives from the start but still create incentives for a variety of interested individuals and organizations to participate? (Responsible officials shall not ask the group for a consensus on project activities, rather the collaborators should share ideas and priorities with the responsible official. It should be clear from the onset that the decision is the sole purview of the responsible official.)

a. *How will the responsible official identify for the collaborators the laws/regulations/policies and Forest Plan standards that guide and/or constrain the decision space and how will these be presented?* The collaboration information is provided to describe how the Forest Plan guides the proposed project and the steps in the NEPA process for the project. In addition, meeting handouts are provided that describe the Farm Bill requirements.

b. *How will the responsible official work to set realistic expectations, while encouraging participants to think creatively, optimistically, and pragmatically throughout the process?* The Responsible Official participates fully in the conversations and engage the partners in the discussion in any meetings or field trips. His staff will be available to provide scientific information and professional opinions to establish the baseline, and he encourages discussion around points of discussion that may be of interest to the participants.

Demonstrate how the responsible official will clearly explain the project principles, share ideas and ask for input from collaborators. (Again, responsible officials shall not ask the group for a consensus decision, rather the collaborators should share ideas and priorities with the responsible official. It should be clear from the onset that the decision is the sole purview of the responsible official.)

a. *Based on initial data collection and project area visits, how will the responsible official outline some of the opportunities that exist? How will the responsible official outline some of the options (proposed treatment areas, possible types of treatment, mitigation measures/design features etc.) that exist?* The authorized officer has made his staff available for the public to question regarding project activities. In addition, specialists are actively discussing the project to their public during meetings and field trips for other types of projects. Staff who developed the proposed action are available for discussion and to share stand exam data and information. In addition, other key district specialists participate to discuss possible design features or other important considerations.

b. *Upon identifying these initial opportunities and options, how will the responsible official allow for feedback and input from the participants?* Collaboration with the public is continuous for all projects on the MNF. Feedback and input on specific projects are collected informally with the group through group discussions and in an 'open house' format in one-on-one discussions, if warranted. Meeting notes capture the participant feedback. In addition, written comments will also be accepted anytime during project planning.

c. *How does the responsible official intend to use this feedback?* The feedback will be used to finalize the proposed action and develop design features. It will also be used to inform collaboration in future projects.

Implementation as Part of the Collaborative Effort

How will the responsible official share information widely and continuously (i.e. routine updates on the project webpage, frequent mailings etc.)? The project planning and collaboration for MNF projects is continuous as the public discussions regarding forest management practices are ongoing and comprehensive. Project specific information is available in the project record and in the Schedule of Proposed Actions.

What commitments will the responsible official make to the collaborative group, and how will he/she ensure these are honored and consistent with existing laws and regulations? If the Responsible Official chooses to make commitments to the partners, they will be captured as part of the project record, as appropriate, or added to this collaborative document.

How will collaborative participants engage during implementation and will they remain involved in monitoring after project completion? The Responsible Official will host information meetings and field trips for the public, if warranted, during project implementation to take further feedback on implementation.

The pertinent specialist has reviewed the proposal and made the following determinations regarding the CAA:

The potential for effects to air quality is minimal from prescribed fire operations. There are no non-attainment areas in the project area and reasonable progress goals are being met for the nearby Class I areas. As such, the project is unlikely to cause any violations of the Clean Air Act.

COMMENTS

Background

The Clean Air Act requires that the U.S. Environmental Protection Agency (EPA) set national ambient air quality standards (NAAQS) at two levels for six criteria air pollutants. A primary NAAQS is set to protect public health, while a secondary NAAQS is set to protect public welfare (e.g., damage to animals, crops, vegetation, and buildings). Each standard is reviewed every few years, and revised if the most recent scientific research indicates that the current standard is not protective enough of sensitive populations. The six criteria pollutants are lead, sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), and particulate matter (PM). When measured concentrations of any of these pollutants consistently exceed the NAAQS, the area is usually designated as a "non-attainment" area by EPA. The criteria pollutants of most concern to prescribed burning on the Monongahela National Forest are particulate matter and ozone. Fine particulate matter is the leading cause of regional haze (also known as visibility impairment), while ozone can harm sensitive vegetation within the forest.

Within pristine wilderness areas, visitors expect to find clean conditions and magnificent views unobscured by manmade air pollution. The EPA has developed two separate strategies in order to improve visibility as well as protect human health. As discussed above, the EPA has established a NAAQS for fine particulate matter, a cause of visibility impairment. EPA also established the Regional Haze Rule, which calls for state and federal agencies to work together to improve visibility in all Class I areas, including most national parks and many wilderness areas. The Regional Haze Rule requires that states, in coordination with the EPA, the National Park Service, the U.S. Fish and Wildlife Service, and the U.S. Forest Service, develop and implement an air quality protection plan to reduce the pollution that causes regional haze. The goal of the program is to improve visibility at all Class I areas to natural background conditions by the year 2064. Each Class I area has its own goal for reasonable progress, with a 'glideslope' that should be met at various time intervals. EPA has established the IMPROVE monitoring network in order to measure progress in meeting the goals established in the Regional Haze Rule.

Direct and Indirect Effects

Air quality impacts from prescribed burning are generally short-term and the majority of smoke from a burn unit disperses within 24 hours. Prescribed fire emissions would have a direct, short-term effect on air quality in the project area. Once the smoke has dispersed, the impact is gone. The amount of smoke and how it is dispersed depend on the size of the burn, the type of fuel, and the meteorological conditions at the time of the burn. In general, smoke from prescribed burning disperses into the atmosphere and combines with other existing pollutants. The wind transports the smoke and pollutants to areas many miles away where they are added to and possibly react with other gases/pollutants present in the atmosphere. The fate of emissions from prescribed fires is twofold. Most of the emissions are "lifted" by convection into the atmosphere where they are dissipated by horizontal dispersion from the fire. The balance of the emissions remains in intermittent contact with the ground. Ground level smoke does not have enough heat to rise into the atmosphere. It stays in intermittent contact with the human environment and turbulent surface winds move it erratically. Human exposure to ground level smoke can be more intense, relatively brief (hours rather than days) and limited to a smaller area than exposure from smoke aloft. Smoke aloft is already dispersed before it returns to the human environment while ground level smoke must dissipate within that environment. Ground level smoke is dissipated through dispersion and deposition of smoke particles on vegetation, soil, and other objects.

Air quality within the analysis area is currently meeting the NAAQS for ozone and fine particulates. This means that current sources of pollution, including intermittent emissions from prescribed fire, are not causing air quality to exceed the current thresholds established to protect human health and welfare.

The closest Class I areas to the proposed burn units are Dolly Sods and Otter Creek Wilderness Areas; the IMPROVE monitoring station is located on site at Bearden Knob, and measures visibility-impairing pollutants. The primary cause of regional haze in the eastern United States is ammonium sulfate, a result of sulfur dioxide emitted from coal-fired power plants. The visibility impairment caused by the proposed prescribed fires is likely to be short term (less than 24 hours) in duration, and reductions in visibility (distance, color and texture) are likely to decrease as a person moves away from the prescribed fire. Wildland fire contributes to the organics portion of the fine particulate matter levels that are measured by the IMPROVE monitors. The regional planning organization VISTAS demonstrated that wildland fire emissions play a very minor role in development of regional haze in the eastern United States. Additionally, visibility at Dolly Sods and Otter Creek Wilderness Areas is shown to be meeting the current reasonable progress goals, indicating that prescribed burning is not impairing visibility at the Class I areas.

Cumulative Effects

The potential for direct and indirect effects to air quality is minimal and consequently this action would have no cumulative effect to air quality.

Conclusion

As a federal agency, the Forest Service must comply with all federal, state, and local laws and regulations concerning air quality. In West Virginia, these include State Implementation Plans for attaining and maintaining national ambient air quality standards (NAAQS) and visibility goals under the Regional Haze Rule. The desired condition for air quality is continued compliance with the NAAQS within the analysis area and minimizing the intermittent impacts of smoke to all sensitive areas.

Based on existing air quality information, no long-term adverse impacts to air quality standards are expected from the proposed Gauley Healthy Forest Restoration Project. The proposed project is designed to ensure that the Basic Smoke Management Practices are followed, and as such does not threaten to lead to a violation of any Federal, State or Local law or regulation related to air quality. However, there may be times when smoke from the proposed prescribed fires causes short-term respiratory discomfort, is a nuisance, or reduces visibility of those near the burn units. Although burns are planned to minimize these impacts to smoke sensitive areas and nearby residents, there is the potential for the smoke plume to change direction and temporarily affect those in its path. These impacts are short-lived and last less than 24 hours. Impacts may also occur some distance downwind depending on the weather conditions. This is particularly the case for burn units that may contain higher than normal fuel loads due to insect and storm damage, and lack of regular fire treatments. For these reasons, smoke management planning is an integral part of each prescribed burn operation.

CATEGORICAL EXCLUSION REVIEW

Blue text indicates instructions/clarifications and should be deleted prior to finalizing the document. Page breaks are currently used to keep sections separate. Sections can be combined to shorten the document prior to finalizing it for signature. Additional information about how the form is organized and how to finalize the form/decision memo can be found here.

PROPOSAL INFORMATION

Proposal Name: Gauley Healthy Forest Restoration Project

Proposal Date: Click here to enter a date.

Proponent Name: Proponent Name

Line Officer: Line Officer Name

District: District Name

County(ies): County(ies)

Anticipated Implementation: Date/Timing

Signing Authority: Level of Signing Authority (District Ranger, Forest Supervisor, Regional Forester etc.)

PALS Tracking #: PALS Tracking Number (required for proposals requiring DM)

If proposal/project is not entered in PALS, delete PALS Tracking # item.

Project File: Link to Pinyon or SharePoint where project documentation should be filed

GIS Info: Link to T: where project GIS info is located

General Location: General location, such as nearby road, topographical feature or facility (e.g. campground)

Applicable Management Areas: Applicable Management Areas from Land Management Plan

Legal Description: Legal Description of Project Location

Elevation Range: Elevation Range of Proposal

Watersheds: Watershed(s) where proposal is located

Is cost recovery anticipated? Choose an item.

If cost recovery is anticipated, enter status of agreement and coordinate with line officer on how to proceed. If not, delete this box: Status of Cost Recovery Agreement

APPLICABLE CATEGORY/IES

This proposal is categorically excluded from documentation in an EA or EIS because it fits the following category/categories, pending extraordinary circumstance determinations:

See 36 CFR 220.6 for full descriptions of categories established by the Chief, 7 CFR 1b.3 for categories established by the Secretary and the applicable law for categories established by statute (references to laws can be found in FSH 1909.15, Chapter 30 (Sect 32.3)) to ensure you fully understand the types of activities that fit the category. Only short titles (category number) are provided in the drop down box. If using more than one category, copy and paste the "Applicable Category" drop down list as many times as needed and choose all categories that apply. ***If the category is new and not included in this form yet, start typing in the selection box. List the category number and indicate if a Decision Memo is required.***

Applicable Category: Choose an item.

This category is/categories are applicable for this project because provide rationale for using category(ies).

PROPOSAL

*Explain the **purpose and need** for the proposal, **who** wants to do **what**, **where** they want to do it, **when** it would be done and **how** it would be accomplished. This information should also demonstrate how the proposal is in alignment with the Land Management Plan (e.g. goals, objectives, desired conditions) and fits the category(ies) identified in the previous section.*

If modifications to the proposal are identified during the environmental analysis review, consider capturing them here for continuity during implementation.

Proposal, to Include Design Features

MAP(S)

Insert vicinity map and/or other types of maps that provide context for the proposal. If there is more than one map, insert additional pages as needed ahead of the Proposal Screening section. If there are numerous maps, consider including only a few here that are most pertinent to the proposal screening considerations and provide a link to the remaining maps (project file, SharePoint, T: etc.).

PROPOSAL SCREENING

REGULATORY CONSIDERATIONS

Given the nature of the proposal, the Responsible Official is requesting documentation to demonstrate compliance with the following regulatory considerations in addition to NEPA:

List other laws as needed. Pertinent Executive Orders can be updated in the applicable section below. Sections for any laws not needing consideration can be deleted in the document below. Sections for any laws needing consideration but not included in the document below can be added.

- ☐ **NFMA/Land Management Plan**
- ☐ **ESA**
- ☐ **Sensitive Species (FSM 2670)**
- ☐ **NHPA**
- ☐ **Tribal Consultation**
- ☐ **CAA**
- ☒ **CWA**
- ☐ **Pertinent Executive Orders**

Special Management Areas:

- ☐ **Wilderness**
- ☐ **Roadless**
- ☐ **Wild & Scenic River Corridor**
- ☐ **Recommended Wilderness**
- ☐ **Research Natural Areas**
- ☐ **National Scenic & Historic Trails**
- ☐ **National Recreation Areas**

AGENCIES, ORGANIZATIONS & PERSONS TO BE CONTACTED

Given the nature of the proposal, the Line Officer/Responsible Official is requesting the following agencies, organizations and/or persons be contacted to provide input to, or to be made aware of, the proposal. A brief overview of feedback or comments provided is included.

If additional agencies, organizations and/or persons are contacted during the analysis process, be sure to add them here as the Decision Memo (if one is required) refers back to this section.

Also be sure to include a brief overview of feedback/comments received from agencies, organizations and/or persons contacted.

List agencies, organizations and/or persons to be contacted

RESOURCE PARTICIPATION IN ENVIRONMENTAL ANALYSIS REVIEW

The Line Officer/Responsible Official has requested the following resource areas to review the proposal to determine compliance with the regulatory considerations.

*The **LAST COLUMN is optional** but this initial input from specialists can help the line officer determine how to move forward with the proposal (part of small NEPA, timing etc.); **delete LAST COLUMN if not needed and/or prior to finalizing document.** Add/delete rows as needed. Upon completing the environmental analysis and regulatory compliance review, specialists need to enter their name and date in the Review Complete column indicating no further work is needed for their resource.*

Table 1: Documentation of Review Completion

Resource	Review Complete	Specialist's Initial Input on Proposal
Botany	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐
Cultural/Heritage	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Consultation anticipated for:** SHPO ☐ Tribal ☐ None ☐
Engineering	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:**
Fisheries	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐
Fuels	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Hydro	Click here to enter a date.	**Field Visit:** Field visit needed post-decision but pre-implementation and environmental review can be completed. **Estimated Total # of Days to Complete Work:** Choose an item.
Lands/Special Uses	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Minerals	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Range	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Recreation	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Are the following needed:** MRDG☐ Roadless Briefing☐ None☐
Scenic Resources	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Soils	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Special Management Areas	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Silviculture	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Wildlife	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?**

Resource	Review Complete	Specialist's Initial Input on Proposal
		YES☐ NO☐ Unsure ☐

ENVIRONMENTAL ANALYSIS REVIEW

NATIONAL FOREST MANAGEMENT ACT (NFMA) – LAND MANAGEMENT PLAN CONSISTENCY

The pertinent specialist has reviewed the proposal and made the following determinations regarding proposal consistency with applicable Land Management Plan direction, standards and guidelines.

Mark N/A if resource review not applicable based on management area or nature of the proposal. If determined to be inconsistent, list the applicable direction/standard/guideline and provide explanation of required modifications to make the proposal consistent. If needed, add resources that need to consider compliance.

Botany: Choose an item.

Cultural/Heritage: Choose an item.

Engineering: Choose an item.

Fisheries: Choose an item.

Fuels: Choose an item.

Hydro: Proposal Modification Needed

Lands/Special Uses: Choose an item.

Minerals: Choose an item.

Range: Choose an item.

Recreation: Choose an item.

Scenic Resources: Choose an item.

Soils: Choose an item.

Silviculture: Choose an item.

Special Management Areas: Choose an item.

Wildlife: Choose an item.

Other:

If needed, add resources that need to consider compliance. If none, "Other" can be deleted.

REQUIRED MODIFICATIONS

List the applicable direction/standard/guideline the proposal is inconsistent with and provide explanation of modifications required to reach consistency. If none are needed, delete this section.

1) Clarification needed on what is meant by "decommission" of temporary roads.
2) Also, clarify what will be the treatment for "existing" temporary roads.

FP Std. RF15: Temporary roads shall be rehabilitated and returned to productivity following their use.

FP Gde. RF13: Road decommissioning shall include the following: …

National Core BMP Technical Guide (FS-990a), Road-5 (Temporary Roads) and Road-6 (Road Storage and Decommissioning), and Figure 3 (flowchart):

Address the following: 1) erosion and sedimentation, 2) natural flow patterns (… hydrologically stable manner to eliminate hydrologic connectivity …), 3) area returned to resource production.

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Land Management Plan consistency checklist if one is used

Table 2: Applicable Project File Documentation to Support NFMA Compliance

Documentation Type	File Name (if applicable/needed)

ENDANGERED SPECIES ACT

THREATENED, ENDANGERED, PROPOSED AND CANDIDATE SPECIES &/OR CRITICAL HABITAT

This form is not intended to replace a BA when one is needed. Options are provided for capturing ESA determinations in this form.

The pertinent specialists reviewed the proposal and made the following determinations for threatened, endangered and/or proposed species:

If no further review needed state so here and delete the content below. State if no review needed for TEPC; if review is needed, delete this box

If further review is needed, you can add the species name in the applicable column in the below table and add/delete rows as needed. (Botany, fish and wildlife can be entered in this table.) If you do not want to use the table but would like to still display determinations in this document, ***you can use the content box below to lump species under the applicable determination.*** *If you just want to refer to the supporting project documentation (e.g. BA), you can state so in the content box and fill out the project file documentation table – whichever is sufficient to meet the responsible official's needs.*

Delete this box if the table is used or no review is needed. If you just want to refer to the project file documentation (e.g. BA), you can type that here.

List species under applicable determination. Botany, fish and wildlife can all be listed here. e.g.:

No Effect: Grizzly Bear, Canada Lynx, Bull Trout

May Affect, Not Likely to Adversely Affect: Northern Spotted Owl, Water Howelia, Lower Columbia River Steelhead

Table 3: TEPC Effect Determinations for ESA

Species/Habitat	Status	Proposed or Designated Critical Habitat Present?	Determination*	Brief Rationale (or refer to other project documentation)
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	

***NE** – No Effect; **NLAA** – May Affect, Not Likely to Adversely Affect; **LAA** – May Affect, Likely to Adversely Affect; **No Jeopardy** - Not Likely to Jeopardize the Continued Existence or Adversely Modify Critical Habitat

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section. Examples of documentation that may be cited: BA, Concurrence Letters

Table 4: Applicable Project File Documentation to Support ESA Compliance

Documentation Type	File Name (if applicable/needed)

SENSITIVE SPECIES (FSM 2670)

This form is not intended to replace a BE when one is needed. Options are provided for capturing SS determinations in this form. If you are under a new Land Management Plan that does not have Sensitive Species, delete this section.

The pertinent specialists reviewed the proposal and made the following determinations for sensitive species:

If no further review needed state so here and delete the content below. State if no review needed for sensitive species; if review is needed, delete this box

If further review is needed, you can add the species name in the applicable column in the below table and add/delete rows as needed. (Botany, fish and wildlife can be entered in this table.) If you do not want to use the table but would like to still display determinations in this document, ***you can use the content box below to lump species under the applicable determination.*** *If you just want to refer to the supporting project documentation (e.g. BE), you can state so in the content box and fill out the project file documentation table – whichever is sufficient to meet the responsible official's needs.*

Delete this box if the table is used or no review is needed. If you just want to refer to the project file documentation (e.g. BE), you can type that here.

List species under applicable determination. Botany, fish and wildlife can all be listed here. e.g.:

No Impact: Gray Wolf, Carpenter Frog, Hickory Shad, Riverbank Quillwort

May Impact Individuals or Habitat, but Will Not Likely Contribute to A Trend Towards Federal Listing or Loss of Viability To the Population or Species: Northern Bobwhite, Little Brown Myotis, Northern Copperbelly Watersnake, Dwarf Whitebirch

Table 5: Sensitive Species Impact Determinations

Species	Determination*	Rationale (or refer to other project documentation)
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	

NI – No Impact; **MIIH**- May Impact Individuals or Habitat, but Will Not Likely Contribute To A Trend Towards Federal Listing Or Loss Of Viability To The Population Or Species; **WIFV** - Will Impact Individuals or Habitat with A Consequence That the Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section. Examples of documentation that may be cited: BE if one is completed outside of this form

Table 6: Applicable Project File Documentation to Support Agency Sensitive Species Compliance

Documentation Type	File Name (if applicable/needed)

NATIONAL HISTORIC PRESERVATION ACT (NHPA) – SECTION 106 REVIEW

The pertinent specialist has reviewed the proposal and made the following determination regarding Section 106 compliance:

Choose an item.

COMMENTS

Delete this section if no comments needed. Otherwise, list mitigation and/or SHPO consultation requirements. Documentation supporting consultation can be referenced below.

List modifications and/or describe SHPO consultation as needed

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Heritage report, letter to SHPO, concurrence, programmatic agreements

Table 7: Applicable Project File Documentation to Support NHPA Compliance

Documentation Type	File Name (if applicable/needed)

TRIBAL CONSULTATION

Based on the nature of the proposal, the line officer/responsible official made the following determination regarding Tribal Consultation:

If the drop down box doesn't provide the options you need, just click on the box and start typing.

Choose an item.

If tribal consultation is not needed, delete the content below for this section. If consultation was completed, you can use the following sections to document the process if/as needed.

COMMENTS

List consultation that has occurred: list Tribes, dates of consultation and outcome – or refer to other project file documentation in the table below.

List Tribes, dates of consultation and outcome – or refer to other project file documentation (listed in the table below)

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: letters to Tribes, meeting agendas/notes

Table 8: Applicable Project File Documentation to Support Tribal Consultation Compliance

Documentation Type	File Name(s)

SPECIAL MANAGEMENT AREAS (E.G. WILDERNESS, ROADLESS ETC.)

If no special management areas need to be considered, delete this page. Lack of presence/proximity for wilderness and roadless areas can be documented under the NEPA extraordinary circumstances discussion and does not need to be discussed here. If compliance for all applicable special management areas (e.g. RNAs, recommended wilderness, wild & scenic river corridors) was already considered under the NFMA/Land Management compliance section, they do not need to be listed here; however, the specialist could choose to list them and then list the Land Management Plan as the law/regulation to demonstrate compliance with and include rationale discussions as needed.

The pertinent specialist has reviewed the proposal and made the following determinations based on special management area presence/proximity or lack of:

Table 9: Special Management Area Compliance Determinations

Management Area Type	Applicable Law/Regulation to Demonstrate Compliance With	Rationale for Compliance or Needs for Proposal Modification

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Roadless briefing materials, MRDG for wilderness, maps demonstrating location of areas or lack of presence/proximity

Table 10: Applicable Project File Documentation to Support Special Management Area Compliance

Documentation Type	File Name(s)

CLEAN AIR ACT (CAA)

If compliance with CAA is not necessary to consider based on the nature of the proposal, delete this page.

The pertinent specialist has reviewed the proposal and made the following determinations regarding the CAA:

COMMENTS

State determination and describe any proposal modifications and/or coordination that needs to occur to ensure compliance with CAA

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: correspondence with or programmatic direction from state regulatory agency

Table 11: Applicable Project File Documentation to Support CAA Compliance

Documentation Type	File Name(s)

CLEAN WATER ACT (CWA)

If compliance with CWA is not necessary to consider based on the nature of the proposal, delete this page.

The pertinent specialist has reviewed the proposal and made the following determination:

State determination and describe any proposal modifications and/or coordination that needs to occur to ensure compliance with CWA

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: CWA Checklists, TMDL information, correspondence with state regulatory agency

Table 12: Applicable Project File Documentation to Support CWA Compliance

Documentation Type	File Name(s)

PERTINENT EXECUTIVE ORDERS

If compliance with any EOs is not necessary to consider based on the nature of the proposal, delete this page.

The line officer and/or applicable specialist(s) have determined the proposal is in compliance with the following Executive Orders (EO), which were deemed pertinent based on the nature of the proposal.

A preliminary list of EOs that typically apply to Forest Service proposals has been provided. Add/delete to reflect Executive Orders applicable based on the nature of the proposal. Links to Executive Orders can be found in the Federal Register.

- EO 11988, Floodplain Management
- EO 11990, Protection of Wetlands
- EO 12898, Environmental Justice
- EO 13007, Indian Sacred Sites
- EO 13112, Invasive Species
- EO 13175, Consultation & Coordination w/ Indian Tribal Governments
- EO 13186, Migratory Birds
- EO 13443, Facilitation of Hunting Heritage & Wildlife Conservation

COMMENTS

Include any additional explanation necessary to support compliance with EOs. If no further explanation is needed, delete this section.

Additional explanation necessary to support compliance with EOs; if none needed delete this box

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) – EXTRAORDINARY CIRCUMSTANCE CONSIDERATIONS

Pertinent specialists have reviewed the proposal and made the following determinations with regards to presence of extraordinary circumstances:

*The **mere presence** of one or more of the resource conditions considered for extraordinary circumstances **does not preclude use of a categorical exclusion (CE). It is the existence of a cause-effect relationship** between a proposed action and **the potential effect on these resource conditions** and if such a relationship exists, **the degree of the potential effect** of a proposed action on these resource conditions **that determine whether extraordinary circumstances exist.** (36 CFR 220.6(b)) **If the degree of potential effect raises** UNCERTAINTY **over its significance, then an extraordinary circumstance exists,** precluding use of a categorical exclusion.*

Table 13: Extraordinary Circumstance Determinations

Resources Conditions Considered for Extraordinary Circumstances	Is there a degree of potential effect that raises uncertainty over its significance? Briefly explain.[1]
WILDLIFE **Federally listed threatened or endangered species, Designated critical habitat, Forest Service sensitive species**	Choose an item. **Rationale for Yes/No:**
FISHERIES **Federally listed threatened or endangered species, Designated critical habitat, Forest Service sensitive species**	Choose an item. **Rationale for Yes/No:**
BOTANY **Federally listed threatened or endangered species, Designated critical habitat, Forest Service sensitive species**	Choose an item. **Rationale for Yes/No:**
Floodplains, wetlands or municipal watersheds	Choose an item. **Rationale for Yes/No:**
Congressionally designated areas, such as wilderness, wilderness study areas, or national recreation areas	Choose an item. **Rationale for Yes/No:**
Inventoried roadless areas	Choose an item.

[1]Be sure to provide resource context for rationale discussions. Is there something unique to this proposal or existing resource conditions that would lead to greater intensity of effects than would typically be anticipated for similar actions?

Resources Conditions Considered for Extraordinary Circumstances	Is there a degree of potential effect that raises uncertainty over its significance? Briefly explain.[1]
	Rationale for Yes/No:
Research natural areas	Choose an item.
	Rationale for Yes/No:
American Indians and Alaska Native religious or cultural sites	Choose an item.
	Rationale for Yes/No:
Archaeological sites, or historic properties or areas	Choose an item.
	Rationale for Yes/No:

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: maps or field notes to demonstrate lack of presence/proximity of resource considered for extraordinary circumstances; model outputs or input from agencies, organizations or persons to support extraordinary circumstance discussions

Table 14: Applicable Project File Documentation to Support NEPA Compliance

Documentation Type	File Name(s)

You have the option of having the DM signed hard copy or electronically. Delete the option you do not want to use. If no DM is required for the category/ies used, delete both DM pages if the Responsible Official chooses not to do a DM. ***Additional information about how to finalize the form/decision memo can be found here (last page).***

HARD COPY SIGNATURE VERSION - *Delete all italicized, blue text prior to having decision signed. Ensure all pertinent specialists have complete their review prior to having the decision signed.*

DECISION MEMO

Project Name

U.S. Forest Service

Ranger District, National Forest

County(ies), State

This decision incorporates all previous information in this document and included in the project file.

DECISION & RATIONALE

I have decided to authorize the activities described above in the Proposal section, to include any modifications identified during environmental analysis and review of regulatory compliance. *If any modifications to the proposal were identified, consider consolidating these under the Proposal section for continuity during implementation.*

APPLICABLE CATEGORICAL EXCLUSION & FINDINGS REQUIRED BY OTHER LAWS

The Proposal Information section above provides rationale for categorically excluding this action from documentation in an Environmental Assessment (EA) or Environmental Impact Statement (EIS) and for using the identified category/categories. The Environmental Analysis Review section documents the finding that no extraordinary circumstances exist, along with findings required by other applicable laws and regulations, demonstrating compliance with the regulatory framework for the activities authorized by this decision.

AGENCIES, ORGANIZATIONS & PERSONS CONTACTED

A list of agencies, organizations and/or persons contacted regarding this proposal is provided above, along with a brief overview of comments/feedback received and how they were considered. *If parties were contacted in addition to those initially identified, be sure they are listed in the section above.*

IMPLEMENTATION DATE

I intend to implement this decision describe timing of implementation.

ADMINISTRATIVE REVIEW

Decisions that are categorically excluded from documentation in an Environmental Assessment (EA) or Environmental Impact Statement (EIS) are not subject to an administrative review process (Agriculture Act of 2014 [Pub. L. No. 113-79], Subtitle A, Sec. 8006).

CONTACT

For additional information concerning this decision, contact:

Name, Title, Mailing Address, City, State, Zip, Phone

Signature Click here to enter a date.

Responsible Official's Name

Responsible Official's Title

ELECTRONIC SIGNATURE VERSION - Delete all italicized, blue text prior to having decision signed. Ensure all pertinent specialists have complete their review prior to having the decision signed.

DECISION MEMO

Project Name

U.S. Forest Service

Ranger District, National Forest

County(ies), State

This decision incorporates all previous information in this document and included in the project file.

DECISION & RATIONALE

I have decided to authorize the activities described above in the Proposal section, to include any modifications identified during environmental analysis and review of regulatory compliance. *If any modifications to the proposal were identified, consider consolidating these under the Proposal section for continuity during implementation.*

APPLICABLE CATEGORICAL EXCLUSION & FINDINGS REQUIRED BY OTHER LAWS

The Proposal Information section above provides rationale for categorically excluding this action from documentation in an Environmental Assessment (EA) or Environmental Impact Statement (EIS) and for using the identified category/categories. The Environmental Analysis Review section documents the finding that no extraordinary circumstances exist, along with findings required by other applicable laws and regulations, demonstrating compliance with the regulatory framework for the activities authorized by this decision.

AGENCIES, ORGANIZATIONS & PERSONS CONTACTED

A list of agencies, organizations and/or persons contacted regarding this proposal is provided above, along with a brief overview of comments/feedback received and how they were considered. *If parties were contacted in addition to those initially identified, be sure they are listed in the section above.*

IMPLEMENTATION DATE

I intend to implement this decision describe timing of implementation.

ADMINISTRATIVE REVIEW

Decisions that are categorically excluded from documentation in an Environmental Assessment (EA) or Environmental Impact Statement (EIS) are not subject to an administrative review process (Agriculture Act of 2014 [Pub. L. No. 113-79], Subtitle A, Sec. 8006).

CONTACT

For additional information concerning this decision, contact:

Name, Title, Mailing Address, City, State, Zip, Phone

X ______________________________

Responsible Official's Name *A date will be automatically included with the electronic signature*

Responsible Official's Title

Gauley Healthy Forest Restoration Project

CATEGORICAL EXCLUSION REVIEW

Blue text indicates instructions/clarifications and should be deleted prior to finalizing the document. Page breaks are currently used to keep sections separate. Sections can be combined to shorten the document prior to finalizing it.

PROPOSAL INFORMATION

Proposal Name: Gauley Healthy Forest Restoration Project

Proposal Date: 11/19/2019

Proponent Name: Monongahela National Forest

Line Officer: Richard Raione

District: Gauley Ranger District

County(ies): Greenbrier, Nicholas, Pocahontas, Webster

Anticipated Implementation: Spring 2020

Signing Authority: District Ranger

PALS Tracking #: PALS Tracking Number (required for proposals requiring DM)

Project File:
[redacted]

GIS Info:
[redacted]

General Location: The project area is adjacent to, and east of Richwood, and extends eastward to the Cranberry Mountain Nature Center. West Virginia Route 39/55 bisects the project area. County road 7/2, Forest Road 99 and the Cranberry River form the northern boundary of the project area, and private lands form the southern boundary

Applicable Management Areas: Applicable Management Areas from Land Management Plan

Legal Description: Legal Description of Project Location

Elevation Range: 2,300 to 4,500 feet

Watersheds: North Fork Cherry River and Cranberry River and a small portion of Spring Creek

APPLICABLE CATEGORY/IES

This proposal is categorically excluded from documentation in an EA or EIS because it fits the following category, pending extraordinary circumstance determinations: .

Applicable Category: Section 603 of HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)): Insect and Disease Infestation.

This category is applicable for this project because all project activities comply with the Healthy Forest Restoration Act section 603 requirements. The project area:

- Does not include more than 3,000 acres. (The project area may be greater than 3,000 acres if the actual treatment areas are 3,000 acres of less.).
- Shall be limited to areas in the wildland-urban interface or to areas in Condition Classes 2 or 3 in Fire Regime Groups I, II, or III outside the wildland-urban interface.
- Shall be identified through a collaborative framework such as described in A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the environment: 10-Year Comprehensive Strategy Implementation Plan, or is developed and implemented through a collaborative process that includes multiple interested persons representing diverse interests and is transparent and nonexclusive; or meets the requirements for a resource advisory committee under subsections (c) through (f) of section 205 of the secure rural School and Community Self-Determination Act of 2000 (16 U.S.C;7125).

- Shall be consistent with agency and departmental procedures and applicable resource management plans.
- Shall not be in wilderness areas or impair the suitability of wilderness study areas for preservation as wilderness.
- Herbicides, insecticides, and pheromones may be used, but their use must be consistent with the applicable Forest Plan.
- Shall not include the construction of new permanent roads or other new permanent infrastructure but may include the construction of temporary roads if they are decommissioned and restored within 3 years of the end of project activities.
- Treatments may include the sale of vegetative material if the primary purpose of the activity is to reduce hazardous fuels.
- Maximizes the retention of old-growth and large trees, as appropriate for the forest type, to the extent that the trees promote stands that are resilient to insects and disease,
- Considers the best available scientific information to maintain or restore the ecological integrity, including maintaining or restoring structure, function, composition, and connectivity.

PROPOSAL

The purpose of the project is to reduce the expansion and threat of significant, damaging forest insects and disease on the Monongahela National Forest and reduce fuels buildup that cause uncharacteristic wildfire conditions. There is a need to address these conditions are as follows:

- Beech bark disease is inhibiting ecological restoration throughout the Forest. Management efforts to improve forest resiliency are needed.
- The continued spread of hemlock woolly adelgid is devastating a species of unique ecosystem value. Areas of particularly high value hemlock have been identified. Substantial tree mortality is likely to occur, if not treated.
- The recurrence of destructive gypsy moth outbreaks throughout the Forest is presently the most significant threat. Gypsy moth defoliation is a significant cause of oak tree mortality affecting forest health and public safety.
- There is a high probability of emerald ash borer eliminating the ash component of the Forest. Emerald ash borer has been detected near the Forest. Substantial ash mortality is likely to occur posing imminent risk to forest health, infrastructure, and public safety.
- The northern hardwoods that comprise 22 percent of the Forest, dominated by beech, hemlock, and sugar maple, are particularly susceptible to beech bark disease, hemlock woolly adelgid and sugar maple decline.

The Gauley Ranger District of the Monongahela National Forest proposes to conduct hazardous fuels reduction activities on 3,000 acres of the 42,000-acre project boundary. The project area is adjacent to, and east of Richwood, and extends eastward to the Cranberry Mountain Nature Center. West Virginia Route 39/55 bisects the project area. County road 7/2, Forest Road 99 and the Cranberry River form the northern boundary of the project area, and private lands form the southern boundary. The general area is managed under Forest Plan management prescriptions 3.0 and 4.1. Project activities would begin in the Spring of 2020. Possible treatments may include, but are not limited to the construction of temporary roads and the upgrade and maintenance of existing designated roads; construction of fuel breaks; the use of herbicides, insecticides, and pheromones; use of pesticides; application of prescribed fire; timber harvesting, including salvage (commercial sale); mastication, mowing, thinning, clear-cut or other thinning methods; and other allowable actions. All project activity specifics will be outlined in an upcoming project implementation plan.

This project is generally located within 3.0 and 4.1 Forest Plan Management Prescriptions.
Management Prescription 3.0 emphasizes the following:

- Age class diversity and sustainable timber production

- A variety of forest scenery
- Habitat for wildlife species tolerant of disturbances, such as deer, grouse, and squirrel
- A primarily motorized recreation environment

Management Prescription 4.1 emphasizes the following:

- Active and passive restoration of spruce and spruce-hardwood communities;
- Recovery of threatened and endangered species and other species of concern associated with spruce and spruce-hardwood communities;
- Management of hardwood communities where spruce is negligible; and
- A mix of forest products.

The desired future condition and goals for portions of Management Prescription 4.1 area with little suitability for spruce restoration are to:

- Enhance diversity of wildlife habitat by managing for a variety of vegetation species, types, and age classes
- Create artificial water sources as needed in conjunction with other resource activities
- Use of vegetation management to enhance the variety of wildlife habitat on the Forest while favoring tree species and forest communities that are beneficial to wildlife.

The focus of the proposed action is on improving forest stand health and composition as outlined in section 602 of HFRA and on the specific forest plan desired conditions for each management area. Providing commercial timber products is a by-product of meeting the desired conditions.

MAP(S)

Insert vicinity map and/or other types of maps that provide context for the proposal. If there is more than one map, insert additional pages as needed ahead of the Proposal Screening section. If there are numerous maps, consider including only a few here that are most pertinent to the proposal screening considerations and provide a link to the remaining maps (project file, SharePoint, T: etc.).

PROPOSAL SCREENING

REGULATORY CONSIDERATIONS

Given the nature of the proposal, the Responsible Official is requesting documentation to demonstrate compliance with the following regulatory considerations in addition to NEPA:

List other laws as needed. Pertinent Executive Orders can be updated in the applicable section below. Sections for any laws not needing consideration can be deleted in the document below. Sections for any laws needing consideration but not included in the document below can be added.

☒ **NFMA/Land Management Plan**

☒ **ESA**

☒ **Sensitive Species (FSM 2670)**

☒ **NHPA**

☒ **Tribal Consultation**

☒ **CAA**

☒ **CWA**

☒ **Pertinent Executive Orders**

Special Management Areas:

☐ **Roadless**

☐ **Wild & Scenic River Corridor**

☐ **Recommended Wilderness**

☐ **Research Natural Areas**

☐ **National Scenic & Historic Trails**

☐ **National Recreation Areas**

AGENCIES, ORGANIZATIONS & PERSONS TO BE CONTACTED

Given the nature of the proposal, the Line Officer/Responsible Official is requesting the following agencies, organizations and/or persons be contacted to provide input to, or to be made aware of, the proposal. A brief overview of feedback or comments provided is included.

Include additional agencies, organizations and/or persons are contacted during the analysis process.

Also be sure to include a brief overview of feedback/comments received from agencies, organizations and/or persons contacted.

(b)(5); Deliberative Process Privilege

[redacted]

RESOURCE PARTICIPATION IN ENVIRONMENTAL ANALYSIS REVIEW

Commented [TAS-1]: All specialists need to fill out this section. Please add additional rows if your resource is not listed.

The Line Officer/Responsible Official has requested the following resource areas to review the proposal to determine compliance with the regulatory considerations.

*The **LAST COLUMN is optional** but this initial input from specialists can help the line officer determine how to move forward with the proposal (part of small NEPA, timing etc.); **delete LAST COLUMN if not needed and/or prior to finalizing document.** Add/delete rows as needed. Upon completing the environmental analysis and regulatory compliance review, specialists need to enter their name and date in the Review Complete column indicating no further work is needed for their resource.*

Table 1: Documentation of Review Completion

Resource	Review Complete	Specialist's Initial Input on Proposal
Botany	Click here to enter a date. Specialist's Name	**Field Visit:** No field visit needed. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐
Cultural/Heritage	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Consultation anticipated for:** SHPO ☐ Tribal ☐ None ☐
Engineering	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:**
Fisheries	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐
Fuels	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Hydro	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Lands/Special Uses	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Minerals	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Range	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Recreation	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Are the following needed:** MRDG☐ Roadless Briefing☐ None☐
Scenic Resources	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Soils	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Special Management Areas	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Silviculture	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Wildlife	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐

ENVIRONMENTAL ANALYSIS REVIEW

NATIONAL FOREST MANAGEMENT ACT (NFMA) – LAND MANAGEMENT PLAN CONSISTENCY

Commented [TAS-2]: All specialists need to fill out this section.

The pertinent specialist has reviewed the proposal and made the following determinations regarding proposal consistency with applicable Land Management Plan direction, standards and guidelines.

Mark N/A if resource review not applicable based on management area or nature of the proposal. If determined to be inconsistent, list the applicable direction/standard/guideline and provide explanation of required modifications to make the proposal consistent. If needed, add resources that need to consider compliance.

Botany: Choose an item.

Cultural/Heritage: Choose an item.

Engineering: Choose an item.

Fisheries: Choose an item.

Fuels: Choose an item.

Hydro: Choose an item.

Lands/Special Uses: Choose an item.

Minerals: Choose an item.

Range: Choose an item.

Recreation: Choose an item.

Scenic Resources: Choose an item.

Soils: Choose an item.

Silviculture: Choose an item.

Special Management Areas: Choose an item.

Wildlife: Choose an item.

Other:

If needed, add resources that need to consider compliance. If none, "Other" can be deleted.

REQUIRED MODIFICATIONS

List the applicable direction/standard/guideline the proposal is inconsistent with and provide explanation of modifications required to reach consistency. If none are needed, delete this section.

List applicable direction/standard/guideline the proposal is inconsistent with and provide explanation of modifications required to reach consistency; if none are needed delete this box

SUPPORTING PROJECT DOCUMENTATION

Commented [TAS-3]: This is where you can reference your individual reports. BABEs and NHPA documentation should be included in the next sections.

Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Land Management Plan consistency checklist if one is used

Table 2: Applicable Project File Documentation to Support NFMA Compliance

Documentation Type	File Name (if applicable/needed)

ENDANGERED SPECIES ACT

Commented [TAS-4]: Wildlife bios, fish, bios, aquatics, plants specialists: please fill out this section.

THREATENED, ENDANGERED, PROPOSED AND CANDIDATE SPECIES &/OR CRITICAL HABITAT

This form is not intended to replace a BA when one is needed. Options are provided for capturing ESA determinations in this form.

The pertinent specialists reviewed the proposal and made the following determinations for threatened, endangered and/or proposed species:

If no further review needed state so here and delete the content below. State if no review needed for TEPC; if review is needed, delete this box

If further review is needed, you can add the species name in the applicable column in the below table and add/delete rows as needed. (Botany, fish and wildlife can be entered in this table.) If you do not want to use the table but would like to still display determinations in this document, ***you can use the content box below to lump species under the applicable determination.*** *If you just want to refer to the supporting project documentation (e.g. BA), you can state so in the content box and fill out the project file documentation table – whichever is sufficient to meet the responsible official's needs.*

Delete this box if the table is used or no review is needed. If you just want to refer to the project file documentation (e.g. BA), you can type that here.

List species under applicable determination. Botany, fish and wildlife can all be listed here. e.g.:

No Effect: Grizzly Bear, Canada Lynx, Bull Trout

May Affect, Not Likely to Adversely Affect: Northern Spotted Owl, Water Howelia, Lower Columbia River Steelhead

Table 3: TEPC Effect Determinations for ESA

Species/Habitat	Status	Proposed or Designated Critical Habitat Present?	Determination*	Brief Rationale (or refer to other project documentation)
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	

***NE** – No Effect; **NLAA** – May Affect, Not Likely to Adversely Affect; **LAA** – May Affect, Likely to Adversely Affect; **No Jeopardy** - Not Likely to Jeopardize the Continued Existence or Adversely Modify Critical Habitat

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section. Examples of documentation that may be cited: BA, Concurrence Letters

Table 4: Applicable Project File Documentation to Support ESA Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-5]: Add BA documentation here, including concurrence letters or BOs.

SENSITIVE SPECIES (FSM 2670)

This form is not intended to replace a BE when one is needed. Options are provided for capturing SS determinations in this form. If you are under a new Land Management Plan that does not have Sensitive Species, delete this section.

The pertinent specialists reviewed the proposal and made the following determinations for sensitive species:

If no further review needed state so here and delete the content below. State if no review needed for sensitive species; if review is needed, delete this box

If further review is needed, you can add the species name in the applicable column in the below table and add/delete rows as needed. (Botany, fish and wildlife can be entered in this table.) If you do not want to use the table but would like to still display determinations in this document, ***you can use the content box below to lump species under the applicable determination.*** *If you just want to refer to the supporting project documentation (e.g. BE), you can state so in the content box and fill out the project file documentation table – whichever is sufficient to meet the responsible official's needs.*

Delete this box if the table is used or no review is needed. If you just want to refer to the project file documentation (e.g. BE), you can type that here.

List species under applicable determination. Botany, fish and wildlife can all be listed here. e.g.:

No Impact: Gray Wolf, Carpenter Frog, Hickory Shad, Riverbank Quillwort

May Impact Individuals or Habitat, but Will Not Likely Contribute to A Trend Towards Federal Listing or Loss of Viability To the Population or Species: Northern Bobwhite, Little Brown Myotis, Northern Copperbelly Watersnake, Dwarf Whitebirch

Table 5: Sensitive Species Impact Determinations

Species	Determination*	Rationale (or refer to other project documentation)
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	

NI – No Impact; **MIIH**- May Impact Individuals or Habitat, but Will Not Likely Contribute To A Trend Towards Federal Listing Or Loss Of Viability To The Population Or Species; **WIFV** - Will Impact Individuals or Habitat with A Consequence That the Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section. Examples of documentation that may be cited: BE if one is completed outside of this form

Table 6: Applicable Project File Documentation to Support Agency Sensitive Species Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-6]: Add BE documentation here.

NATIONAL HISTORIC PRESERVATION ACT (NHPA) – SECTION 106 REVIEW

The pertinent specialist has reviewed the proposal and made the following determination regarding Section 106 compliance:

Choose an item.

COMMENTS

Delete this section if no comments needed. Otherwise, list mitigation and/or SHPO consultation requirements. Documentation supporting consultation can be referenced below.

List modifications and/or describe SHPO consultation as needed

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Heritage report, letter to SHPO, concurrence, programmatic agreements

Table 7: Applicable Project File Documentation to Support NHPA Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-7]: Heritage/Cultural Resource specialists complete the next two sections. Include any file documentation below such as SHPO consultation records and concurrence documents.

TRIBAL CONSULTATION

Based on the nature of the proposal, the line officer/responsible official made the following determination regarding Tribal Consultation:

If the drop down box doesn't provide the options you need, just click on the box and start typing.

Choose an item.

If tribal consultation is not needed, delete the content below for this section. If consultation was completed, you can use the following sections to document the process if/as needed.

COMMENTS

List consultation that has occurred: list Tribes, dates of consultation and outcome – or refer to other project file documentation in the table below.

List Tribes, dates of consultation and outcome – or refer to other project file documentation (listed in the table below)

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: letters to Tribes, meeting agendas/notes

Table 8: Applicable Project File Documentation to Support Tribal Consultation Compliance

Documentation Type	File Name(s)

SPECIAL MANAGEMENT AREAS (E.G., ROADLESS ETC.)

Commented [TAS-8]: All specialists fill out the next sections for special management areas such as roadless, WSR, national landmarks, botanical areas, RNA, NRAs, etc. Add the location of specific documentation for these management areas below

If no special management areas need to be considered, delete this page. Lack of presence/proximity for wilderness and roadless areas can be documented under the NEPA extraordinary circumstances discussion and does not need to be discussed here. If compliance for all applicable special management areas (e.g. RNAs, recommended wilderness, wild & scenic river corridors) was already considered under the NFMA/Land Management compliance section, they do not need to be listed here; however, the specialist could choose to list them and then list the Land Management Plan as the law/regulation to demonstrate compliance with and include rationale discussions as needed.

The pertinent specialist has reviewed the proposal and made the following determinations based on special management area presence/proximity or lack of:

Table 9: Special Management Area Compliance Determinations

Management Area Type	Applicable Law/Regulation to Demonstrate Compliance With	Rationale for Compliance or Needs for Proposal Modification

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Roadless briefing materials, MRDG for wilderness, maps demonstrating location of areas or lack of presence/proximity

Table 10: Applicable Project File Documentation to Support Special Management Area Compliance

Documentation Type	File Name(s)

CLEAN AIR ACT (CAA)

If compliance with CAA is not necessary to consider based on the nature of the proposal, delete this page.

The pertinent specialist has reviewed the proposal and made the following determinations regarding the CAA:

COMMENTS

State determination and describe any proposal modifications and/or coordination that needs to occur to ensure compliance with CAA

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: correspondence with or programmatic direction from state regulatory agency

Table 11: Applicable Project File Documentation to Support CAA Compliance

Documentation Type	File Name(s)

Commented [TAS-9]: Specialists fill out this section and add documentation location below.

CLEAN WATER ACT (CWA)

If compliance with CWA is not necessary to consider based on the nature of the proposal, delete this page.

The pertinent specialist has reviewed the proposal and made the following determination:

State determination and describe any proposal modifications and/or coordination that needs to occur to ensure compliance with CWA

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: CWA Checklists, TMDL information, correspondence with state regulatory agency

Table 12: Applicable Project File Documentation to Support CWA Compliance

Documentation Type	File Name(s)

Commented [TAS-10]: Specialists fill out this section and add documentation location below.

PERTINENT EXECUTIVE ORDERS

If compliance with any EOs is not necessary to consider based on the nature of the proposal, delete this page.

The line officer and/or applicable specialist(s) have determined the proposal is in compliance with the following Executive Orders (EO), which were deemed pertinent based on the nature of the proposal.

A preliminary list of EOs that typically apply to Forest Service proposals has been provided. Add/delete to reflect Executive Orders applicable based on the nature of the proposal. Links to Executive Orders can be found in the Federal Register.

- EO 11988, Floodplain Management
- EO 11990, Protection of Wetlands
- EO 12898, Environmental Justice
- EO 13007, Indian Sacred Sites
- EO 13112, Invasive Species
- EO 13175, Consultation & Coordination w/ Indian Tribal Governments
- EO 13186, Migratory Birds
- EO 13443, Facilitation of Hunting Heritage & Wildlife Conservation

COMMENTS

Include any additional explanation necessary to support compliance with EOs. If no further explanation is needed, delete this section.

Additional explanation necessary to support compliance with EOs; if none needed delete this box

Gauley Healthy Forest Restoration Project

CATEGORICAL EXCLUSION REVIEW

Blue text indicates instructions/clarifications and should be deleted prior to finalizing the document. Page breaks are currently used to keep sections separate. Sections can be combined to shorten the document prior to finalizing it.

PROPOSAL INFORMATION

Proposal Name: Gauley Healthy Forest Restoration Project

Proposal Date: 1/30/2020

Proponent Name: Monongahela National Forest

Line Officer: Richard Raione

District: Gauley Ranger District

County(ies): Greenbrier, Nicholas, Pocahontas, Webster

Anticipated Implementation: Spring 2020

Signing Authority: District Ranger

PALS Tracking #: 57335

Project File:
(b)(4) [redacted]

GIS Info:
(b)(4) [redacted]

General Location: The project area is adjacent to, and east of Richwood, and extends eastward to the Cranberry Mountain Nature Center. West Virginia Route 39/55 bisects the project area. County road 7/2, Forest Road 99 and the Cranberry River form the northern boundary of the project area, and private lands form the southern boundary

Applicable Management Areas: Applicable Management Areas from Land Management Plan

Legal Description: Legal Description of Project Location

Elevation Range: 2,300 to 4,500 feet

Watersheds: North Fork Cherry River and Cranberry River and a small portion of Spring Creek

APPLICABLE CATEGORY/IES

This proposal is categorically excluded from documentation in an EA or EIS because it fits the following category:

Applicable Category: Section 603 of HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)): Insect and Disease Infestation.

This category is applicable for this project because all project activities comply with the Healthy Forest Restoration Act section 603 requirements. The project area:

- Does not include more than 3,000 acres. (The project area may be greater than 3,000 acres if the actual treatment areas are 3,000 acres of less).
- Shall be limited to areas in the wildland-urban interface or to areas in Condition Classes 2 or 3 in Fire Regime Groups I, II, or III outside the wildland-urban interface.
- Shall be identified through a collaborative framework such as described in *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan*, or is developed and implemented through a collaborative process that includes multiple interested persons representing diverse interests and is transparent and nonexclusive; or meets the requirements for a resource advisory committee under subsections (c) through (f) of section 205 of the secure rural School and Community Self-Determination Act of 2000 (16 U.S.C;7125).
- Shall be consistent with agency and departmental procedures and applicable resource management plans;

- Shall not be in wilderness areas or impair the suitability of wilderness study areas for preservation as wilderness;
- Herbicides, insecticides, and pheromones may be used, but their use must be consistent with the applicable Forest Plan;
- Shall not include the construction of new permanent roads or other new permanent infrastructure but may include the construction of temporary roads if they are decommissioned and restored within 3 years of the end of project activities;
- Treatments may include the sale of vegetative material if the primary purpose of the activity is to reduce hazardous fuels;
- Maximizes the retention of old-growth and large trees, as appropriate for the forest type, to the extent that the trees promote stands that are resilient to insects and disease; and
- Considers the best available scientific information to maintain or restore the ecological integrity, including maintaining or restoring structure, function, composition, and connectivity.

PROPOSAL

The Gauley Ranger District of the Monongahela National Forest proposes to conduct hazardous fuels reduction activities on 2,984 acres of the 48,000-acre project boundary. The project area is adjacent to, and east of Richwood, and extends eastward to the Cranberry Mountain Nature Center. West Virginia Route 39/55 bisects the project area. County road 7/2, Forest Road 99, and the Cranberry River form the northern boundary of the project area, and private lands form the southern boundary. The general area is managed under Forest Plan management prescriptions 3.0 and 4.1. Project activities would begin in the Spring of 2020. Possible treatments may include, but are not limited to the construction of temporary roads and the upgrade and maintenance of existing designated roads; construction of fuel breaks; the use of herbicides, insecticides, and pheromones; use of pesticides; application of prescribed fire; timber harvesting, including salvage (commercial sale); mastication, mowing, thinning, clear-cut or other thinning methods; and other allowable actions. All project activity specifics will be outlined in an upcoming project implementation plan.

All design criteria, best management practices, and mitigation measures developed for this project (as approved by the authorized officer) will be implemented as well as all applicable measures outlined in the Forest Plan Standards and Guidelines. As such, resource specialists will conduct their analysis with the assumption that these practices will be applied in full force and effect during project implementation.

Thinning and Associated Treatments

Thinning. Forest Plan, page A2 "The thinning method is an intermediate cut that . . . removes high risk . . . low quality, diseased, and over mature trees to increase the health, development, and growth of the residual trees in a stand. . .. Thinning is applicable to all of the forest types found on the Forest."

The primary purpose of treatment is stand improvement to develop resilient healthy stands more resistant to insects, disease, or fire. Some, but not all of trees to be removed in the thinning treatment are dead, dying, or damaged from an active infestation of insects or disease (See Forest Service Handbook 2409.19 Chapter 70) such as hemlock wooly adelgid, beech bark disease, emerald ash borer, and other native pests. Wood rot fungi related to damage from recurrent storm events (including the Derecho and Hurricane Sandy in 2012 and tornados in 2016) are also a major factor in the need to remove and salvage trees. Timber volume from salvage will vary depending on individual stand characteristics, but it is estimated to be less than 25 percent of the volume. Depending on timing of salvage needs, additional entry into specific areas could be needed for salvage.

Thinning is expected to remove about one-third of the basal area in a commercial harvest, which removes mostly sawtimber. Within treatment areas, large trees will be favored to be left to the extent that they are healthy and have potential to persist within the stand. Many large trees would be cut to salvage, or because of dead tops and branches, or because of active infestations of insects or diseases. Removing some trees by thinning, whether commercially or non-commercially, is part of an Integrated Pest Management method to minimize or prevent the development of pest problems (Forest Plan Goal VE26). In some areas, especially in or near the fuel breaks and around Summit Lake campground, treatment may be needed in addition to commercial harvests or instead of commercial harvests if trees to be removed are not suitable for timber products.

Firewood gathering opportunities may be provided (Goal TR14). Many or most of the trees to be removed have been determined by the Forest to be a risk to public safety, so personal use firewood may include dead, down or green trees to be removed (Standard TR15). Some of the areas to be treated may be made available to the public as green firewood sale to accomplish the resource management objectives of reducing fire and insect and disease risk (TR16). Closed roads may be opened temporarily for firewood collecting (TR17).

Commercial timber harvest involves the use of hand or mechanical felling and removal from the forest by helicopter or skidder.

Vine Control. Vine Control may be done in stands to be thinned– Forest Plan page A16. "Vines interfere with the growth of trees, causing decreased growth, deformity, and broken tops. Broken tops allow entrance for insect and diseases, decreasing the vigor of a stand. Vines are severed with cutting tools near the ground. (This treatment may be done three growing seasons prior to harvest.)

Clearcutting (Regeneration) and Associated Treatments

Clearcutting (Regeneration). Forest Plan, page A2 "The clearcutting method harvests most or all of the trees within a stand in one removal. Typically, some reserve trees are left to meet wildlife habitat or other resource needs." Commercial timber harvest involves the use of hand or mechanical felling and removal from the forest by helicopter or skidder. Firewood gathering opportunities may be provided with these treatments also, as described under thinning.

The primary purpose of treatment is to develop healthy resilient young stands that will be more resistant to insects, disease, or fire in the long-term. Up to 10 percent of timber to be removed may be salvage of material that is dead, dying, or damaged from an active infestation of insects or disease.

Associated with the clearcutting treatment is ***Site Preparation with Hand Tools for Natural Regeneration*** – Forest Plan page A15. "The objective of site preparation is to enhance germination, sprouting, and survival of natural regeneration. Site preparation includes cutting down residual trees between 1 and 5 inches in diameter during or immediately after a regeneration harvest. Normally red spruce, hemlock, dogwood, serviceberry and shrub species that produce mast for wildlife are not cut. This treatment opens up the forest floor to increased sunlight to improve seed germination potential, promotes sprouting of cut trees, and reduces shading that could inhibit the growth of shade intolerant and moderately tolerant species."

Vine Control may be done in stands to be regenerated– Forest Plan page A16. "Vines interfere with the growth of trees, causing decreased growth, deformity, and broken tops. Broken tops allow entrance for insect and diseases, decreasing the vigor of a stand. Vines are severed with cutting tools near the ground. (This treatment may be done three growing seasons prior to harvest to prevent sprouting of vines during the regeneration period that would harm young trees.)

Additional associated treatments may be included as needed to enhance regeneration such as hand tree planting, fencing, or caging to protect from deer browse, weeding to enhance species composition, and treatment of non-native invasive plant species. These treatments would involve hand tools and hand labor, which would involve minimal ground disturbance. Scalping of each planting spot with hand tools, spot spraying of herbicides, or individual tree fertilization could be part of the tree planting methodology. These potential treatments would occur during the regeneration period (normally 1 to 5 years after the harvest and site preparation) and are done with hand tools. Natural regeneration is typically rapid and successful in this area, so tree planting and associated treatments are unlikely to be needed on more than 100 acres, and planting could be used to enhance species diversity.

Crop tree release (Forest Plan, page A – 16) may be done within regenerated areas to increase tree species diversity that would further enhance resistance to insects, disease, or fire. Integrated Pest Management methods would be used to minimize or prevent the development of pest problems, and could include the use of pesticides, for example, to preserve hemlock trees facing mortality from hemlock wooly adelgid (VE26, 27, 28, 29, 32, 34, 35, 36, and 37).

Herbicide. Forest Plan page A16. This treatment will be used to control competition with diseased beech sprouts, only in stands where beech bark disease occurs and has resulted in dense competition that excludes tree and understory species. In most cases, it will be possible to control competition with diseased beech sprouts by cutting alone, as described above in **Site Preparation with Hand Tools for Natural Regeneration**. Diseased American beech trees should not be left standing in regeneration cuts, since the resulting diseased beech thickets are not a desired outcome of the treatment. For herbicide treatment of diseased beech, herbicides would be applied to individual stems by stem injection (cut surface treatment) or basal spray, both methods using manual labor.

Prescribed Fire and Fuels Reduction Treatments

Prescribed Fire – Broadcast. The project will be implemented during either the Spring (prior to green-up) or Fall (dormant) seasons to promote fire adapted species and to reduce leaf litter and the threat of uncharacteristic wildfire. A low to moderate fire intensity will be used to reduce leaf litter while maintaining fire adapted overstory trees. The result of this prescribed fire project will be to create a healthy forest by reducing dead woody debris, increasing sunlight by reducing competition from fire intolerant tree species, promoting native grasses, increasing oak regeneration, and increasing wildlife populations. Natural features such as roads, streams, and rivers will be used as much as possible to limit the impact on the land. In instances where handline or bulldozer lines need to be constructed Minimum Impact Suppression Tactics (MIST) techniques will be used. The concept of MIST is to use the minimum amount of forces necessary to effectively achieve the fire management protection objectives consistent with land and resource management objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects when determining how to implement an appropriate suppression response. In some cases, MIST may indicate where cold trailing or wet line may be more appropriate than constructed handline. In another example, the use of an excavator may be used rather than a bulldozer. Individual determinations will be dependent on the specific situation and circumstances of each fire. Prescribed fire would be implemented in this area periodically until resource objectives are meet.

Prescribed Fire – Piles. An associated treatment that consists of creating hand piles along private property boundary and Forest Service infrastructure will reduce logging slash and woody debris created from the thinning project within the fuel break. Piles will consist of top wood and non-merchantable wood. Piles will be burned during low fire danger days when spread potential is low. No handline will be constructed for hand piling. Piles may be constructed whenever there is a change in fuel loadings that may influence the effectiveness of the fuel break. An example of this would be a weather event that blows down trees within the fuel break.

Fuel Breaks*:* Mechanical fuel breaks will be constructed along portions of private property and Forest Service infrastructure and will typically be within thinning treatment units. This mechanical fuel break will consist of removing dead and down trees, pruning limbs of larger trees, and removing brush/vines and some small diameter trees within 100 feet of private property or Forest Service infrastructure. Slash created from harvest operation will be mechanically or hand piled and burned or pulled away from private property or Forest Service infrastructure by the contractor approximately 100 feet from property boundary. Fuel breaks will be created and maintained by using chainsaws, prescribed fire, and/or mowing. Prescribed burning may be used within fuel breaks to reduce fuel loading of brush, shrubs, and trees while encouraging the growth of fire adapted species. These fuel breaks will create defensible space in the event of a wildfire in the vicinity. The fuel breaks will be evaluated periodically for effectiveness of the defensible space and to determine if future treatments are needed.

Roads

Road maintenance. Road maintenance will occur as needed on system roads within the project area to provide for egress and ingress in case of fire and for firefighting as well as timber haul. It includes mowing, grading, cleaning or replacing culverts, and applying surface material. Some of the culverts to be replaced are at stream crossings, such as the one on FR 946 where it crosses Spencer Run. Road maintenance also includes removing hazard trees (using commercial sale methods where practical) that may fall and block the road access and to thin the canopy across and along roads so they can act as fuel breaks (Forest Plan RF11).

Closed roads may be opened temporarily for firewood collecting (TR17).

Temporary roads. Temporary roads used for removal of timber products involve blading a route with cut and fill slopes, providing for water crossings during use, and decommissioning after use. Temporary roads used for hauling products may also involve gravel surfacing. Temporary roads for hauling or skidding are not anticipated to be needed on very steep slopes (more than 50 percent). Building or using temporary roads on steep slopes (40 to 50 percent) would be avoided where possible. If during implementation, operation on steep slopes (40 to 50 percent) is found to be needed, then operation on these slopes shall be analyzed on a case-by-case basis to determine the best method of operation while maintaining soil stability and productivity according to standard SW07.

Temporary roads will be needed for removal of timber products. Temporary roads will be decommissioned and restored within 3 years of the end of project activities as required by the Section 603 of HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)). Decommissioning methods used for temporary roads should allow for fuel reduction by brushing to retain defensible space, where appropriate. Decommissioning methods for temporary roads built on existing linear wildlife openings should consider the need to retain defensible space as well as maintenance of wildlife and pollinator plantings after use.

Decommissioning of temporary roads used for both hauling and skidding would follow guideline RF13. The road profile should not normally be returned to contour during decommissioning. Decommissioning should also allow for treatment of non-native plant species, as appropriate.

Non-Native Invasive Species

Existing and new infestations of high-priority nonnative invasive plants in proposed activity areas will be treated before, during, and after project implementation to prevent the spread of nonnative species into new areas. Treatment methods will include hand-pulling, mowing, grubbing, biological control, and herbicide application. The species that may be controlled and the herbicides that may be used are listed in Table 2.1 of the *2010 Forest-wide Nonnative Invasive Plant Management Project Environmental Analysis* (beginning on page 2 to 7). All design criteria, mitigation measures, and monitoring requirements listed in Chapter 2 this analysis (page 2 to 15 through 2 to 20) will be followed. Herbicide use on nonnative invasive species has also been examined under this analysis.

Project Implementation

- It is estimated that project activities will occur within a 5 to 7-year timeframe with specific details to be addressed in the implementation plan.
- During implementation, conventional units may be harvested by helicopters at the discretion of the responsible official.
- An NNIS implementation plan will be developed prior to implementing the proposed action.
- Forest Plan standard WF14 will be coordinated with specialists and the responsible official during implementation.

Standard VE13 - Prior to implementation, surveys for threatened, endangered, and sensitive (TES) plants would be conducted from June 1st through September 30th in proposed activity areas that have not been previously surveyed, where optimal habitat conditions persist. If any occurrences of TES plants are found in or near any activity areas, occurrences will be documented. Implementation will not be allowed to proceed, until protective measures have been established to avoid or minimized negative effects. Protective Measures could include the following mitigations: plant monitors on site, avoidance areas, temporary fencing, translocation, etc. Protective measures will be developed by the ecologist and approved by the Responsible Official.

Project Acreages and Mileages

Table 1. Project acreages

Treatment	Acreage
Thinning, using ground-based logging, without prescribed burning	1519
Thinning, using helicopter logging, without prescribed burning	741
Prescribed burning and thinning using ground-based logging	200
Prescribed burning (without thinning)	157
Regeneration harvest, using ground-based logging	242
Regeneration harvest, using helicopter logging	109
Fuel break, not included in other timber harvest in 3 locations	16
Total Treatment Acreage	2984

Table 2. Road mileages

Type of Road	Mileage	Width in feet
Temporary road construction	1.0	25
Temporary road reconstruction	1.9	25
Temporary road construction	28.6	12
Temporary road reconstruction	30.4	12
Maintenance of forest system roads	19.1	

Table 3. Regeneration Units

Harvest Unit ID	Treatment	Logging Method	GIS Acres
R3	Regen	Ground based	29
R4	Regen	Ground based	25
R5	Regen	Ground based	26
R6	Regen	Ground based	15
R8	Regen	Ground based	38
R9	Regen	Ground based	34
R10	Regen	Ground based	39

Harvest Unit ID	Treatment	Logging Method	GIS Acres
R74	Regen	Ground based	36
		Total Ground Based Regeneration Acres:	*242*
R1	Regen	Helicopter	41
H2	Regen	Helicopter	29
H7	Regen	Helicopter	39
		Total Helicopter Regeneration Acres:	*109*
		Total Acres	**351**

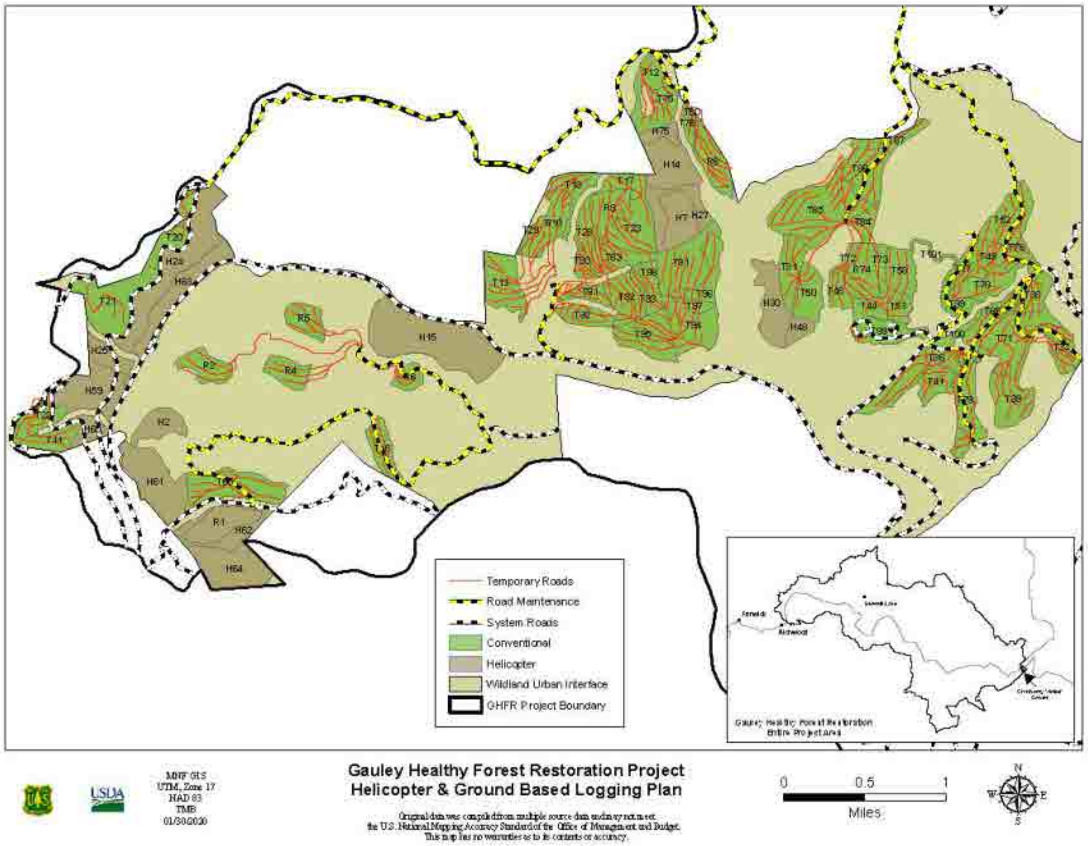
Table 4. Unit details

ID	Cut Type	Method	GIS Acres	Prescribed Burn
T11	Thinning	Conventional	24	No
T12	Thinning	Conventional	44	No
T13	Thinning	Conventional	48	No
T16	Thinning	Conventional	28	No
T17	Thinning	Conventional	20	No
T18	Thinning	Conventional	25	No
T20	Thinning	Conventional	33	No
T21	Thinning	Conventional	75	No
T22	Thinning	Conventional	34	No
T23	Thinning	Conventional	45	No
T28	Thinning	Conventional	17	No
T29	Thinning	Conventional	6	No
T31	Thinning	Conventional	34	No
T34	Thinning	Conventional	27	No
T36	Thinning	Conventional	50	No
T38	Thinning	Conventional	23	No
T41	Thinning	Conventional	23	No
T44	Thinning	Conventional	22	No
T46	Thinning	Conventional	17	No
T49	Thinning	Conventional	29	No
T50	Thinning	Conventional	33	No
T52	Thinning	Conventional	31	No
T53	Thinning	Conventional	17	No
T58	Thinning	Conventional	30	No
T65	Thinning	Conventional	68	No
T69	Thinning	Conventional	31	No
T70	Thinning	Conventional	33	No
T71	Thinning	Conventional	73	No

ID	Cut Type	Method	GIS Acres	Prescribed Burn
T72	Thinning	Conventional	8	No
T73	Thinning	Conventional	9	No
T75	Thinning	Conventional	11	No
T76	Thinning	Conventional	8	No
T77	Thinning	Conventional	18	No
T78	Thinning	Conventional	30	No
T79	Thinning	Conventional	53	No
T80	Thinning	Conventional	2	No
T81	Thinning	Conventional	60	No
T82	Thinning	Conventional	39	Yes
T83	Thinning	Conventional	30	No
T84	Thinning	Conventional	15	No
T85	Thinning	Conventional	102	No
T86	Thinning	Conventional	50	No
T87	Thinning	Conventional	16	No
T88	Thinning	Conventional	43	No
T89	Thinning	Conventional	35	No
T90	Thinning	Conventional	16	No
T91	Thinning	Conventional	16	Yes
T92	Thinning	Conventional	23	Yes
T93	Thinning	Conventional	13	Yes
T94	Thinning	Conventional	49	Yes
T95	Thinning	Conventional	51	Yes
T97	Thinning	Conventional	9	Yes
T96	Thinning	Conventional	30	No
T98	Thinning	Conventional	10	No
T99	Thinning	Conventional	15	No
T100	Thinning	Conventional	12	No
T101	Thinning	Conventional	6	No
		Sub Total Conventional Thinning	***1719***	
H14	Thinning	Helicopter	51	No
H15	Thinning	Helicopter	145	No
H24	Thinning	Helicopter	97	No
H25	Thinning	Helicopter	24	No
H27	Thinning	Helicopter	35	No
H30	Thinning	Helicopter	49	No
H48	Thinning	Helicopter	13	No
H59	Thinning	Helicopter	64	No
H60	Thinning	Helicopter	19	No

ID	Cut Type	Method	GIS Acres	Prescribed Burn
H61	Thinning	Helicopter	73	No
H62	Thinning	Helicopter	31	No
H63	Thinning	Helicopter	63	No
H64	Thinning	Helicopter	63	No
H75	Thinning	Helicopter	14	No
		Sub Total Helicopter Thinning	***741***	
		Acreage Totals	**2460**	

MAP(S)


Temporary Roads
Road Maintenance
System Roads
Conventional
Helicopter
Wildland Urban Interface
GHFR Project Boundary
MNF GIS
UTM, Zone 17
NAD 83
TMB
01/30/2020
Gauley Healthy Forest Restoration Project
Helicopter & Ground Based Logging Plan
Original data was compiled from multiple source data and may not meet
the U.S. National Mapping Accuracy Standard of the Office of Management and Budget.
This map has no warranties as to its contents or accuracy.
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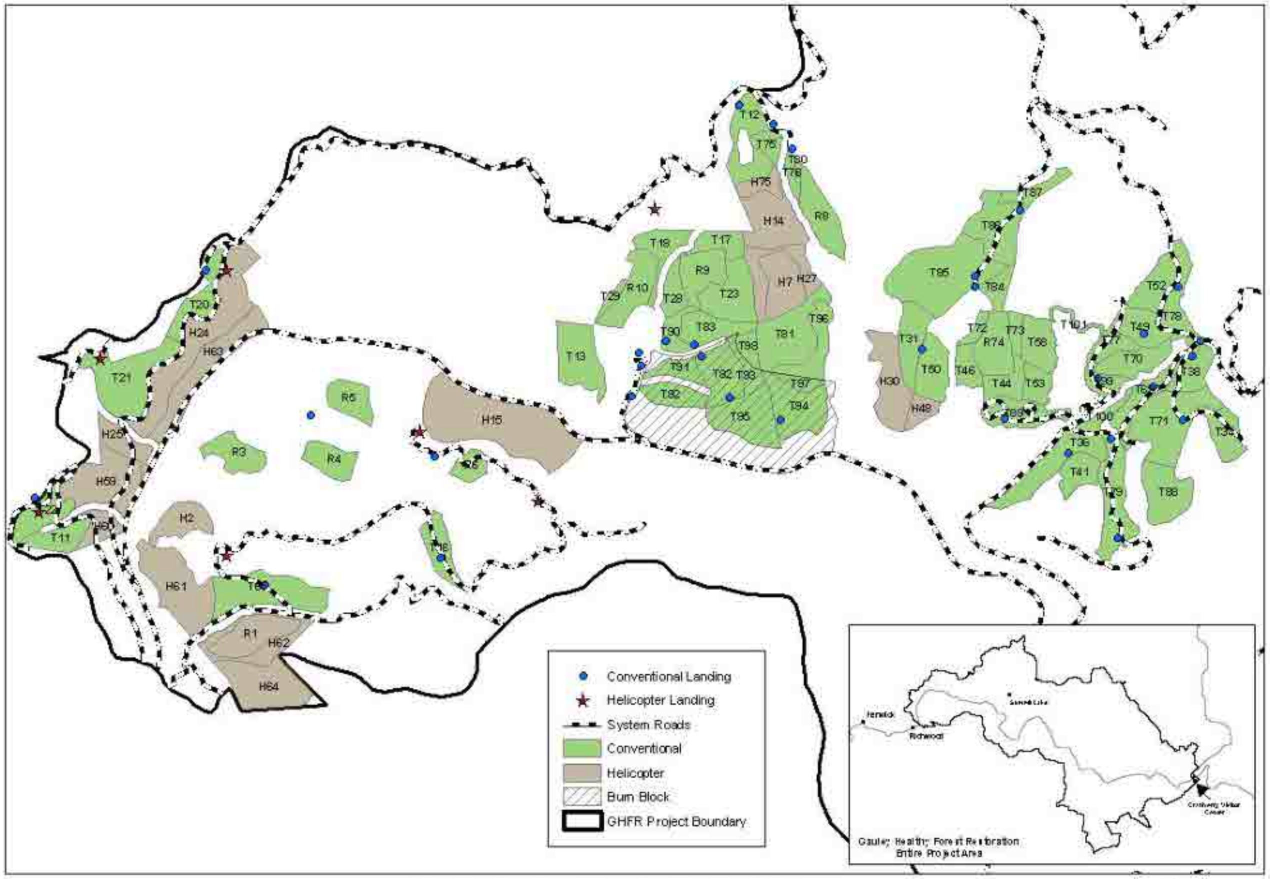
Gauley Healthy Forest Restoration Project



MNF GIS
UTM, Zone 17
NAD 83
TMB
01/28/2020

Gauley Healthy Forest Restoration Project
Helicopter & Ground Based Logging Plan

Original data was compiled from multiple source data and may not meet the U.S. National Mapping Accuracy Standard of the Office of Management and Budget. This map has no warranties as to its contents or accuracy.

0 5 10
Miles

PROPOSAL SCREENING

REGULATORY CONSIDERATIONS

Given the nature of the proposal, the Responsible Official is requesting documentation to demonstrate compliance with the following regulatory considerations in addition to NEPA:

List other laws as needed. Pertinent Executive Orders can be updated in the applicable section below. Sections for any laws not needing consideration can be deleted in the document below. Sections for any laws needing consideration but not included in the document below can be added.

☒ **NFMA/Land Management Plan**

☒ **ESA**

☒ **Sensitive Species (FSM 2670)**

☒ **NHPA**

☒ **Tribal Consultation**

☒ **CAA**

☒ **CWA**

☒ **Pertinent Executive Orders**

Special Management Areas:

☐ **Roadless**

☒ **Wild & Scenic River Corridor**

☐ **Recommended Wilderness**

☐ **Research Natural Areas**

☐ **National Scenic & Historic Trails**

☐ **National Recreation Areas**

AGENCIES, ORGANIZATIONS & PERSONS TO BE CONTACTED

Given the nature of the proposal, the Line Officer/Responsible Official is requesting the following agencies, organizations and/or persons be contacted to provide input to, or to be made aware of, the proposal. A brief overview of feedback or comments provided is included.

Include additional agencies, organizations and/or persons are contacted during the analysis process.

Also be sure to include a brief overview of feedback/comments received from agencies, organizations and/or persons contacted.

(b)(5); Deliberative Process Privilege
[redacted]

RESOURCE PARTICIPATION IN ENVIRONMENTAL ANALYSIS REVIEW

The Line Officer/Responsible Official has requested the following resource areas to review the proposal to determine compliance with the regulatory considerations.

*The **LAST COLUMN is optional** but this initial input from specialists can help the line officer determine how to move forward with the proposal (part of small NEPA, timing etc.); **delete LAST COLUMN if not needed and/or prior to finalizing document.** Add/delete rows as needed. Upon completing the environmental analysis and regulatory compliance review, specialists need to enter their name and date in the Review Complete column indicating no further work is needed for their resource.*

Table 5: Documentation of Review Completion

Resource	Review Complete	Specialist's Initial Input on Proposal
Botany	Click here to enter a date. Amy Coleman	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐
Cultural/Heritage	Click here to enter a date. Gavin Hale	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Consultation anticipated for:** SHPO ☐ Tribal ☐ None ☐
Engineering	Click here to enter a date. Specialist's Name	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:**
Fisheries	Click here to enter a date. Kyle Tasker	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐
Fuels	Click here to enter a date. John Fry, Walt Walter	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Hydro	Click here to enter a date. Tim Tolley	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Lands/Special Uses	Click here to enter a date. Carol Whetsell	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Recreation	2/3/2020 Matt Edwards	**Field Visit:** Field visit needed prior to decision being signed but can complete most of the environmental review prior to that. **Estimated Total # of Days to Complete Work:** 2-5 **Are the following needed:** MRDG☐ Roadless Briefing☐ None☒
Scenic Resources	2/3/2020 Matt Edwards	**Field Visit:** Field visit needed prior to decision being signed but can complete most of the environmental review prior to that. **Estimated Total # of Days to Complete Work:** <2
Soils	Click here to enter a date. Adrienne Nottingham	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Special Management Areas	2/3/2020 Matt Edwards	**Field Visit:** No field visit needed. **Estimated Total # of Days to Complete Work:** <2
Silviculture	Click here to enter a date. Jane Bard	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item.
Wildlife	Click here to enter a date. Kim Tarter, Cheryl Tanner	**Field Visit:** Choose an item. **Estimated Total # of Days to Complete Work:** Choose an item. **Is consultation with a regulatory agency anticipated?** YES☐ NO☐ Unsure ☐

Commented [TAS-1]: All specialists need to fill out this section. Please add additional rows if your resource is not listed.

Resource	Review Complete	Specialist's Initial Input on Proposal

ENVIRONMENTAL ANALYSIS REVIEW

NATIONAL FOREST MANAGEMENT ACT (NFMA) – LAND MANAGEMENT PLAN CONSISTENCY

The pertinent specialist has reviewed the proposal and made the following determinations regarding proposal consistency with applicable Land Management Plan direction, standards and guidelines.

Mark N/A if resource review not applicable based on management area or nature of the proposal. If determined to be inconsistent, list the applicable direction/standard/guideline and provide explanation of required modifications to make the proposal consistent. If needed, add resources that need to consider compliance.

Botany: Choose an item.

Cultural/Heritage: Choose an item.

Engineering: Choose an item.

Fisheries: Choose an item.

Fuels: Choose an item.

Hydro: Choose an item.

Lands/Special Uses: Choose an item.

Minerals: Choose an item.

Range: Choose an item.

Recreation: Consistent

Scenic Resources: Consistent

Soils: Choose an item.

Silviculture: Choose an item.

Special Management Areas: Proposal Modification Needed

Wildlife: Choose an item.

Other:

If needed, add resources that need to consider compliance. If none, "Other" can be deleted.

REQUIRED MODIFICATIONS

List the applicable direction/standard/guideline the proposal is inconsistent with and provide explanation of modifications required to reach consistency. If none are needed, delete this section.

(b)(5); Deliberative Process Privilege

[redacted]

SUPPORTING PROJECT DOCUMENTATION

Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Land Management Plan consistency checklist if one is used

Table 6: Applicable Project File Documentation to Support NFMA Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-2]: All specialists need to fill out this section.

Commented [MJ-F3]: Highlighted

Commented [TAS-4]: This is where you can reference your individual reports. BABEs and NHPA documentation should be included in the next sections.

Documentation Type	File Name (if applicable/needed)

ENDANGERED SPECIES ACT

Commented [TAS-5]: Wildlife bios, fish, bios, aquatics, plants specialists: please fill out this section.

THREATENED, ENDANGERED, PROPOSED AND CANDIDATE SPECIES &/OR CRITICAL HABITAT

This form is not intended to replace a BA when one is needed. Options are provided for capturing ESA determinations in this form.

The pertinent specialists reviewed the proposal and made the following determinations for threatened, endangered and/or proposed species:

If no further review needed state so here and delete the content below. State if no review needed for TEPC; if review is needed, delete this box

If further review is needed, you can add the species name in the applicable column in the below table and add/delete rows as needed. (Botany, fish and wildlife can be entered in this table.) If you do not want to use the table but would like to still display determinations in this document, ***you can use the content box below to lump species under the applicable determination.*** *If you just want to refer to the supporting project documentation (e.g. BA), you can state so in the content box and fill out the project file documentation table – whichever is sufficient to meet the responsible official's needs.*

Delete this box if the table is used or no review is needed. If you just want to refer to the project file documentation (e.g. BA), you can type that here.

List species under applicable determination. Botany, fish and wildlife can all be listed here. e.g.:

No Effect: Grizzly Bear, Canada Lynx, Bull Trout

May Affect, Not Likely to Adversely Affect: Northern Spotted Owl, Water Howelia, Lower Columbia River Steelhead

Table 7: TEPC Effect Determinations for ESA

Species/Habitat	Status	Proposed or Designated Critical Habitat Present?	Determination*	Brief Rationale (or refer to other project documentation)
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	
	Choose an item.	Choose an item.	Choose an item.	

***NE** – No Effect; **NLAA** – May Affect, Not Likely to Adversely Affect; **LAA** – May Affect, Likely to Adversely Affect; **No Jeopardy** - Not Likely to Jeopardize the Continued Existence or Adversely Modify Critical Habitat

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section. Examples of documentation that may be cited: BA, Concurrence Letters

Table 8: Applicable Project File Documentation to Support ESA Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-6]: Add BA documentation here, including concurrence letters or BOs.

SENSITIVE SPECIES (FSM 2670)

This form is not intended to replace a BE when one is needed. Options are provided for capturing SS determinations in this form. If you are under a new Land Management Plan that does not have Sensitive Species, delete this section.

The pertinent specialists reviewed the proposal and made the following determinations for sensitive species:

If no further review needed state so here and delete the content below. State if no review needed for sensitive species; if review is needed, delete this box

If further review is needed, you can add the species name in the applicable column in the below table and add/delete rows as needed. (Botany, fish and wildlife can be entered in this table.) If you do not want to use the table but would like to still display determinations in this document, ***you can use the content box below to lump species under the applicable determination.*** *If you just want to refer to the supporting project documentation (e.g. BE), you can state so in the content box and fill out the project file documentation table – whichever is sufficient to meet the responsible official's needs.*

Delete this box if the table is used or no review is needed. If you just want to refer to the project file documentation (e.g. BE), you can type that here.

List species under applicable determination. Botany, fish and wildlife can all be listed here. e.g.:

No Impact: Gray Wolf, Carpenter Frog, Hickory Shad, Riverbank Quillwort

May Impact Individuals or Habitat, but Will Not Likely Contribute to A Trend Towards Federal Listing or Loss of Viability To the Population or Species: Northern Bobwhite, Little Brown Myotis, Northern Copperbelly Watersnake, Dwarf Whitebirch

Table 9: Sensitive Species Impact Determinations

Species	Determination*	Rationale (or refer to other project documentation)
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	
	Choose an item.	

NI – No Impact; **MIIH**- May Impact Individuals or Habitat, but Will Not Likely Contribute To A Trend Towards Federal Listing Or Loss Of Viability To The Population Or Species; **WIFV** - Will Impact Individuals or Habitat with A Consequence That the Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section. Examples of documentation that may be cited: BE if one is completed outside of this form

Table 10: Applicable Project File Documentation to Support Agency Sensitive Species Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-7]: Add BE documentation here.

NATIONAL HISTORIC PRESERVATION ACT (NHPA) – SECTION 106 REVIEW

The pertinent specialist has reviewed the proposal and made the following determination regarding Section 106 compliance:

Choose an item.

COMMENTS

Delete this section if no comments needed. Otherwise, list mitigation and/or SHPO consultation requirements. Documentation supporting consultation can be referenced below.

List modifications and/or describe SHPO consultation as needed

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Heritage report, letter to SHPO, concurrence, programmatic agreements

Table 11: Applicable Project File Documentation to Support NHPA Compliance

Documentation Type	File Name (if applicable/needed)

Commented [TAS-8]: Heritage/Cultural Resource specialists complete the next two sections. Include any file documentation below such as SHPO consultation records and concurrence documents.

TRIBAL CONSULTATION

Based on the nature of the proposal, the line officer/responsible official made the following determination regarding Tribal Consultation:

If the drop down box doesn't provide the options you need, just click on the box and start typing.

Choose an item.

If tribal consultation is not needed, delete the content below for this section. If consultation was completed, you can use the following sections to document the process if/as needed.

COMMENTS

List consultation that has occurred: list Tribes, dates of consultation and outcome – or refer to other project file documentation in the table below.

List Tribes, dates of consultation and outcome – or refer to other project file documentation (listed in the table below)

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: letters to Tribes, meeting agendas/notes

Table 12: Applicable Project File Documentation to Support Tribal Consultation Compliance

Documentation Type	File Name(s)

SPECIAL MANAGEMENT AREAS (E.G., ROADLESS ETC.)

If no special management areas need to be considered, delete this page. Lack of presence/proximity for wilderness and roadless areas can be documented under the NEPA extraordinary circumstances discussion and does not need to be discussed here. If compliance for all applicable special management areas (e.g. RNAs, recommended wilderness, wild & scenic river corridors) was already considered under the NFMA/Land Management compliance section, they do not need to be listed here; however, the specialist could choose to list them and then list the Land Management Plan as the law/regulation to demonstrate compliance with and include rationale discussions as needed.

The pertinent specialist has reviewed the proposal and made the following determinations based on special management area presence/proximity or lack of:

Table 13: Special Management Area Compliance Determinations

Management Area Type	Applicable Law/Regulation to Demonstrate Compliance With	Rationale for Compliance or Needs for Proposal Modification
Wild and Scenic Rivers	Monongahela National Forest Wild and Scenic River Study Report The National Wild and Scenic Rivers Act of 1968.	Proposed actions fall within WSR corridor. NFLMP Standard WS03 states: When management actions are proposed that may compromise the outstandingly remarkable value, classification, or free-flowing character of an eligible Wild and Scenic River segment, a suitability study shall be completed for that eligible river segment prior to initiating the actions.

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: Roadless briefing materials, MRDG for wilderness, maps demonstrating location of areas or lack of presence/proximity

Table 14: Applicable Project File Documentation to Support Special Management Area Compliance

Documentation Type	File Name(s)

Commented [TAS-9]: All specialists fill out the next sections for special management areas such as roadless, WSR, national landmarks, botanical areas, RNA, NRAs, etc. Add the location of specific documentation for these management areas below

Documentation Type	File Name(s)

CLEAN AIR ACT (CAA)

Commented [TAS-10]: Specialists fill out this section and add documentation location below.

If compliance with CAA is not necessary to consider based on the nature of the proposal, delete this page.

The pertinent specialist has reviewed the proposal and made the following determinations regarding the CAA:

COMMENTS

State determination and describe any proposal modifications and/or coordination that needs to occur to ensure compliance with CAA

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: correspondence with or programmatic direction from state regulatory agency

Table 15: Applicable Project File Documentation to Support CAA Compliance

Documentation Type	File Name(s)

CLEAN WATER ACT (CWA)

If compliance with CWA is not necessary to consider based on the nature of the proposal, delete this page.

The pertinent specialist has reviewed the proposal and made the following determination:

State determination and describe any proposal modifications and/or coordination that needs to occur to ensure compliance with CWA

SUPPORTING PROJECT DOCUMENTATION

Optional - Provide references to project file documentation necessary to support the above determinations. Add/delete rows as needed. If no additional documentation needed, delete this section.

Examples of documentation that may be cited: CWA Checklists, TMDL information, correspondence with state regulatory agency

Table 16: Applicable Project File Documentation to Support CWA Compliance

Documentation Type	File Name(s)

Commented [TAS-11]: Specialists fill out this section and add documentation location below.

PERTINENT EXECUTIVE ORDERS

If compliance with any EOs is not necessary to consider based on the nature of the proposal, delete this page.

The line officer and/or applicable specialist(s) have determined the proposal is in compliance with the following Executive Orders (EO), which were deemed pertinent based on the nature of the proposal.

A preliminary list of EOs that typically apply to Forest Service proposals has been provided. Add/delete to reflect Executive Orders applicable based on the nature of the proposal. Links to Executive Orders can be found in the Federal Register.

- EO 11988, Floodplain Management
- EO 11990, Protection of Wetlands
- EO 12898, Environmental Justice
- EO 13007, Indian Sacred Sites
- EO 13112, Invasive Species
- EO 13175, Consultation & Coordination w/ Indian Tribal Governments
- EO 13186, Migratory Birds
- EO 13443, Facilitation of Hunting Heritage & Wildlife Conservation

COMMENTS

Include any additional explanation necessary to support compliance with EOs. If no further explanation is needed, delete this section.

Additional explanation necessary to support compliance with EOs; if none needed delete this box

Effects of Imidacloprid Treatment of Hemlocks on Aquatic Ecosystems: Is the Cure Worse Than the Disease?

USGS-NPS Water Quality Partnership Grant
Contract No. G17AC00066

Final Project Report

27 December 2019

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ABSTRACT

In this study, we investigated whether the usage of a common insecticide for forest conservation has non-target effects on stream organisms. Hemlock woolly adelgid (HWA; *Adelges tsugae*) is an invasive insect that has caused wide-spread loss of hemlock trees in the eastern United States. Imidacloprid is a neonicotinoid insecticide and is the most widely used treatment to mitigate hemlock mortality from HWA infestations, but application of imidacloprid can result in lethal and sublethal effects on non-target taxa. we assessed non-target effects of HWA treatments using imidacloprid on benthic macroinvertebrates and stream salamanders in central West Virginia hemlock forests.

This final report has four chapters. In Chapter 1, we provide a literature review of the impact of HWA on forest systems and known non-target effects of HWA treatments on benthic macroinvertebrates and amphibians. We also review studies that investigated bioaccumulation of imidacloprid in amphibians and other taxa.

In Chapter 2, we assess whether stream salamanders or benthic macroinvertebrates bioaccumulate imidacloprid or imidacloprid metabolites through exposure to HWA treatments. We also evaluate relationships between imidacloprid bioaccumulation and exposure and sublethal effects in salamanders, including corticosterone hormone levels and body condition indices. Of 107 stream salamanders, 29 individuals had detectable levels of imidacloprid ($n = 14$) and/or imidacloprid-olefin ($n = 19$) in their tissues. Of 15 stream invertebrate samples, 15 had detectable levels of imidacloprid and 13 had detectable levels of imidacloprid-urea in their tissues. Corticosterone levels increased with increasing numbers of imidacloprid applications and body condition decreased as water imidacloprid concentration increased. Our study demonstrates that stream salamanders and invertebrates can bioaccumulate imidacloprid from HWA treatments and imidacloprid exposure likely has sublethal effects on stream salamanders.

In Chapter 3, we evaluate whether abundances of five stream salamander species are affected by imidacloprid presence. We surveyed stream salamanders 5–7 times at 48 sites, 27 of which were directly adjacent to HWA treatments. We used *N*-mixture models and a model selection approach to identify important predictors of abundance for *Desmognathus fuscus*, *D. monticola*, *D. ochrophaeus*, *Eurycea* spp., and *Gyrinophilus porphyriticus.* We identified influential detection and habitat variables for each species and then tested models containing imidacloprid predictors. For all species, there was support for models containing predictors of

imidacloprid exposure, but the model confidence intervals overlapped with 0 for nearly all models. We did find a negative correlation between number of years since treatment and the abundances of *D. ochrophaeus* adults and *G. porphyriticus* larva, suggesting that both were negatively affected by imidacloprid exposure but that the effects on population abundances do not occur immediately.

In Chapter 4, we evaluate whether imidacloprid exposure affects benthic macroinvertebrate communities in the Monongahela National Forest and two units of the National Park Service in West Virginia. We sampled benthic macroinvertebrates from 47 sites, 26 of which were directly adjacent to HWA treatments. We calculated seven benthic macroinvertebrate community metrics and then compared those indices to four imidacloprid predictors with linear or beta regressions. There was support for effects of imidacloprid exposure on all community metrics, and the relationship between community metrics and imidacloprid differed by locality with GLIMPSS and WVSCI being lower in the Monongahela National Forest in sites with imidacloprid exposure. Additionally, we compared functional traits of benthic macroinvertebrate communities to metrics of imidacloprid exposure. Functional traits analysis showed no significant differences in community functional traits composition between sites with or without imidacloprid presence, and with or without treated trees. Variation in functional traits was higher in sites in MNF with environmental imidacloprid exposure, suggesting that some functional traits may be lost from streams with imidacloprid. We conclude that use of imidacloprid is likely negatively affecting benthic macroinvertebrate communities in MNF.

The goal of this study was to inform forest managers about potential non-target concerns in stream organisms exposed to HWA treatments. We detected sublethal effects in *Desmognathus* spp., decreases in abundances in *D. ochrophaeus* adults and *G. porphyriticus* larva with increasing number of years since treatment, and effects on benthic macroinvertebrate communities in MNF. Overall, this study has demonstrated that stream organisms in West Virginia may be at risk from imidacloprid used for HWA treatments.

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CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1. Impact of hemlock woolly adelgid on hemlock forests

Eastern hemlock (*Tsuga canadensis*) is a long-lived, late-successional, and ecologically important species that is the predominant species on approximately 931,000 hectares of land in the United States (U.S.; Ellison et al. 2010, McWilliams and Schmidt 2000). Eastern hemlock ranges from as far south as Northern Alabama and Georgia to southern Canada and reaches its western extent in Wisconsin (Havill et al. 2014). The less common Carolina hemlock (*T. caroliniana*) is a relict species that exists in several pockets in the Southern U.S. (Havill et al. 2014, Ward et al. 2004). Although hemlocks have low economic value for their timber and pulp, they are recognized for their ecological and aesthetic attributes (Havill et al. 2014). Eastern hemlock is a foundation species in both urban and forested landscapes of the eastern U.S. because it provides critical habitat for diverse plant and animal species (Becker et al. 2008, Ellison 2014, Snyder et al. 2002, Tingley et al. 2002).

In the Appalachian Mountains, hemlocks typically grow near headwater streams and greatly influence stream characteristics such as temperature, nutrient cycling, and the biotic communities within the streams (Ellison et al. 2010, Havill et al. 2014). Hemlock-dominated stands produce deep shade and slowly-decomposing litter, producing damp and cool microclimates (Mathewson 2009). Hemlocks also photosynthesize and store carbon in the spring and fall when deciduous trees are leafless but fix less carbon and transpire 50% less water in the summer than deciduous trees, which stabilizes soil moisture levels, stream base-flows, and stream temperatures (Daley et al. 2007, Hadley and Schedlbauer 2002, Snyder et al. 2002). These characteristics enable aquatic macroinvertebrate species that are intolerant of seasonal drying to persist in streams within hemlock forests, resulting in high macroinvertebrate diversity (Snyder et al. 2002). Several macroinvertebrate taxa show strong associations with hemlock forests (Snyder et al. 2002). In addition, streams that drain hemlock forests often have unique communities of birds, salamanders, fish, and macroinvertebrates (Becker et al. 2008, Mathewson 2009, Snyder et al. 2002, Tingley et al. 2002, Ward et al. 2004). Hemlock stands provide the moist conditions that salamanders require for the deposition and development of eggs and for cutaneous respiration (Harper and Guynn 1999, Petranka 1998).

The most significant threat to eastern hemlock and Carolina hemlock is the non-native insect hemlock woolly adelgid (HWA; *Adelges tsugae*) (Havill et al. 2014). HWA was first reported in the eastern U.S. in 1951 in Virginia. This population originated from central Japan where the insects feed on southern Japanese hemlocks (*T. sieboldii*) (Preisser et al. 2014) and was likely introduced to the U.S. on live plant material imported from Japan (Havill et al. 2014). HWA infests hemlock trees in Japan in high numbers without causing substantial injury or tree mortality, likely due to host resistance, host tolerance, and natural enemies of HWA (Havill et al. 2014).

HWA presents an important and immediate threat to eastern hemlock populations and has expanded to ca. 50% of the eastern hemlock's range (Havill et al. 2014). The threat posed by HWA led the International Union for Conservation of Nature (IUCN) to list eastern hemlock as "Near Threatened" and place it on the Red List of Threatened Species (Farjon 2013). HWA causes hemlock mortality by inducing a systemic hypersensitive response in the hemlock tree which causes localized cell death in the tree and dieback of branches (Havill et al. 2014, Radville et al. 2011). Hemlock mortality occurs more rapidly in the southern U.S. because warmer winter air temperatures can support larger HWA populations (Ellison et al. 2010, Ford et al. 2012). In one study in Connecticut, 80% of hemlock mortality occurred 15 years after infestation (Small et al. 2005), while in North Carolina, 80% mortality occurred six years after infestation (Ford et al. 2012). Hemlock generally does not repopulate after HWA-induced death and is instead replaced by hardwood species such as birches (*Betula* spp.), oaks (*Quercus* spp.) and maples (*Acer* spp., Orwig et al. 2002). The loss of hemlock trees throughout the eastern U.S. is expected to cause considerable changes to those ecosystems' functions (Orwig et al. 2008).

2. Imidacloprid treatment of HWA

Early treatment of HWA infestations used foliar insecticides, but this approach was replaced in the early 1990s by neonicotinoids because foliar insecticides required frequent re-application and applications that drenched the foliage (Havill et al. 2014). Neonicotinoids are synthetic derivatives of nicotine which kill insects by acting on their central nervous system and antagonizing the nicotinic acetylcholine receptors (nAChR) (Matsuda et al. 2001, Yamamoto 1999). Neonicotinoids have a greater binding affinity to the nAChR in insect brains than in mammalian brains, which makes neonicotinoids more toxic to insects than to mammals (Yamamoto 1999).

There are seven commercially available neonicotinoid compounds (imidacloprid, clothianidin, thiamethoxam, acetamiprid, dinotefuran, thiacloprid, and nitenpyram), of which imidacloprid is the most commonly applied (Elbert et al. 2008). Imidacloprid is a systemic, chloro-nicotinyl insecticide first synthesized in 1985 (Elbert et al. 1998), registered for use in the U.S. in 1994 (Cox 2001), and has become one of the most commonly used insecticides in the world (van Dijk et al. 2013). Imidacloprid is an ingredient in over 400 products and one-fifth of insecticides sold worldwide (Elbert et al. 2008). This pesticide has a wide range of uses, including treating fleas and ticks on domestic animals, controlling termites, and protecting crops from insect pests (Gervais et al. 2010).

Hemlocks are treated with imidacloprid through soil and trunk injections, which control HWA infestations within 1–3 months of application (Havill et al. 2014). Soil injections provide better long-term control of HWA but the risk of leaching imidacloprid from the soil is high. In general, the volume of applied insecticide which reaches its intended target is much smaller than the volume which is released into the environment (Warnhoff and Schneider 1999). Trunk injections reduce the risk of imidacloprid spreading into the surrounding environment but may only provide protection for HWA for several months (Ward 2004), making re-application necessary for long-term control. Currently, chemical treatments are the most effective method of controlling HWA, although other control options are also being explored, including biological controls such as the predator *Laricobius nigrinus* (Zilahi-Balogh et al. 2003), silvicultural thinning (Fajvan 2008), and propagating hemlock trees that are putatively resistant to HWA (Caswell et al. 2008).

3. Leaching of imidacloprid into aquatic systems

Three previous studies have quantified imidacloprid concentrations in streams associated with HWA treatments. Less than 1.0 ng/mL of imidacloprid was detected in a stream in Chattahoochee National Forest 720 days after imidacloprid application; no imidacloprid was detected in three other treatment streams (Churchel et al. 2011). Imidacloprid concentrations ranging from 0.053–0.833 ng/mL were detected in three streams adjacent to HWA treatment areas in Big South Fork National River and Recreational Area during a rain event (4.7 cm/24 hours) that occurred 184 to 196 days after imidacloprid application, but imidacloprid was not detected in water samples which were collected every month prior to the rain event and for ca. 7 months after the rain event (Wiggins et al. 2018). In the Great Smoky Mountains National Park, water samples were collected 10–100 m downstream of treated areas and 10-100 m upstream of treated areas that each contained 100–1000 hemlock trees treated 1–8 years prior to the study. The samples were analyzed for concentrations of imidacloprid and two of its metabolites (olefin and 5-hydroxy). Imidacloprid was detected in 7 of 10 downstream locations with concentrations ranging from 0.0285–0.3791 ng/mL but in no upstream locations. All samples were below limit of detection (LOD) for olefin and 5-hydroxy. Concentration of imidacloprid was highly correlated with amount of imidacloprid applied to the treatment area (Benton et al. 2015).

Several characteristics of imidacloprid make it more susceptible to leaching into ground or surface water than many other pesticides. Imidacloprid's high water solubility allows for leaching into groundwater and streams (US EPA 2003). Imidacloprid also has low volatility and a low soil organic water partition coefficient, which is the ratio of the mass of the chemical adsorbed in the soil to the mass of organic carbon in the soil (Ding et al. 2011). These characteristics, in conjunction with the general proximity of hemlock forests to riparian areas, increase the risk of imidacloprid leaching into stream systems (Ding et al. 2011). Imidacloprid is more likely to leach in areas with low organic matter in the soil because it has a high organic binding capacity (Anhalt et al. 2008). Most forests have large quantities of organic matter in the soil, but it is possible that the high doses of imidacloprid applied to the trees saturate the local binding capacity (Anhalt et al. 2008). Imidacloprid in surface water degrades when exposed to sunlight into several photoproducts (Ding et al. 2011), a process known as aqueous photolysis (Colombo et al. 2013), but continual leaching into stream systems may maintain imidacloprid presence in stream systems near treated hemlocks (Benton et al. 2016). Imidacloprid is more likely to leach during rain events (Churchel et al. 2011, Cowles et al. 2009, McGrath et al. 2010). Another route for imidacloprid to enter aquatic systems and negatively impact stream fauna is through the leaves of imidacloprid treated trees falling into streams (Kreutzweiser et al., 2008). Imidacloprid and its metabolites (olefin, 5-hydroxy and dihydroxy) can be detected in hemlock foliage for up to seven years after treatment with a soil drench (Benton et al. 2015). To our knowledge, no studies have directly investigated the persistence of imidacloprid in stream sediment.

4. Ecological consequences of imidacloprid treatment on benthic macroinvertebrates

Several field studies have been conducted to assess whether benthic macroinvertebrates are at risk from HWA treatments. In Great Smoky Mountains National Park, aquatic communities in 9 streams exposed to HWA treatments were compared to upstream reaches without HWA treatment and to pre-treatment data (Benton et al. 2017). Community diversity metrics did not differ between the control and treatment streams or between the pre- and post-treatment data and groups had similar functional feeding groups and life habits (Benton et al. 2017). A study in the Southern Appalachian Mountains surveyed four streams pre- and post-treatment and a reference stream and did not detect differences in community metrics due to imidacloprid exposure (Churchel et al. 2011). These results should be interpreted cautiously because soils at these study sites do not easily leach imidacloprid and imidacloprid was not detected in most study streams (Churchel et al. 2011). An unpublished field study (Devine 2015) conducted in the Monongahela National Forest (MNF) in West Virginia in 2011 compared macroinvertebrates collected upstream and downstream of HWA treatment areas. This study found a weak negative correlation between the amount of imidacloprid applied and the relative abundance of benthic macroinvertebrates. Additionally, this study found that population diversity was significantly lower and there were fewer sensitive taxa in treatment streams (Devine 2015). An additional study conducted in the Netherlands investigated aquatic macroinvertebrate abundances in surface water containing imidacloprid (Van Dijk 2013). Aquatic macroinvertebrate abundance was significantly lower in surface water with higher imidacloprid concentrations for the orders Amphipoda (crustaceans), Diptera (true flies), Ephemeroptera (mayflies), Isopoda (crustaceans) and Basommatophora (snails) (Van Dijk 2013).

Numerous laboratory and microcosm studies have demonstrated negative impacts of imidacloprid on benthic macroinvertebrates. Imidacloprid has been shown to cause substantial mortality at 50 μg/mL and feeding inhibition at 12 μg/mL in stonefly (*Pteronarcys dorsata*) nymphs and cranefly (*Tipula* sp.) larvae (Kreutzweiser et al. 2008). Foraging activity was impaired in mayflies at concentrations of ≥0.5 μg/mL and immobility in oligochaetes was observed at 5 μg/mL (Alexander et al. 2007). In a microcosm study in which macroinvertebrates were fed imidacloprid-treated maple leaves, macroinvertebrate feeding was inhibited by exposure to imidacloprid concentrations of 1300 mg/L (Kreutzweiser et al., 2009). Pulses of low concentrations of imidacloprid led to decreases in survival and emergence of Ephemeroptera, Tanypodinae, and Orthocladiinae, and an increase in the survival of *Radix* spp., which is a non-sensitive genus of snail (Columbo et al 2013). This decline occurred despite imidacloprid undergoing aqueous photolysis (Colombo et al. 2013), which is the process in which imidacloprid degrades in sunlight into several photoproducts (Ding et al. 2011). Pulses of imidacloprid treatments in outdoor stream mesocosms to imitate runoff that occurs during rain events caused significant declines in benthic macroinvertebrate abundances and community diversity (Pestana et al. 2009).

Downstream drift of macroinvertebrates is a well-documented reaction to environmental disturbances in which stressors such as toxicants cause invertebrates to become dislodged and move downstream (Beketov and Liess 2008). Imidacloprid triggered downstream drift in a stream microcosm at concentrations which did not cause significant mortality of macroinvertebrates (Beketov and Liess 2008). Interestingly, drift of invertebrates began within only 2 hours of imidacloprid exposure (Beketov and Liess 2008). Similarly, Berghahn et al. (2012) exposed Ephemeroptera larvae, Diptera larvae, and Gammaridae larvae and adults to 3 pulses of imidacloprid in indoor stream mesocosms. The addition of imidacloprid to the mesocosm led to immediate increases in drift in all taxa (Berghahn et al. 2012).

5. Observed and potential impacts of imidacloprid exposure on amphibians

North America is a global hotspot for salamander diversity (Yap et al. 2015), and salamanders are particularly abundant in the Appalachian Mountains (Petranka and Murray 2001). One study in the southern Appalachians estimated that salamander density in riparian habitat was $1.8/m^2$ which made them the dominant forest predator (Petranka and Murray 2001). However, salamanders, like all amphibian orders, are declining globally. West Virginia has 34 species of salamander, 14 of which are considered rare, threatened, or endangered within the state, and 6 of which are considered dependent on headwater streams (WV DNR 2017).

In headwater streams, salamanders are often the dominant vertebrates in terms of abundance and biomass (Burton and Likens 1975, Davic and Welsh 2004). Loss of salamander populations from headwater streams can have ecosystem-wide consequences because salamanders can influence insect population dynamics, regulate detritus food webs, and link stream and terrestrial food webs (Petranka 1998). Thus, salamander occupancy and abundance can serve as an indicator of stream quality (Southerland et al. 2004) and ecosystem stress (Lowe and Bolger 2002, Welsh and Ollivier 1998, Wood and Williams 2013).

Although imidacloprid is generally not lethal to adult vertebrates at levels typically found in the environment, studies have found a variety of sublethal impacts to mammals, birds, fish, and frogs, including impacts on reproduction and growth (reviewed by Gibbons et al. 2015). Feng et al. (2004) demonstrated that imidacloprid is genotoxic to the black-spotted pond frog (*Pelophylax nigromaculatus*) with DNA damage increasing as aquatic concentrations increased. Similarly, imidacloprid exposure led to DNA lesions in Montevideo tree frog (*Hypsiboas pulchellus*) tadpoles, although this effect was only displayed at concentrations higher than typical field conditions (Pérez-Iglesias et al. 2014). Imidacloprid exposure also decreased survival rates in northern cricket frogs (*Acris crepitans*) (Ade et al. 2010).

Aquatic salamanders could encounter imidacloprid from ingested invertebrate prey, as well as from direct uptake through their highly permeable skin (Gibbons et al. 2015). Previous studies have not yet evaluated the impact imidacloprid has on wild salamander abundances or whether imidacloprid can have sublethal impacts on salamanders.

6. Imidacloprid uptake and bioaccumulation

No previous research has assessed whether salamanders can bio-accumulate imidacloprid, potentially resulting in high concentrations that could have sublethal or lethal effects and making the chemical available for ingestion by vertebrates that consume salamanders. Several studies have investigated storage and bioaccumulation of imidacloprid in other amphibians. Measurable levels of imidacloprid were detected with liquid chromatography/mass spectrometry (LC/MS) in northern cricket frog, eastern narrowmouth toad (*Gastrophryne carolinensis*), barking trees frog (*Hyla gratiosa*), and southern leopard frog (*Lithobates sphenocephala*) tissues after eight hours of exposure in a laboratory (Glinski et al. 2018, Van Meter et al. 2014, Van Meter et al. 2015).

Several studies have quantified bioaccumulation of imidacloprid in other taxa. The aquatic oligochaete *Lumbriculus variegatus* is commonly used for evaluating toxicity of freshwater contaminants and was found to biomagnify imidacloprid. Worms exposed to higher concentrations of imidacloprid presented higher levels of imidacloprid in whole body tissues (Sardo and Soares 2010). Imidacloprid concentrations were higher in the liver, gills, gut, and muscle of the freshwater fish *Australoheros facetus* after 48 vs 24 hours of exposure, and imidacloprid was also detected in the blood and brain (Iturburu et al. 2016). A recent study conducted in areas of high-neonicotinoid application in Texas found that 12% of bobwhite quail had detectable levels of neonicotinoid compounds in the liver, including imidacloprid, acetamiprid, clothianidin, and thiamethoxam (Ertl et al. 2018). All detections were below the limit of quantification, but 20% of birds displayed tissue degeneration in the liver and testicles (Ertl et al. 2018) which are known secondary targets of neonicotinoids (Yamamoto 1999). However, only one bird with detectable levels of neonicotinoids in the liver also exhibited neonicotinoid-induced tissue damage, suggesting that neonicotinoids may be rapidly metabolized *in vivo* in birds (Ertl et al. 2018). To our knowledge, no studies have investigated whether benthic macroinvertebrates or crayfish bioaccumulate imidacloprid.

7. Study Area

Hemlock trees represent an important natural resource in West Virginia, where they comprise 1% of forests statewide and are key components to many of the state's tourist attractions (Kish 2007). This study was conducted in the Monongahela National Forest (MNF) and two units of the National Park Service (NPS): Gauley River National Recreational Area (GARI) and New River Gorge National River (NERI) in West Virginia, USA (Figure 1). Hemlock stands in the MNF were treated with a single application of imidacloprid in 2014 or 2015. In NPS units, applications of imidacloprid began in 2006 and re-treatments have occurred annually within the NPS units. Sites in NPS have been treated 1–7 times since 2006 (Appendix 2-1).

8. Research goals and summary of chapters

In aquatic ecosystems, environmental stress typically is first detected at the population level and impacts sensitive species first (Odum 1992). The goal of this research is to use the abundance and diversity of benthic macroinvertebrates and stream salamanders as indicators for the integrity of stream systems. The results of this project will either confirm that the current imidacloprid treatment strategy has minimal non-target impacts or will inform forest managers that changes in imidacloprid usage may be necessary to minimize environmental impacts. The study will also have broad-scale value, as many agencies use imidacloprid to control a variety of additional insect pests (e.g., emerald ash borer [*Agrilus planipennis*]; Smitley et al. 2015), and because imidacloprid has become a major pesticide for agricultural use (Elbert et al. 2008, Gervais et al. 2010). The specific goals for this study are to (1) quantify the concentration of imidacloprid and two of its metabolites (imidacloprid-urea and imidacloprid-olefin) present in stream water and compare these concentrations to hemlock treatment histories; (2) assess the presence/absence of imidacloprid, imidacloprid-urea, and imidacloprid-olefin in stream sediment; (3) compare the concentrations of imidacloprid, imidacloprid-olefin, and imidacloprid-urea in stream water with the abundance and health (i.e., body condition) of stream salamanders and community metrics of benthic macroinvertebrate taxa; and (4) investigate whether imidacloprid, imidacloprid-olefin, or imidacloprid-urea are bioaccumulating in stream salamanders and benthic macroinvertebrates.

In the second chapter, we investigate whether stream salamanders and benthic macroinvertebrates bioaccumulate imidacloprid or its metabolites and whether these concentrations are correlated with environmental concentrations of imidacloprid. We also investigate whether imidacloprid exposure and bioaccumulation induce sublethal effects in salamanders, such as changes to the stress hormone corticosterone or body condition.

In the third chapter, we compare the abundances of five stream salamander species to multiple measurements of imidacloprid exposure including the concentration of imidacloprid detected in the water and the presence of environmental imidacloprid.

In the fourth chapter, we compare benthic macroinvertebrate metrics, including Genus Level Index of Most Probably Stream Status (GLIMPSS) and West Virginia Stream Condition Index (WVSCI) to four imidacloprid predictors. We also compare functional traits of benthic macroinvertebrates to the presence of environmental imidacloprid and presence of treated trees.

Eastern hemlocks will continue to decline due to HWA infestation, forcing forest managers to make decisions between the positive impacts of imidacloprid treatment and the effects on non-target species exposed to imidacloprid. The results of this study will add to a growing body of literature investigating the influence of HWA treatment and use of neonicotinoid insecticides on non-target species.

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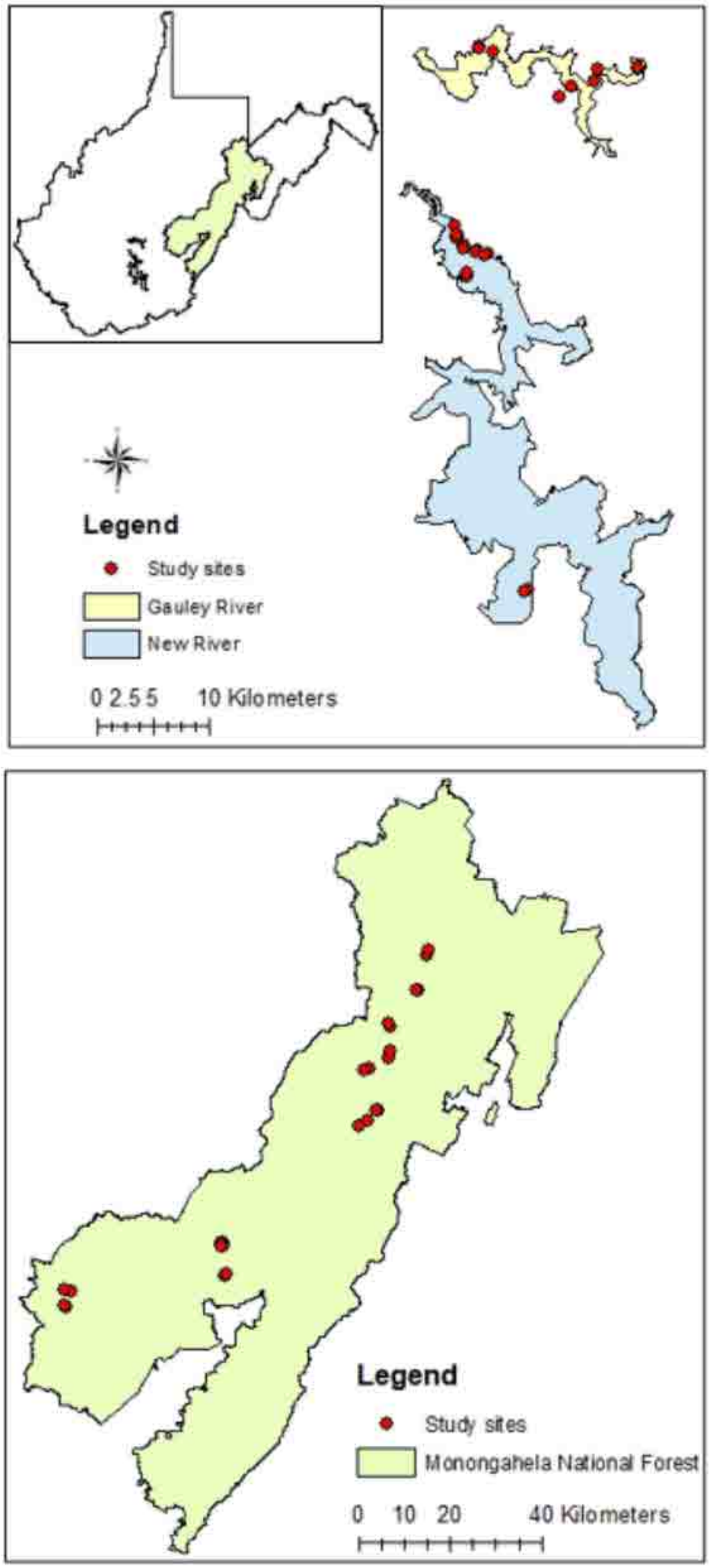

Figure 1-1. Locations of 48 sampled streams within the Monongahela National Forest, New River Gorge National River, and Gauley River National Recreation Area in West Virginia (inset), USA.

CHAPTER 2: BIOACCUMULATION OF THE PESTICIDE IMIDACLOPRID IN STREAM ORGANISMS AND SUBLETHAL EFFECTS ON SALAMANDERS

Currently under review at Global Ecology and Conservation, submitted on December 3, 2019.

ABSTRACT

Neonicotinoids are one of the most widely used classes of insecticides in the world. The neonicotinoid imidacloprid is commonly applied to hemlock (*Tsuga* spp.) stands in eastern North America to reduce infestations of the invasive hemlock woolly adelgid (HWA; *Adelges tsugae*). While laboratory and mesocosm studies have determined that imidacloprid can bioaccumulate in anurans and cause sublethal effects, no field studies have investigated whether salamanders or insects in streams adjacent to HWA treatments bioaccumulate imidacloprid or if sublethal effects are detectable in wild salamanders. We assessed the effect of imidacloprid exposure on a stress hormone, corticosterone, and body condition indices (BCI) in stream salamanders in West Virginia, USA. For 802 salamanders from 48 sites, BCI decreased as concentration of imidacloprid in stream water increased (β = -0.001, 95% CI: -0.002– -0.0001). To quantify bioaccumulation and corticosterone levels, we collected *Desmognathus* spp. salamanders from a subset of sites. Of 107 salamanders from 11 sites tested for bioaccumulation, we detected imidacloprid in 14 and the metabolite imidacloprid-olefin in 19 for a total of 29 individuals with one or both chemicals. Of 15 benthic macroinvertebrate samples tested, we detected imidacloprid and its metabolite imidacloprid-urea in 13 and 15 samples, respectively. For 115 salamanders from 11 sites, corticosterone concentration increased with increasing number of treated trees (β = 0.0013, 95% CI: 0.0005–0.0021). Our study suggests that chronic leaching of imidacloprid from treated hemlock stands into adjacent streams can negatively affect aquatic organisms and may provide a route of exposure to higher trophic levels.

1. INTRODUCTION

Neonicotinoids are one of the most widely used classes of insecticides in the world and have applications in agriculture, household use, and protection of native trees from invasive pests (Jeschke et al. 2010, Webb et al. 2003). Although neonicotinoids are highly selective for insect nicotinic acetylcholine receptors, many studies have documented negative effects of neonicotinoids on the health and survival of vertebrates (Gibbons et al. 2015). Neonicotinoids are generally not lethal to adult vertebrates at concentrations typically found in the environment, but studies have found a variety of sublethal effects on mammals, birds, fish, and frogs, including effects on reproduction and growth (reviewed by Gibbons et al. 2015).

In eastern North America, the neonicotinoid imidacloprid is the most common and effective method for reducing mortality in eastern hemlock (*Tsuga canadensis*) and Carolina hemlock (*T. caroliniana*) from infestations of the invasive pest, hemlock woolly adelgid (HWA; *Adelges tsugae;* Havill et al. 2014, Webb 2003). Hemlocks are ecologically important trees that provide unique microhabitat conditions used by diverse invertebrate and vertebrate taxa (Becker et al. 2008, Ellison 2014, Snyder et al. 2002, Tingley et al. 2002). Hemlock trees exert a strong influence on the abiotic environment by creating deep shade that reduces ground and stream temperatures and stabilizes soil moisture levels (Snyder et al. 2002).

North America is a global hotspot for salamander diversity (Yap et al. 2015), particularly the Appalachian Mountains in the eastern USA (Petranka and Murray 2001). In headwater streams, salamanders are often the dominant vertebrates in abundance and biomass (Davic and Welsh 2004). Previous studies found that imidacloprid can leach from HWA treated areas into adjacent streams (Benton et al. 2016, Churchel et al. 2011, Wiggins et al. 2018), thus potentially exposing stream salamanders to the insecticide. However, research investigating the physiological and ecological consequences of imidacloprid on salamanders is lacking, with the exception of a laboratory study that confirmed terrestrial spotted salamanders (*Ambystoma maculatum*) can uptake imidacloprid dermally through exposure to contaminated soil, and individuals with higher imidacloprid concentration had lower body condition and prey consumption (Appendix 2-2). In anurans, four species had measurable levels of imidacloprid in their tissues after 8 hours of exposure to imidacloprid in a laboratory (Glinski et al. 2018, Van Meter et al. 2014, 2015), and additional studies found that exposure can cause DNA damage and increased mortality rates (Ade et al. 2010, Feng et al. 2004, Pérez-Iglesias et al. 2014). Additionally, laboratory studies have documented sublethal and lethal effects of imidacloprid exposure on benthic macroinvertebrates (Alexander et al. 2007, Columbo et al. 2013, Kreutzweiser et al. 2009), which are the primary food of stream salamanders (Petranka 1998) and thus are a potential route of pesticide exposure for salamanders and other vertebrates.

Sublethal effects of environmental stressors are associated with hormone level changes in amphibians, particularly the hormone corticosterone, which is associated with reproduction, development, growth, and stress in amphibians (Romero et al. 2004). Long-term elevation of corticosterone levels induced by chronic stressors can have negative effects, including suppression of the immune system and growth (Romero et al. 2004). Multiple studies have documented increases in corticosterone levels in salamanders from environmental stressors such as increased temperature and small vernal pool size (Millikin et al. 2019, Novarro et al. 2018. Similar associations were found in anurans where corticosterone was elevated in environments with limited food (Glennemeier and Denver 2002) and with environmental contaminants (Hopkins et al. 1997). Further, exposure to contaminants can negatively affect the size, growth rate, and body condition of individuals. For example, exposure to the herbicide atrazine was associated with smaller sizes and lower weights in tiger salamander (*Ambystoma tigrinum*) larvae (Larson et al. 1998) and reduced Cuban tree frog (*Osteopilus septentrionalis*) tadpole snout-vent length (SVL) and mass (Gabor et al. 2018). Negative effects on the health of individuals can ultimately result in population-level declines if they affect growth, reproduction, or survival rates (Hayes et al. 2010, Willson et al. 2012).

Although previous studies reported effects of imidacloprid in agricultural systems, to our knowledge, no studies have investigated whether imidacloprid application for native tree conservation is resulting in imidacloprid bioaccumulation and sublethal effects in wild stream salamanders. The purpose of our study was to determine if salamanders inhabiting streams adjacent to imidacloprid-treated hemlock stands (hereafter HWA treatments) are bioaccumulating imidacloprid and if there are detectable sublethal effects on individuals. We also assessed bioaccumulation of imidacloprid and its metabolites in benthic macroinvertebrates. We used corticosterone levels and body condition indices (BCI) to assess potential sublethal effects of imidacloprid exposure on salamanders. We hypothesized that salamanders in streams with imidacloprid would have accumulated imidacloprid in their body, that the imidacloprid concentration in salamanders would be positively correlated with environmental concentration, and that imidacloprid exposure would be positively associated with corticosterone concentrations and negatively associated with BCI scores. We also hypothesized that benthic macroinvertebrates would bioaccumulate imidacloprid.

2. METHODS

2.1. Study Sites

This study was conducted in the Monongahela National Forest (MNF) and two units of the National Park Service (NPS): Gauley River National Recreational Area (GARI) and New River Gorge National River (NERI) in West Virginia, USA (Fig. 1). Hemlock trees in the MNF were treated with a single application of imidacloprid in 2014 or 2015. In MNF sites, the majority (~70%) of trees were treated with soil injections and the remainder were treated with stem injections. Hemlock stand treatments in the NPS units began in 2006 and continued annually, including repeated applications at 10 of the sampling locations. In NPS sites, 5% of trees were treated with stem injections, 12% were treated with soil drenches, and 83% were treated with soil injections (Strickler 2012). We did not select NPS treatment sites if the last treatment occurred prior to 2011. We used ArcGIS 10.4 to identify candidate 1st or 2nd order headwater streams based on proximity to HWA treatments. Candidate streams were visited to determine whether the stream depth, stream substrate, and water flow speeds were suitable for sampling salamanders and stream invertebrates. Final study sites were selected based on the suitability of the streams for sampling, the proximity of treated trees, or the absence of known treatments for non-treated sites. They were also selected to be relatively similar in habitat characteristics such as stream size, water flow, water chemistry, and surrounding vegetative community (Appendix 3-2).

We sampled 24 sites in MNF, 14 sites in NERI, and 10 sites in GARI. Of these 48 sites, 27 were adjacent to HWA treatments and 21 were not. In the sites adjacent to HWA treatments, on average 151.9 ± 83.6 hemlock trees were treated (range = 5–3993). Hemlock trees that were treated multiple years were counted as multiple trees (i.e. a tree that was treated for two years was counted as two trees to better represent treatment intensity). Sites that were not adjacent to HWA treatments were either a minimum of 100 m upstream of imidacloprid application or were in a watershed without known HWA treatments. We selected 100 m as a minimum distance because Benton et al. (2016) did not detect imidacloprid in stream sites that were 10–100 m upstream of treated trees, and because *Desmognathus* spp. typically have home ranges smaller than 100 m (reviewed by Petranka 1998).

2.2 Water and Sediment Sampling

We collected water and sediment adjacent to the salamander sampling plots from the NPS sites in June 2017 and from the MNF sites in June–July 2018. We collected 2 L of water from each site in 1 L plastic bottles (Thermo Scientific Nalgene™ labware, Rochester, New York, USA) without disturbing the stream sediment. Stream sediment was collected from the bottom of the stream using a trowel and enough sediment was collected to fill one quart-sized plastic bag. If the stream bottom did not have any sediment, we collected sediment from the sides of the stream bank. The trowel was wiped with 70% ethanol between each use to prevent contamination. The bottles of water and bags of sediment were placed in black bags and a backpack to prevent light exposure from metabolizing imidacloprid until the samples could be placed in a cooler with ice. The samples were stored at 4°C from the day of collection until extraction procedures began.

2.3 Salamander and Habitat Sampling

Within each of the 48 sites, we established three 6.6 m^2 (3.3 m by 2 m) subplots for a total plot area of 20 m^2 (10 m by 2 m). One meter of the subplot width was on the bank and one meter was within the wetted stream channel. We primarily placed subplots in riffles, but occasionally placed subplots in runs or pools if the site did not have riffle habitat. Across sites, we chose subplots to be similar in terms of stream depth, substrate, canopy cover, vegetative community, and flow regime. We sampled salamanders April–July 2017 in the NPS sites and April–July 2018 in the MNF sites, sampling each site 6–7 times during the year during baseflow conditions. While moving upstream to prevent stream sediment from flowing downstream and obscuring our view, we flipped every cover object greater than 50 mm in diameter and searched through leaf packs.

We removed all captured salamanders and placed them in individual plastic bags. We identified all salamanders to species, or genus when identification to species was not possible. We weighed all captured salamanders to the nearest 0.1 g with a spring scale (Pesola Precision Scales, Schindellegi, Switzerland) and measured SVL and total length to the nearest 0.1 mm with dial calipers (Wiha Tools, Monticello, Minnesota, USA). We measured salamanders using a salamander stick to maximize accuracy (Margenau et al. 2018). We took note of any missing limbs or tails and if salamanders were gravid. After processing, we released salamanders at their point of capture.

After every sampling event, we measured stream depth (cm) in the center of the plot. We measured canopy cover at each subplot once during each sampling season after full leaf-out using a 25 cm x 25 cm plexiglass grid which was divided into 5 cm x 5 cm cells. We held the plexiglass grid overhead and visually estimated how many cells were covered by the tree and shrub canopy and calculated % canopy cover (Haché et al. 2013).

2.4 Salamander Sampling for Corticosterone Concentration and Imidacloprid Bioaccumulation

After sampling salamanders for BCI (section 2.3), we collected adult individuals of the salamander genus *Desmognathus* to quantify imidacloprid bioaccumulation and corticosterone levels from 11 of the 48 sampled sites (n = 7 for GARI, n = 4 for NERI). We selected sites that had high densities of large adult seal salamanders (*D. monticola*) and northern dusky salamanders (*D. fuscus*) to obtain a large enough volume of tissue for imidacloprid testing. Seven of the 11 sites were directly adjacent to HWA treatments and four were not. The seven sites adjacent to HWA treatments had an average of 242.2 ± 80.1 treated hemlock trees (range = 17–494).

We hand captured 168 *D. monticola* and *D. fuscus* by flipping rocks and other cover objects in the stream between 8 July and 24 November 2017. Of the 168 salamanders captured, 109 salamanders were from sites treated with imidacloprid and 59 were from untreated sites. We quantified plasma levels of corticosterone for a subset of the salamanders (n = 119). For these samples, we decapitated salamanders in the field and collected a minimum blood sample of 2 μL within 3 min of initial disturbance of the salamander to minimize the influence of capture stress on corticosterone level (Romero and Reed 2005). These samples were stored in coolers until they were transferred to the laboratory. In the laboratory, we centrifuged blood samples for 5 min and plasma was collected and stored at -20°C until analysis. Plasma samples were packed in a cooler on dry ice and sent to the Endocrine Technology Laboratory at the Oregon National Primate Research Center and assayed for corticosterone using radioimmunoassay (RIA; Thomas and Woodley 2017). Recovery was 98.8% and intra-assay coefficient of variation (CV) was 8.1%. For the remaining 49 salamanders captured, we measured and weighed them in individual plastic bags, transferred them to the laboratory, humanely euthanized them through exposure to carbon dioxide followed by decapitation, and then froze them until processing for imidacloprid extraction.

2.5 Benthic Macroinvertebrate Sampling

We sampled benthic macroinvertebrates, including crayfish, at 15 of the 48 sites with five of the sites in NERI, two in GARI, and eight in MNF. We selected sites with abundant riffles and all were adjacent to HWA treatments to evaluate the potential for bioaccumulation. These 15 sites had an average of 371.2 ± 260.2 treated hemlock trees (range = 34–3993).

We collected samples between 17 September and 20 November 2018 by placing a D-net flush with the stream bottom and disturbing the substrate upstream or by sweeping the D-net under stream overhangs. All invertebrates from each site were stored together in a tube containing 75% ethanol and covered with foil to prevent light exposure until imidacloprid extraction. Only crayfish <2.5 cm were included in the samples to ensure that they were of a size that could be consumed by a salamander.

2.6 Water and Sediment Imidacloprid Extraction and Quantification

We adopted water and sediment extraction procedures from Baskaran et al. (1997). We filtered 1 L of water from each site through 0.22-µm filters. We then filtered the water samples through pre-conditioned C18 solid-phase extraction (SPE; Restek, State College, PA, USA) cartridges on a vacuum manifold. We eluted the imidacloprid from the cartridges with 5 mL acetone into 15-mL glass test tubes and dried the eluent under nitrogen at 40°C and reconstituted the residue in 0.5 mL of acetonitrile. We then filtered the reconstituted samples through 0.20-µm filters into liquid chromatography (LC) vials.

We dried sediment samples at 100°C for 3 days before fracturing and sieving the samples. We then weighed the sediment samples to 30 g, added 100 mL of deionized (DI) water, and stirred for 1 min. We filtered the samples through cheese cloth and a 0.22-µm filter and transferred the extract to a separatory funnel with 25 mL of chloroform. We mixed the solution vigorously and extracted the chloroform layer through anhydrous sodium sulfate. We repeated this process twice before drying the solution under nitrogen at 40°C and reconstituting the residue in 0.5 mL of acetonitrile. We filtered the reconstituted samples through pre-conditioned Florisil cartridges, eluted the imidacloprid using 5 mL of acetonitrile, and dried the eluent under nitrogen at 100°C. We reconstituted the residue in 0.5 mL of acetonitrile and filtered the reconstituted samples through 0.20 μm filters into LC vials.

We quantified the concentration of imidacloprid in the stream sediment and water using ultra-performance liquid chromatography-tandem mass spectrometry ([UP] LC-MS/MS). We adopted the chromatographic and mass spectrometry conditions from Galeano et al. (2013). We used the Exion LC AD UHPLC system coupled with AB Sciex Qtrap 5500 triple quadrupole AcQuRate CEM detector. We separated the compounds imidacloprid, imidacloprid-urea, and imidacloprid-olefin and external standards on a Kromasil C_{-18} (M05CLD05) column (2.1 × 50 mm) maintained at an oven temperature of 40°C. We maintained the autosampler temperature at 10°C and the injection volume was 2 μL. The MS/MS detection of the compounds was performed by electrospray ionization (ESI) source operated in positive ion mode.

We used multiple reaction monitoring (MRM) for the detection and quantification of imidacloprid and metabolites. MRM parameters were as follows: imidacloprid, Q1 mass 256.000 Da, Q3 mass 209.000 Da, 50.0 msec; imidacloprid urea, Q1 mass 213.200 Da, Q3 mass 129.000, 50.0 msec; imidacloprid olefin, Q1 mass 254.100 Da, Q3 mass 171.000 Da, 50 msec. We maintained the IonSpray voltage and source temperature at 4.50 kV and 450°C, respectively. We used the LC-MS/MS software Analyst (AB Sciex, version 1.6.3) for data acquisition and processing. Due to project constraints, we were unable to quantify recovery success of imidacloprid from sediment, and thus we treated sediment data as presence-absence only for analyses. We note that estimated imidacloprid concentrations in sediment were minor compared to estimated concentrations in stream water (i.e., typically <15% of the concentration in stream water). We did not test for presence/absence of metabolites in water for sites at NERI and GARI.

2.7 Salamander and Invertebrate Imidacloprid Extraction and Quantification

We quantified imidacloprid concentrations in 107 *Desmognathus* salamanders (34 *D. fuscus* and 73 *D. monticola*). We adopted pesticide extraction and chromatographic and mass spectrometry conditions from procedures developed by Lehotay (2006) and Galeano et al. (2013). We placed individual salamanders and the composite macroinvertebrates from each site into 50-mL tubes. We flash froze samples in liquid nitrogen and placed them in a freeze dryer for 3 d. We placed 3 5-mm steel beads into each 50-mL tube and ground the salamanders and invertebrates in a Retsch MixerMill (MM 400, Haan, Germany) for 3 mins. We sonicated the samples for 20 min and added Quick Easy Cheap Effective Rugged Safe (QuEChERS) Mylar salt pouches (UCT, ECQUEU7-MP) to each sample. We centrifuged the samples at 2,200 relative centrifugal force for 5 min. We assembled a high-throughput vacuum apparatus with clean-up cartridges (UCT, ECPSAC1856) and conditioned with 5 mL of acetonitrile. Eight mL of the organic layer (acetonitrile) of each sample was collected and cleaned through the cartridges. We then dried the test tubes under nitrogen at 50°C, reconstituted them in 0.5 mL of acetonitrile, and filtered the samples through PTFE Whatman Mini-UniPrep Syringeless Filter vials. We followed the same procedure to quantify imidacloprid concentration as described above for water and sediment.

We calculated limit of detection (LOD) values from an external standard solution containing imidacloprid, imidacloprid-urea, and imidacloprid-olefin ranging from 5–300 ng/mL in LC-MS grade acetonitrile. We performed a linear regression on the data points in the concentration range ($n = 7$) and calculated the LOD using the formula $3 \times (SE / R^2)$, where SE is standard error and R^2 is coefficient of determination). In all sample types, the LOD values were 5.98 ng/mL, 33.7 ng/mL, and 4.15 ng/mL for imidacloprid, imidacloprid-urea, and imidacloprid-olefin, respectively.

2.8 Statistical Analyses

We examined relationships between imidacloprid exposure and the following response variables: bioaccumulation in salamanders, bioaccumulation in benthic macroinvertebrates, salamander corticosterone concentration, and salamander BCI score. For the two bioaccumulation variables, we related imidacloprid concentration in stream water to total imidacloprid concentration (imidacloprid and its metabolites summed) in salamanders and macroinvertebrates. For bioaccumulation analyses in salamanders, we did not test species separately because of the small sample size, and we only included individuals with detectable levels of imidacloprid or one of its metabolites. For corticosterone and BCI, we related each variable to four predictors of imidacloprid exposure including imidacloprid concentration in stream water, whether the site was adjacent to treated trees, number of treated trees in adjacent treated stands (a measure of treatment intensity), and whether imidacloprid was present in the environment. We considered a site to be present for imidacloprid if imidacloprid or at least one of its metabolites (i.e. imidacloprid-urea and imidacloprid-olefin) was detected in either stream water or sediment or the sampling site was located adjacent to imidacloprid-treated trees. We also related BCI to percent canopy cover and average stream water depth (cm) to account for the potential influence of site-level factors on BCI.

We calculated the BCI score by regressing (log) SVL on (log) weight (Schulte-Hostedde et al. 2005) for 802 individuals of 5 species. Positive residuals indicate a higher-than-average weight for a given SVL. We did not include salamanders missing portions of their tails or legs in BCI analyses. We created separate BCIs for five salamander species, and for gravid females within-species, including *D. fuscus* (n = 207), *D. monticola* (n = 274), *D. ochrophaeus* (Allegheny Mountain dusky salamander; n = 141), *Eurycea* spp. (northern and southern two-lined salamanders; n = 59), and *Gyrinophilus porphyriticus* (spring salamander; n = 121). For BCI, we excluded larval salamanders that weighed ≤0.1 g and all larval *Eurycea* spp. because SVL was not a strong predictor of weight. For each BCI, we z-score transformed the data so that standard deviations were equal across species (Legendre and Legendre 2012).

We used linear regressions and a model selection approach using Akaike's Information Criterion corrected for small sample size (AIC_c) to assess the influence of imidacloprid predictors on our response variables (Burnham et al. 2011, Zuur et al. 2009). For all analyses, we assessed assumptions of normality using quantile-quantile plots and homoscedasticity using residual plots (Zuur et al. 2009, 2010). For the macroinvertebrate bioaccumulation data set, we identified the two water concentration samples as outliers and removed them to satisfy the assumption of homoscedasticity. For the corticosterone data set, we removed the four highest corticosterone concentration samples as outliers to satisfy the assumption of normality. For the corticosterone model selection, we accounted for inherent differences in corticosterone concentration among species and sex (i.e., males, females, gravid females; Dickens and Romero 2013) by including these factors in all imidacloprid models. For the BCI model selection, we did not include sex as a predictor because we could not reliably identify sex for many of the captures, but we did include life stage (i.e., larva or adult/sub-adult). We created linear regressions using the GLS function with a constant variance structure in the package nlme (Pinheiro et al. 2016; version 3.1-137) in program R (R Core Team 2019; version 3.4.1). We gauged model support based on ΔAIC_c and Akaike weight (w_i), and considered candidate models to have some support when $\Delta AIC_c < 7$ (Burnham et al. 2011).

3. RESULTS

3.1 Water and Sediment Imidacloprid Concentrations

Of the 48 sampled sites, 27 were adjacent to HWA treatments (Appendix 1). Imidacloprid was detected in the stream water at 24 sites, with a mean concentration of 49.8 ± 20.2 ng/mL (range = 6.5–489.6). Imidacloprid-urea was not detected in the stream water at any site. We detected imidacloprid-olefin in the water at two sites, both of which had detectable levels of imidacloprid. Imidacloprid was detected in sediment at eight sites, five of which were adjacent to HWA treatments. We did not detect imidacloprid-olefin or imidacloprid-urea in the sediment at any site. Sites adjacent to HWA treatments where we detected imidacloprid in the water or sediment on average had been treated 2.5 ± 0.2 (range = 1–3.5) years prior to sampling.

3.2 Salamander Imidacloprid Bioaccumulation

Of the 107 salamanders tested for bioaccumulation, 29 had detectable levels of imidacloprid or imidacloprid-olefin, three of which were from sites without imidacloprid treatments or detectable imidacloprid in the stream water or sediment. We detected imidacloprid in the tissues of 10 *D. monticola* and 4 *D. fuscus*, with a mean concentration of 24.6 ± 3.6 ng/mL (range = 6.4–51.3). We detected imidacloprid-olefin in the tissues of 13 *D. monticola* and 6 *D. fuscus*, with a mean concentration of 8.3 ± 0.8 ng/mL (range = 4.2–19.8). Three *D. monticola* and one *D. fuscus* had detectable levels of both imidacloprid and imidacloprid-olefin. We did not detect imidacloprid-urea in the tissues of any salamanders. We detected imidacloprid or imidacloprid-olefin in the tissue of three salamanders collected from sites that were not adjacent to treated trees (sites 9, 11, 32; Appendix 1).

The model containing concentration of imidacloprid in stream water received higher support than the null model ($w_i = 0.60$; Table 1), indicating that imidacloprid concentrations in stream water relate to concentrations in salamander tissues. Imidacloprid concentration in salamanders increased with concentration in stream water, but the 95% confidence interval (CI) overlapped 0 ($\beta = 0.093$, 95% CI: -0.013–0.199).

3.3 Imidacloprid Bioaccumulation in Benthic Macroinvertebrates

Macroinvertebrate samples included organisms belonging to the orders Ephemeroptera (mayfly), Plecoptera (stonefly), Trichoptera (caddisfly), Megaloptera (dobsonfly), Coleoptera (beetles), Diptera (flies), and Decapoda (crayfish). We detected imidacloprid in all 15 benthic macroinvertebrate samples, with a mean concentration of 26.4 ± 3.8 ng/mL (range = 12.1–68.4). We also detected imidacloprid-urea in 13 of these samples but did not detect imidacloprid-olefin in any samples. For three sites adjacent to HWA treatments, imidacloprid was not detected in the water or sediment, but was detected in the invertebrate samples (mean invertebrate concentration of these three samples = 26.1 ± 4.9 ng/mL; Appendix 1). The null model received higher support than the model containing concentration of imidacloprid in stream water (w_i = 0.75; Table 1).

3.4 Sublethal Effects of Imidacloprid on Salamanders

For the corticosterone model selection, the model with the strongest support contained additive effects of species, sex, and number of treated hemlock trees (w_i = 0.49; Table 1). Corticosterone concentration increased with increasing number of treated hemlock trees (β = 0.0013, 95% CI: 0.0005–0.0021). The second most supported model contained an interaction effect between sex and number of treated trees (w_i = 0.20) and indicated that effects were strongest for non-gravid females (Fig. 2a). Concentration of imidacloprid in stream water (ΔAIC_c = 4.39) also had some support as a positive predictor of corticosterone concentration (Table 1).

For the BCI model selection, the model with the strongest support contained an interactive effect between canopy cover and concentration of imidacloprid in stream water (w_i = 0.53), and the model with the second strongest support contained canopy cover as a predictor (w_i = 0.47). After accounting for canopy cover, BCI decreased as concentration of imidacloprid in stream water increased (β = -0.001, 95% CI: -0.002–-0.0001; Fig. 2b). There was no support for number of treated trees (ΔAIC_c = 24.43, w_i = 0.00), presence of environmental imidacloprid (ΔAIC_c = 24.49, w_i = 0.00), or presence of treated trees (ΔAIC_c = 24.93, w_i = 0.00). For all five species, mean BCI score was lower at sites with presence of imidacloprid in the environment, and median BCI score was lower for four of the species (Fig. 3).

4. DISCUSSION

We found strong evidence that stream salamanders and stream macroinvertebrates uptake imidacloprid that leaches into their environment from nearby treated hemlock stands. For salamanders, the two primary pathways for bioaccumulation are direct oral/dermal uptake or consumption of contaminated prey. Terrestrial spotted salamanders in contact with contaminated soil can uptake imidacloprid dermally (Appendix 2-2) and we assume that stream salamanders in contact with contaminated water or sediment can do so as well. Benthic macroinvertebrates, including crayfish, are important food sources of stream salamanders and other aquatic and terrestrial vertebrates, and all composite invertebrate samples from streams adjacent to treated hemlocks contained imidacloprid. Thus, prey consumption may represent a route of imidacloprid exposure for salamanders and other vertebrate species.

Corticosterone in *D. monticola* and *D. fuscus* was positively associated with number of treated hemlock trees. Conclusions from previous studies investigating pesticide-associated changes in corticosterone levels are conflicted. For example, larval western tiger salamanders (*Ambystoma mavortium*) had higher corticosterone levels in agricultural wetlands with elevated levels of neonicotinoid insecticides, compared to reference wetlands (Davis et al. 2019). In contrast, wood frog (*Lithobates sylvaticus*) tadpoles experimentally exposed to environmentally relevant concentrations of the neonicotinoid thiamethoxam had lower corticosterone concentrations, and there was no difference in corticosterone concentrations in juveniles (Gavel et al. 2019). In addition, while number of treated trees was the strongest predictor of corticosterone concentration, we acknowledge that most of the variance in corticosterone concentration was not captured by this predictor. This is not surprising given the complexities of natural systems and the variation in treatment histories at our sites (e.g., different numbers of treatment years and treated trees among sites).

We found that salamander BCI decreased with higher imidacloprid concentration in stream water, and that BCI was lower in streams with environmental imidacloprid for all five species sampled. Body condition is an important indicator of amphibian health and correlates with survival and productivity (e.g., Reading 2007, Roznik et al. 2015). For example, larger body size is advantageous in mate competition (Howard et al. 1997). However, as with corticosterone concentration, we acknowledge that most of the variance in BCI scores was not captured by our imidacloprid predictor and suggest that more controlled studies be conducted to further clarify the relationship.

We detected imidacloprid in the tissues of macroinvertebrates from three sites adjacent to treated hemlock stands but where we did not detect imidacloprid in the stream water or sediment. Presence of imidacloprid in stream water varies temporally and increases after rain events (Churchel et al. 2011, Cowles et al. 2009) but can break down quickly in the presence of sunlight

(Ding et al. 2011). Grab sampling of stream water for pesticide runoff research does not account for spatial and temporal variation and can lead to underestimates of pesticide residues (Xing et al. 2013). Our results suggest that sampling stream invertebrates may be more reliable than sampling stream water to confirm presence of imidacloprid in streams. Additionally, downstream drift and upstream movement commonly occur in aquatic macroinvertebrate communities, and the dispersal of macroinvertebrates with imidacloprid bioaccumulation may contribute to the spread of environmental imidacloprid in riparian environments (Bird et al. 1981).

Three sites that were not directly adjacent to HWA treatments contained salamanders with detectable levels of imidacloprid or imidacloprid-olefin. One of these sites was located downstream of farmland and we did detect imidacloprid in the stream sediment. Imidacloprid is commonly used in agriculture (Elbert et al. 2008), and thus leaching from upstream farmland may explain presence of imidacloprid at this site. Similarly, another site was near private homes, and imidacloprid is used in residential areas to treat pests including termites (Parman and Vargo 2010). However, we did not detect imidacloprid in the stream water or sediment at this site. The third site was located 100 m upstream of a known treatment site, and we speculate that the salamander traveled upstream following exposure to imidacloprid suggesting that untreated control sites need to be farther upstream than the 100-m suggested by the results of Benton et al. (2016). Further, hemlock foliage can contain imidacloprid for 4-7 years after treatments, and hemlock needles falling and spreading from treated areas pose a potential mechanism for imidacloprid spreading to non-treated areas (Benton et al. 2015).

In summary, our research indicates that treating hemlock stands adjacent to streams with imidacloprid can result in the pesticide entering aquatic food webs and lead to sublethal effects on salamanders. Imidacloprid is one of the world's most widely used pesticides, with heavy application in agricultural, urban, and forest systems (Elbert et al. 2008, Havill et al. 2014). Given the widespread use of imidacloprid and documented bioaccumulation in invertebrate and vertebrate organisms, additional studies investigating potential biomagnification in food webs are warranted.

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Table 2-1. Model selection results for the influence of water imidacloprid concentration (Concentration) on imidacloprid bioaccumulation in (1) *Desmognathus* spp. and (2) benthic macroinvertebrates, (3) the influence of species (*D. fuscus* and *D. monticola*), sex (males, females, and gravid females), and imidacloprid exposure on corticosterone concentration in stream salamanders (n = 115), and (4) the influence of species, life stage (larva or adult/sub-adult), habitat (% canopy cover, water depth), and imidacloprid exposure on salamander body condition index (BCI) score (n = 802). For the corticosterone and BCI models, we tested four predictors of imidacloprid exposure, including whether the site was adjacent to treated trees (Trees), number of treated trees in adjacent hemlock stands (# Treated Trees), whether imidacloprid was detected in the environment (Presence), and concentration in the stream water (ng/mL; Concentration). For the BCI model, we standardized BCI scores for each species and thus did not include species as an independent factor in the model selection. Species included *D. fuscus*, *D. monticola*, *D. ochrophaeus*, *Eurycea* spp. (*E. bislineata* and *E. cirrigera*), and *Gyrinophilus porphyriticus*. We used Akaike's Information Criterion corrected for small sample size (AIC_c) to rank candidate models. The null model is shown as (.) and includes only the intercept. Akaike weights are represented as w_i.

Model	Parameters	AICc	ΔAICc	Adj-R2	w_i
1. Salamander bioaccumulation					
Concentration	3	235.47	0.00	0.07	0.60
(.)	2	236.28	0.81	NA	0.40
2. Benthic macroinvertebrate bioaccumulation					
(.)	2	164.82	0.00	NA	0.75
Concentration	3	166.97	2.15	-0.01	0.25
3. Corticosterone					
Species + Sex + # Treated Trees	6	309.93	0.00	0.16	0.49
Species + Sex × # Treated Trees	8	311.68	1.75	0.17	0.21
Sex + Species × # Treated Trees	7	312.17	2.24	0.16	0.16
Species + Sex + Concentration	6	314.32	4.39	0.13	0.06
Species × Sex	13	315.19	5.26	0.19	0.04
Species × Sex × # Treated Trees	7	315.96	6.03	0.13	0.02
Species + Sex	5	317.93	8.00	0.09	0.01
Species + Sex + Trees	6	318.23	8.30	0.10	0.01
Species + Sex + Presence	6	319.94	10.01	0.09	0.00
Species	3	321.46	11.53	0.05	0.00

Sex	4	321.93	12.00	0.05	0.00
(.)	2	325.90	15.97	NA	0.00
4. BCI					
Canopy Cover + Concentration	4	2247.51	0.00	0.03	0.53
Canopy Cover	3	2247.73	0.22	0.03	0.47
Water Depth + Concentration	4	2267.51	20.00	0.01	0.00
Concentration	3	2269.34	21.83	0.00	0.00
Water Depth	3	2270.66	23.15	0.00	0.00
# Treated Trees	3	2271.94	24.43	0.00	0.00
(.)	2	2271.95	24.44	NA	0.00
Presence	3	2272.00	24.49	0.00	0.00
Trees	3	2272.44	24.93	0.00	0.00
Life Stage × Concentration	5	2273.15	25.64	0.00	0.00
Life Stage	3	2273.77	26.26	0.00	0.00
Species × Concentration	11	2281.69	34.18	0.00	0.00

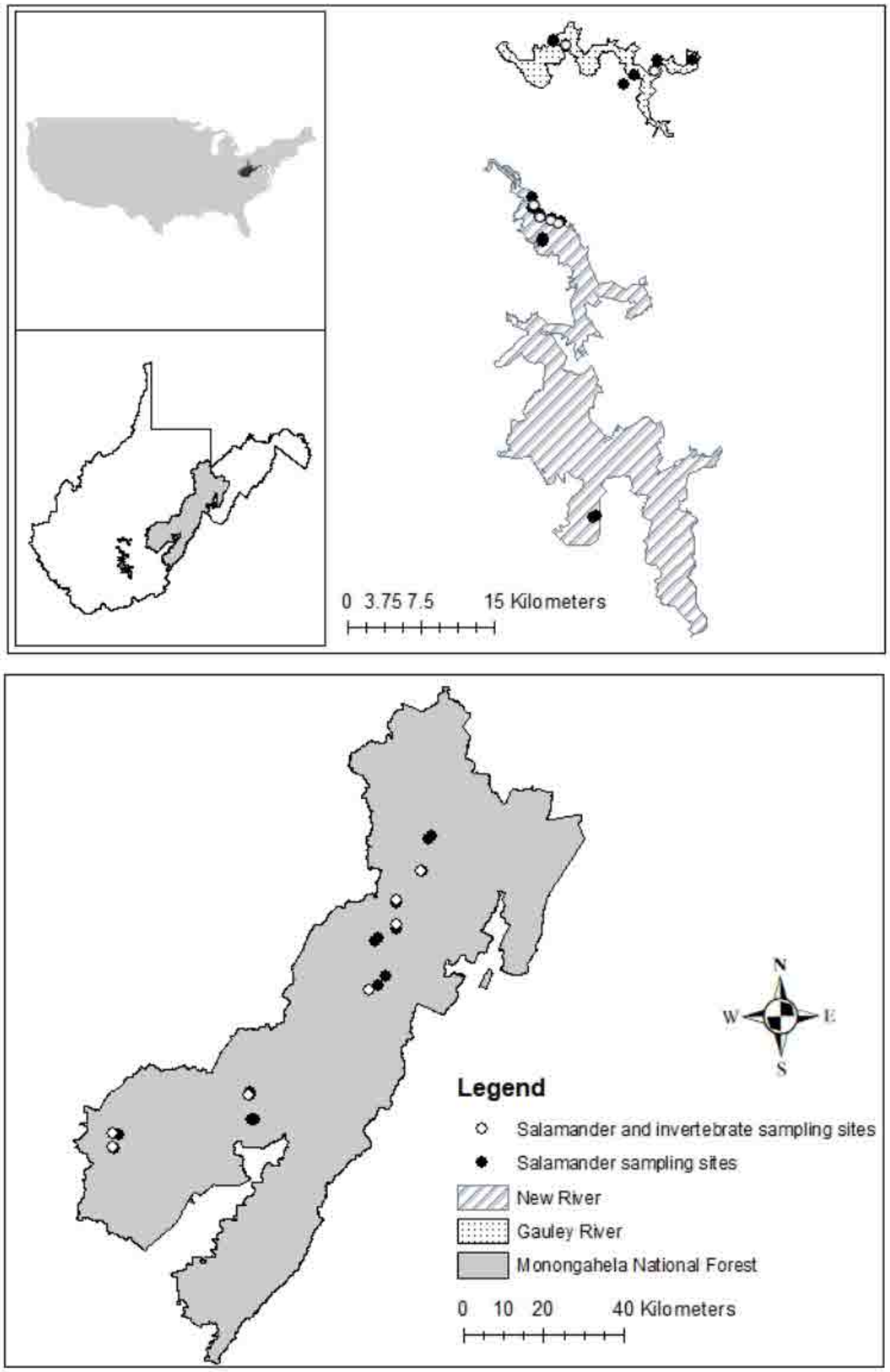

Figure 2-1. Map of study sites to investigate bioaccumulation of imidacloprid and its metabolites in stream salamanders and invertebrates, and sublethal impacts of imidacloprid on salamanders. West Virginia, USA (inset).

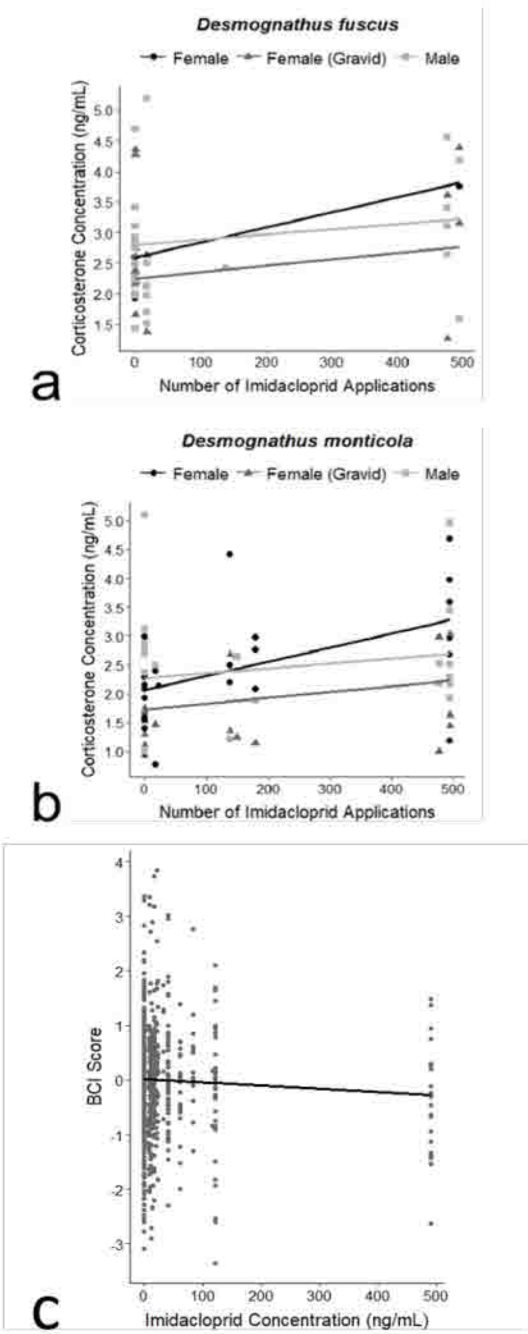

Figure 2-2. Potential sublethal effects of imidacloprid exposure on stream salamanders in West Virginia, USA. Model-estimated relationship between concentration of the hormone corticosterone and total number of treated trees at the sampling site for male, non-gravid female, and gravid female (a) *Desmognathus fuscus* (n = 46) and (b) *Desmognathus monticola* (n = 69). (c) Model-estimated relationship between standardized salamander body condition index (BCI) score and concentration of imidacloprid in stream water with canopy cover (%) held at the mean (63.4%) (n = 802 individuals representing 5 species).

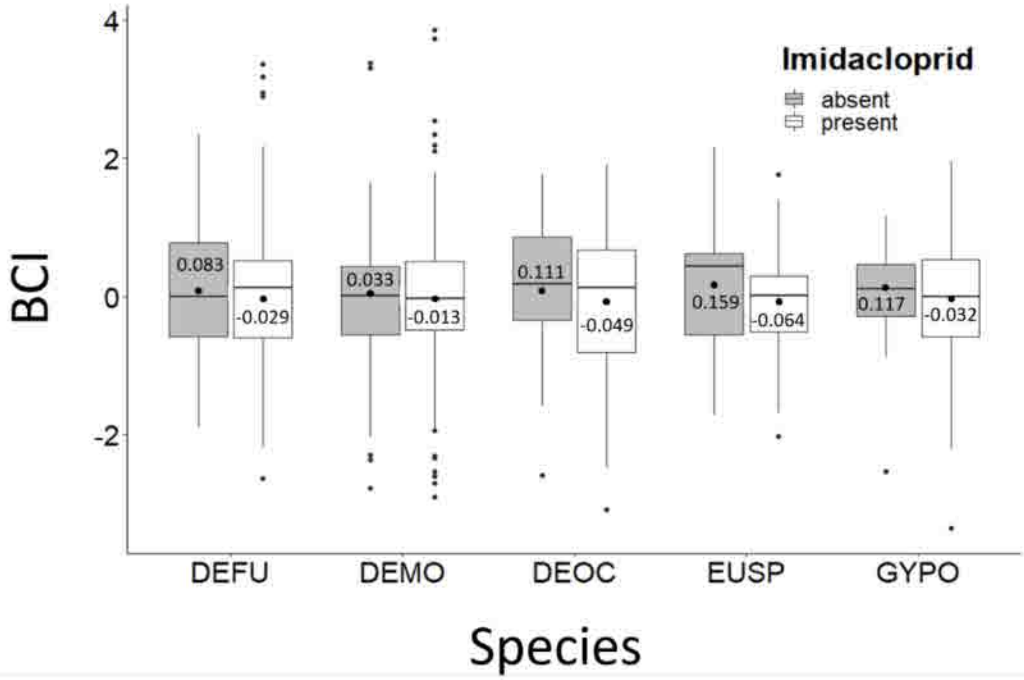

Figure 2-3. Boxplot summaries of body condition index (BCI) values assessing potential sublethal effects of imidacloprid exposure on *Desmognathus fuscus* (DEFU, absent, n = 54, present, n = 153), *D. monticola* (DEMO, absent, n = 79, present, n = 195), *D. ochrophaeus* (DEOC, absent, n = 43, present, n = 98), *Eurycea* spp. adults (EUSP, absent, n = 17, present, n = 42), and *G. porphyriticus* (GYPO, absent, n = 26, present, n = 95). Mean BCI is indicated with a circle and generally was lower in streams with imidacloprid present in the environment for each species tested.

Appendix 2-1. Summary of study sites in New River Gorge National River (NERI), Gauley River National Recreational Area (GARI), and Monongahela National Forest (MNF) in West Virginia, USA, and detection of imidacloprid, imidacloprid-urea, and imidacloprid-olefin in stream water, sediment, invertebrates, and salamanders. We did not detect imidacloprid-urea in water, imidacloprid-urea or imidacloprid-olefin in sediment, imidacloprid-olefin in invertebrates, or imidacloprid-urea in salamanders. *Additional imidacloprid applications at site 14 occurred prior to salamander sampling and after benthic macroinvertebrate collection, therefore, salamanders were exposed to 3927 treated trees. NT = not tested; NS = not sampled.

Site	Locality	Latitude	Longitude	# Treated Trees	# Years Treated	Imidacloprid in water (ng/mL)	Imidacloprid-olefin in water (ng/mL)	Imidacloprid in sediment	Imidacloprid in invertebrates (ng/mL)	Imidacloprid -urea in invertebrates (ng/mL)	Mean Imidacloprid in salamanders (ng/mL)	Mean Imidacloprid -olefin in salamanders (ng/mL)
1	NERI	38.0724	-81.0780	0	0	0	NT	absent	NS	NS	NS	NS
2	NERI	38.0757	-81.0778	149	3	11.3	NT	absent	35.7	34.7	0	11.6
3	NERI	38.0829	-81.0784	17	1	0	NT	absent	NS	NS	0	4.9
4	NERI	38.0757	-81.0778	138	2	121.4	NT	present	31.6	41.9	31.8	9.5
5	GARI	38.2108	-80.9322	0	0	0	NT	absent	NS	NS	NS	NS
6	GARI	38.2007	-80.9357	179	3	17.4	NT	absent	14.7	50.8	22.6	6.7
7	MNF	38.3318	-80.1267	5	1	20.2	0	absent	NS	NS	NS	NS
8	MNF	38.3325	-80.1206	66	1	0	0	absent	NS	NS	NS	NS
9	GARI	38.1885	-80.9710	0	0	0	NT	present	NS	NS	16.0	8.3
10	GARI	38.1968	-80.9595	494	3	61.5	NT	present	NS	NS	21.5	7.4
11	NERI	38.0673	-81.0700	0	0	0	NT	absent	NS	NS	6.4	6.3
12	NERI	38.065	-81.0702	76	1	12.8	NT	absent	25.2	57.7	NS	NS
13	NERI	38.0633	-81.0557	0	0	0	NT	absent	NS	NS	NS	NS
14	NERI	38.0622	-81.0568	3993*	7	0	NT	absent	23.8	34.2	NS	NS
15	GARI	38.2286	-81.0542	0	0	0	NT	absent	NS	NS	NS	NS

16	GARI	38.227	-81.0540	23	1	6.5	NT	absent	NS	NS	0	9.5
17	MNF	38.3003	-80.5101	0	0	0	0	absent	NS	NS	NS	NS
18	MNF	38.3057	-80.5267	52	1	0	0	absent	35.6	119.4	NS	NS
19	MNF	38.7583	-79.7081	5	1	0	0	absent	NS	NS	NS	NS
20	MNF	38.7698	-79.7042	60	1	23.6	40.67	absent	25.7	146.9	NS	NS
21	MNF	38.8196	-79.7039	0	0	0	0	absent	NS	NS	NS	NS
22	MNF	38.8245	-79.7047	60	1	82.5	0	present	68.4	20.0	NS	NS
23	MNF	38.3943	-80.1309	0	0	0	0	absent	NS	NS	NS	NS
24	MNF	38.3889	-80.1307	120	1	32.7	0	absent	14.1	81.7	NS	NS
25	MNF	38.3946	-80.1330	0	0	22.1	0	absent	NS	NS	NS	NS
26	MNF	38.3883	-80.1361	82	1	13.8	0	absent	15.7	201.4	NS	NS
27	MNF	38.8895	-79.6287	0	0	0	0	present	NS	NS	NS	NS
28	MNF	38.8893	-79.6327	60	1	17.2	0	absent	38.5	77.6	NS	NS
29	NERI	38.0417	-81.0661	0	0	10.7	NT	absent	NS	NS	NS	NS
30	NERI	38.0443	-81.0662	169	3	0	NT	absent	NS	NS	NS	NS
31	GARI	38.2239	-81.0397	0	0	0	NT	absent	NS	NS	0	11.0
32	GARI	38.2247	-81.0401	476	4	39.9	NT	absent	22.2	78.9	33.8	7.2
33	MNF	38.2706	-80.5236	0	0	0	0	absent	NS	NS	NS	NS
34	MNF	38.2749	-80.5271	34	1	0	0	absent	18.9	179.3	NS	NS
35	MNF	38.6536	-79.7374	0	0	0	0	absent	NS	NS	NS	NS
36	MNF	38.6331	-79.7599	56	1	16.4	0	absent	NS	NS	NS	NS
37	MNF	38.6533	-79.7385	0	0	0	0	absent	NS	NS	NS	NS

38	MNF	38.6237	-79.7859	47	1	13.3	0	absent	13.5	0	NS	NS
39	NERI	38.0598	-81.0457	0	0	12.0	NT	absent	NS	NS	NS	NS
40	NERI	38.0591	-81.0477	42	2	15.7	NT	absent	12.1	123.6	NS	NS
41	NERI	37.7862	-81.0043	0	0	10.9	NT	present	NS	NS	NS	NS
42	NERI	37.7854	-81.0074	470	2	20.3	NT	absent	NS	NS	NS	NS
43	GARI	38.2109	-80.8920	0	0	8.1	NT	absent	NS	NS	NS	NS
44	GARI	38.2113	-80.8906	237	2	489.6	NT	present	NS	NS	NS	NS
45	MNF	38.9606	-79.6081	0	0	0	0	absent	NS	NS	NS	NS
46	MNF	38.9685	-79.6026	60	1	0	0	absent	NS	NS	NS	NS
47	MNF	38.7381	-79.7574	0	0	0	0	absent	NS	NS	NS	NS
48	MNF	38.7318	-79.7689	120	1	116.0	5.11	present	NS	NS	NS	NS

Appendix 2-2. Dermal Uptake and Sublethal Effects on Spotted Salamanders (*Ambystoma maculatum*) from Exposure to Soil Containing High Concentrations of Imidacloprid

ABSTRACT

The neonicotinoid pesticide imidacloprid is widely applied in natural systems to manage the spread and impact of nonnative forest insects, such as the hemlock woolly adelgid (*Adelges tsugae*). While application of this pesticide is an effective management tool for native tree preservation, previous research has identified negative impacts on non-target invertebrates and vertebrates. However, few studies have assessed vulnerability of amphibians to imidacloprid exposure, particularly in the terrestrial environment. We conducted a laboratory experiment using terrestrial juvenile spotted salamanders (*Ambystoma maculatum*) to determine if exposure of salamanders to soil contaminated with high concentrations of imidacloprid resulted in bioaccumulation of the pesticide and detectable sublethal effects. We assessed two soil imidacloprid concentrations and exposed salamanders for 1–18 days. We found that terrestrial spotted salamanders were capable of uptaking imidacloprid through dermal exposure, and that soil imidacloprid concentration and number of days of exposure were positively correlated with the concentration of imidacloprid in salamanders. We also found that soil imidacloprid concentration and number of days of exposure were negatively associated with salamander body condition and prey consumption. The results of this study indicate that salamanders inhabiting forest soil with high levels of imidacloprid, such as soil drench or injection application points, could be negatively impacted by the pesticide. However, soil drench and injection zones represent a small proportion of total forest surfaces, and soil imidacloprid concentration decreases with time since application and distance from application. Additional research is needed to assess impacts of long-term exposure to low soil imidacloprid concentrations on terrestrial salamanders.

1. INTRODUCTION

Many forest ecosystems in the United States are being impacted by nonnative insects that damage or kill native trees, such as the emerald ash borer (*Agrilus planipennis*), European gypsy moth (*Lymantria dispar dispar*), and hemlock woolly adelgid (*Adelges tsugae*; Lovett et al. 2016). A variety of biological, chemical, silvicultural, and cultural management approaches have been implemented to manage the spread and impacts of nonnative forest insects (e.g., Webb et al. 2003, Lamb et al. 2006, Muzika 2017). One of the most common approaches is application of systemic insecticides through soil drenches, injections, or tablets (Kovacs et al. 2010, Meng et al. 2015), with imidacloprid being the most widely used insecticide for management of hemlock woolly adelgid infestations (Dilling et al. 2010, Turcotte et al. 2017). Soil treatments are substantially more effective than trunk injections, and are thus recommended (Cowles et al. 2006, Cowles and Lagalante 2009).

While the use of imidacloprid is an effective management tool for hemlock (*Tsuga* spp.) preservation (Webb et al. 2003), a thorough understanding of the potential non-target impacts of using the pesticide is needed. Imidacloprid is a neonicotinoid, a group of pesticides that act as neurotoxicants in insects (Jeschke and Nauen 2008). Neonicotinoids are generally considered low-risk pesticides for vertebrates because they are highly selective for insect nicotinic acetylcholine receptors (Jeschke et al. 2011, Simon-Delso et al. 2015). However, previous studies have documented lethal and sublethal effects when exposing vertebrates to environmentally-relevant concentrations of imidacloprid (reviewed by Gibbons et al. 2015). In an agricultural system, surface water concentrations of just 0.02 ng/mL were associated with local declines in insectivorous birds (Hallmann et al. 2014). Adult red-legged partridges (*Alectoris rufa*) that were fed seeds coated with imidacloprid at the dose recommended for cereal seed coating exhibited reduced body condition, fertility, and chick survival rates (Lopez-Antia et al. 2013). In an extreme case, 26 American Goldfinches (*Spinus tristis*) died from consuming seeds contaminated with imidacloprid following soil drench applications in a California suburb (Rogers et al. 2019). Importantly, several metabolites of imidacloprid may have higher toxicity to vertebrates than imidacloprid (reviewed by Wang et al. 2018).

Few studies have investigated non-target impacts of imidacloprid on amphibians, and most previous research focused on assessing lethal concentrations and genotoxicity to anuran tadpoles (e.g., Feng et al. 2004, Pérez-Iglesias et al. 2014, Ruiz de Arcaute et al. 2014). The Appalachian region is a global biodiversity hotspot for salamanders (Buckley and Jetz 2007, Rissler and Smith 2010), and imidacloprid is widely used to preserve hemlock stands in the region (Turcotte et al. 2017). Imidacloprid applied to soil in forest systems can leach into surrounding aquatic habitats (Benton et al. 2016), and thus assessing potential impacts on aquatic and aquatic-stage amphibians is relevant in these systems. However, vulnerability may be highest for terrestrial amphibians that are chronically exposed to comparatively high concentrations of the pesticide in soil, particularly for amphibians occupying soil in imidacloprid drench or injection zones. Van Meter et al. (2014) confirmed that anurans can uptake imidacloprid through dermal exposure, but to our knowledge this has not been tested in terrestrial salamanders, and no studies have assessed sublethal effects of imidacloprid on salamanders.

The purpose of this study was to determine if exposure of salamanders to soil contaminated with high concentrations of imidacloprid results in uptake and bioaccumulation of the pesticide, and if detectable sublethal effects occur. We used terrestrial juvenile spotted salamanders (*Ambystoma maculatum*) as our focal species. We tested the influence of imidacloprid soil concentration and number of days of exposure (hereafter exposure time) on salamander bioaccumulation, body condition, and prey consumption to better understand how application concentration and chronic exposure could impact salamanders.

2. MATERIALS AND METHODS

2.1. Salamander collection and husbandry

We collected larval spotted salamanders on 1 July 2018 from 2 created vernal pools (distance between pools = 1.5 km) in the Monongahela National Forest, West Virginia, USA, that were located ca. 12 km from the nearest hemlock stands treated with imidacloprid based on U.S. Forest Service records. We transferred the larvae to an indoor laboratory at West Virginia University, and maintained them in three 38-L aquatic tanks until metamorphosis. We separated larvae by size class to reduce cannibalism and fed them blood worms ad libitum until metamorphosis. We placed floating islands in the aquatic tanks to minimize drowning of individuals undergoing metamorphosis. When salamanders lost their gills and tail fins (20 July – 29 August), we transferred them to individual terrestrial tanks (4.5 cm x 7 cm). We lined the terrestrial tanks with a moist paper towel and provided salamanders with an additional moist paper towel as a cover object. We fed terrestrial salamanders small crickets, earthworms, and waxworms ad libitum until initiation of the experiment on 31 October 2018. Mean weight at experiment initiation was 2.98 g (range = 1.49–4.23 g, N = 49).

2.2 Soils and pesticides

We collected soil from an untreated eastern hemlock (*Tsuga canadensis*) stand in the West Virginia Botanic Garden, Morgantown, West Virginia. We restricted our collection to the organic layer because imidacloprid binds to organic matter in soil (Liu et al. 2006), and thus we would expect long-term persistence of the pesticide to be highest in this layer. During active periods, *Ambystoma* salamanders typically use subterranean refuges that are close to the surface (Faccio 2003), providing the opportunity for chronic exposure to pesticides present in the organic layer. We autoclaved the soil at 121 °C for 45 minutes to minimize microbial degradation of imidacloprid during the study (Sabourmoghaddam et al. 2015). We also neutralized the soil to ca. pH 7 using sodium bicarbonate because previous research found that low pH (≤5) negatively impacted growth and survivorship of juvenile Marbled Salamanders (*Ambystoma opacum*; Anderson and Johnson 2018).

We used Merit® 75 WSP, a commercially available imidacloprid treatment that is commonly used by land management agencies for application in hemlock systems, including by the National Park Service in West Virginia (Strickler 2014). The product instructions recommend applying 0.75 g and 1.5 g of active ingredient per 2.54 cm trunk diameter at breast height for trees < 38.1 cm and ≥ 38.1 cm in diameter, respectively (Cowles 2009, Benton and Cowles 2017). The diameter of hemlock trees can exceed 100 cm (Godman and Lancaster 1990), and thus the amount of active ingredient (AI) used can exceed 60 g for very large trees. We tested two soil imidacloprid concentrations for this study, including 'moderate' and 'high' concentration treatments consisting of 0.15 g and 1 g of dissolved imidacloprid, respectively, mixed in 70 g of soil (i.e., 2,143,000 ng/mL and 12,286,000 ng/mL, respectively). Once soil was treated with the imidacloprid, we minimized soil exposure to light to restrict photodegradation of imidacloprid prior to, and during, the experiment (Liu et al. 2006).

2.3 Experimental design

We reared 49 spotted salamanders for inclusion in the experiment and began the experiment on 31 Oct 2018. We housed experimental salamanders in individual 4.5 cm x 7 cm containers containing 70 g of soil and no cover object. We kept soil moist throughout the experiment by misting the soil with non-chlorinated H_20. We randomly placed 42 of the salamanders into the 2 imidacloprid treatments and 7 exposure times, with 3 individuals used per treatment-exposure time combination. Exposure time included 1, 3, 6, 9, 12, 15, and 18 days of pesticide exposure. We used the remaining 7 salamanders as controls. We measured and weighed all salamanders at initiation of the experiment, and remeasured control salamanders at each exposure time to provide comparative data for body condition. We used a salamander stick to maximize accuracy of salamander length measurements (Margenau et al. 2018). We measured salamanders to the nearest 0.1 mm using dial calipers (Wiha Tools, Monticello, Minnesota, USA), and weighed salamanders to the nearest 1 mg using a precision balance (Ohaus SPX123, Parsippany, New Jersey, USA). Every 3 days, we removed the remaining salamanders from experimental tanks for ca. 24 hours to allow them to feed on non-contaminated prey. During this time, we kept the salamanders in individual tanks lined with a moist paper towel and provided them with a single waxworm weighing ca. 0.2 g. We recorded prey consumption by each salamander throughout the experiment.

2.4 Salamander processing and pesticide extraction

At the conclusion of each exposure time category, we placed salamanders assigned to that time in individual holding bags and euthanized them through exposure to carbon dioxide. We then handwashed each salamander under running tap water for two minutes to remove all soil and minimize presence of imidacloprid residue on the epidermis and transferred salamanders to clean holding bags. We measured and weighed the salamanders, and then froze them until conclusion of the experiment and subsequent processing for imidacloprid extraction.

We quantified the concentration of imidacloprid in salamanders using ultra-performance liquid chromatography-tandem mass spectrometry ([UP] LC-MS/MS). Pesticide extraction and chromatographic and mass spectrometry conditions were adapted from procedures developed by Lehotay (2006) and Galeano et al. (2013). We placed salamanders in individual 50 ml tubes, flash froze them in liquid nitrogen, and then placed them in a freeze dryer for 3 days. We placed 3 5-mm steel beads into each 50 ml tube and ground the salamanders in a Retsch MixerMill (MM 400, Haan, Germany) for 3 mins at 30 reps/min. We then removed the steel beads and added 10 ml of deionized water and 10 ml of acetonitrile. Samples were briefly vortexed then sonicated for 20 mins at room temperature in a sonication bath. We added Quick Easy Cheap Effective Rugged Safe (QuEChERS) Mylar salt pouches (UCT, ECQUEU7-MP) to each sample, and the samples were vortexed for 10 secs and shaken by hand for 1 min. We centrifuged the samples at 2,200 relative centrifugal force for 5 mins. We assembled a high-throughput vacuum apparatus with clean-up cartridges (UCT, ECPSAC1856) and conditioned with 5 mL of acetonitrile. Eight ml of the organic layer (acetonitrile) of each sample was collected and cleaned through the cartridges and deposited in 15 ml glass test tubes. We then dried the test tubes under nitrogen at 50 °C, reconstituted them in 0.5 ml of acetonitrile, and filtered the samples through PTFE Whatman Mini-UniPrep Syringeless Filter vials.

We used an Exion LC AD UHPLC system coupled with an AB Sciex Qtrap 5500 triple quadrupole AcQuRate CEM detector. We separated the compounds imidacloprid, imidacloprid-urea, and imidacloprid-olefin, as well as external standards, on a Kromasil C_{-18} column (2.1 x 50 mm) maintained at an oven temperature of 40 °C using a mobile phase gradient of (A) 0.1% formic acid in water and (B) 0.1% formic acid in acetonitrile. We programmed the elution gradient as follows: 0–1.0 min, isocratic A to B (80:20, v/v); 1.0–1.3 min, from A to B (80:20, v/v) to (0:100, v/v); 1.3–2.3 min, isocratic A to B (0:100, v/v); at 2.3 min, from A to B (0:100, v/v) to (80:20, v/v); 2.3–6.0 min, isocratic A to B (80:20, v/v). We maintained the autosampler temperature at 10 °C; the injection volume was 2 µl.

The LC-MS/MS detection of the compounds was performed by electrospray ionization (ESI) source operated in positive ion mode. We used multiple reaction monitoring (MRM) for the detection and quantification of imidacloprid and metabolites. MRM parameters were as follows: imidacloprid, Q1 mass 256.000 Da, Q3 mass 209.000 Da, 50.0 msec; imidacloprid-urea, Q1 mass 213.200 Da, Q3 mass 129.000 Da, 50.0 msec; imidacloprid-olefin, Q1 mass 254.100 Da, Q3 mass 171.000 Da, 50 msec. We maintained the IonSpray voltage and source temperature at 4.50 kV and 450 °C, respectively. We performed data acquisition and processing using the software Analyst® (Sciex, Version 1.6.3).

We assessed recovery of imidacloprid and metabolites from salamanders by spiking non-study salamander tissues with known concentrations of the chemicals. We used tissue from wild-caught dusky salamanders (*Desmognathus* spp.) that had been previously analyzed via LC-MS/MS to confirm concentrations lower than 0.5 ng/mL for the targeted compounds. We homogenized a total of 10 g of salamander tissue in a mixer mill and used 0.5 g of the tissue for each spike. We conducted tissue spikes by adding 1 ml of a mixed standard solution containing imidacloprid, imidacloprid-urea, and imidacloprid-olefin at 10,000 ng/mL, 1,000 ng/mL, and 100 ng/mL in acetonitrile. The average recovery of salamanders spiked with imidacloprid, imidacloprid-urea, and imidacloprid-olefin was 73.5%, 65.1%, and 49.2%, respectively.

2.5 Statistical analyses

We assessed and quantified the influence of soil imidacloprid concentration (control, moderate, high) and exposure time on salamander bioaccumulation, body condition, and prey consumption. We used concentration of imidacloprid in each salamander as the bioaccumulation response variable. We created a body condition index (BCI) by regressing (log) body length on (log) weight (Schulte-Hostedde et al. 2005). Positive residuals indicate a higher-than-average weight for a given length, and vice versa. For each salamander, we computed the difference in these residual values between the initial and end measurement and used this difference as our BCI. This allowed us to control for individual differences in body condition at initiation of the experiment without adding an additional model covariate. For prey consumption, we used a binary response variable that represented if prey was consumed each feeding day.

We used a generalized least squares model to assess soil imidacloprid concentration and exposure time effects on salamander bioaccumulation for the 42 individuals in the high and low treatments (Zuur et al. 2009). The body condition and prey consumption data sets included repeated measurements of the 49 individuals from all three treatments, and thus we used mixed effects models, treating individuals as an intercept random effect (Zuur et al. 2009). We used a Gaussian distribution for the bioaccumulation and body condition analyses, and a binomial distribution for the prey consumption analysis. We assessed model fit and determined the most appropriate model structures using residual plots and Akaike Information Criterion (AIC) scores (Zuur et al. 2009). For the body condition model, examination of residuals indicated that variance increased with increasing exposure time. To address this, we used a fixed variance structure based on exposure time, which provided a better model fit than a constant variance structure.

For each data set, we used a model selection approach with AIC corrected for small sample size (AIC_c) to determine the optimal fixed effect covariate structure (Burnham et al. 2011). Specifically, we compared interaction, additive, and main effects models to a null model that contained no fixed effects (Table 1). For the body condition and prey consumption model selections, all models included individuals as an intercept random effect. We performed all statistical analyses using program R (version 3.5.3; The R Foundation for Statistical Computing, Vienna, Austria). We used the package nlme (version 3.1-137) for the bioaccumulation and body condition analyses, package lme4 (version 1.1-21) for the prey consumption analysis, and package AICcmodavg (version 2.2-1) for model selection.

3. RESULTS

No imidacloprid, imidacloprid-olefin, or imidacloprid-urea was detected in the 7 control salamanders. Imidacloprid concentration in all treatment salamanders exceeded the limit of detection and quantification (1731 and 5770.1 ng/mL, respectively). Mean salamander imidacloprid concentration in the moderate and high soil concentration groups was 18782.8 ng/mL and 27562.4 ng/mL, respectively (Figure 1a). The top model for imidacloprid bioaccumulation included an additive effect for soil concentration and exposure time (Akaike weight = 0.45; Table 1). Mean salamander imidacloprid concentration increased by 129.7 (± 79.4) ng/mL per day. Salamander imidacloprid concentration per soil imidacloprid concentration and exposure time is shown in Figure 1b, c. All treatment salamanders contained detectable levels of imidacloprid-olefin and imidacloprid-urea. Mean concentration of imidacloprid-olefin was 1097.7 (range = 262–3282.1) and 2445 (range = 604–5002.6) ng/mL in the moderate and high soil concentration groups, respectively. Mean concentration of imidacloprid-urea was 260.5 (range = 77.4–713.8) and 523.7 (range = 198.7–1086.5) ng/mL in the moderate and high soil concentration groups, respectively.

The top model for salamander BCI included an interaction effect between soil imidacloprid concentration and exposure time (Akaike weight = 0.48; Table 1). Predicted BCI had a minimal positive association with exposure time for control salamanders (slope = 0.0003/exposure day; Figure 2a). Predicted BCI was negatively associated with exposure time for moderate and high soil concentration salamanders, with a ca. 3 times stronger relationship for high soil concentration salamanders (slope = -0.0019 vs -0.0064/exposure day for moderate and high soil concentration salamanders, respectively; Figure 2a).

The top model for prey consumption included an additive effect between soil imidacloprid concentration and exposure time (Akaike weight = 0.56; Table 1). Probability of prey consumption at exposure day 3 was 0.989, 0.724, and 0.494 for control, moderate, and high soil concentration salamanders, respectively. At exposure day 15, probability of prey consumption declined to 0.669, 0.383, and 0.005 for control, moderate, and high soil concentration salamanders, respectively (Figure 2b). No high soil concentration salamander consumed prey after 9 days of imidacloprid exposure.

4. DISCUSSION

The results of this study indicate that terrestrial salamanders can uptake the pesticide imidacloprid through dermal exposure, consistent with the findings of Van Meter et al. (2014, 2015) for terrestrial anurans. We also found that while exposure to high imidacloprid soil concentrations did not result in mortality during the time-span of our study, it did negatively impact body condition, likely related to the decreased prey consumption rates that we also observed. However, we were unable to explicitly quantify the relationship between BCI and prey consumption because body condition was only measured at the beginning and end of the experiment, and the number of prey consumption events for most salamanders was too small to reliably estimate proportion of prey consumed. Amphibian body condition correlates with survival, productivity, and movement dynamics (e.g., Lowe et al. 2006, Reading 2007, Roznik et al. 2015) and these individual-level effects can scale up to impact population-level vital rates (Ozgul et al. 2010, Willson et al. 2012).

We recognize that the presence of very high imidacloprid concentrations in forest systems is limited to initial applications at soil drench and injection points, and these are both spatially and temporally limited. However, pesticide degradation can take years in forest soils with high organic matter content, such as hemlock systems (Anhalt et al. 2008, Bonmatin et al. 2015). Terrestrial salamanders have long life-spans and generally have restricted movement outside of the breeding period (reviewed by Petranka et al. 1998), and thus could be exposed to lower concentrations of imidacloprid in the environment for many years and potentially their entire lifespan. In addition, lower concentrations of imidacloprid can be present in the broader environment, primarily through deposition and movement of tree needles or leaves containing the pesticide (Cowles et al. 2006) and leaching of the pesticide into groundwater and subsequent transport to streams (Benton et al. 2016).

Our study examined bioaccumulation strictly through dermal uptake. Salamanders in the wild could also acquire imidacloprid through consumption of contaminated invertebrate prey (Pisa et al. 2015). Further, predators of salamanders, including mammals, birds, reptiles, other amphibians, fish, and macroinvertebrates (Petranka 1998), could potentially acquire the chemical through consumption of contaminated salamanders. Additional research is needed to assess potential impacts to salamanders and other vertebrates from chronic exposure to low pesticide concentrations in forest systems, as well as to assess the potential for bioaccumulation of imidacloprid through prey consumption.

Eastern hemlock is a foundation species in both urban and forested landscapes of the eastern United States because it creates critical and stable conditions required by many species (Ellison 2014). Many plants and animals that depend on hemlock systems would be negatively impacted by extensive mortality of hemlock forests, thus, control of hemlock woolly adelgid is critical. However, our laboratory study confirms that imidacloprid can have measurable sublethal effects on salamanders, at least at high concentrations. Additional research is needed to assess both individual-level and population-level impacts to salamanders in real-world systems.

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Table 1. Model selection results to determine the optimal covariate structure for the influence of imidacloprid soil concentration (control [body condition and prey consumption-only], moderate, high) and time of exposure on terrestrial juvenile spotted salamander (*Ambystoma maculatum*) pesticide bioaccumulation (N = 42 individuals and observations), body condition (N = 49 individuals and 91 total observations), and prey consumption (N = 49 individuals and 125 total observations), using Akaike's Information Criterion corrected for small sample size (AIC_c). The null model includes no fixed effects and is shown as (.). For the body condition and prey consumption model selections, all models included individuals as an intercept random effect. w_i represents Akaike weights.

Data Set	**Model**	**Parameters**	**ΔAIC_c**	**w_i**
Bioaccumulation	Concentration + Exposure	4	0.00	0.45
	Concentration	3	0.33	0.38
	Concentration x Exposure	5	2.04	0.16
	(.)	2	46.71	0.00
	Exposure	3	48.18	0.00
Body condition	Concentration x Exposure	8	0.00	0.48
	Exposure	4	1.42	0.23
	(.)	3	1.50	0.23
	Concentration	5	5.26	0.03
	Concentration + Exposure	6	5.46	0.03
Prey consumption	Concentration + Exposure	5	0.00	0.56
	Concentration x Exposure	7	0.52	0.43
	Exposure	3	10.08	0.00
	Concentration	4	10.22	0.00
	(.)	2	16.25	0.00

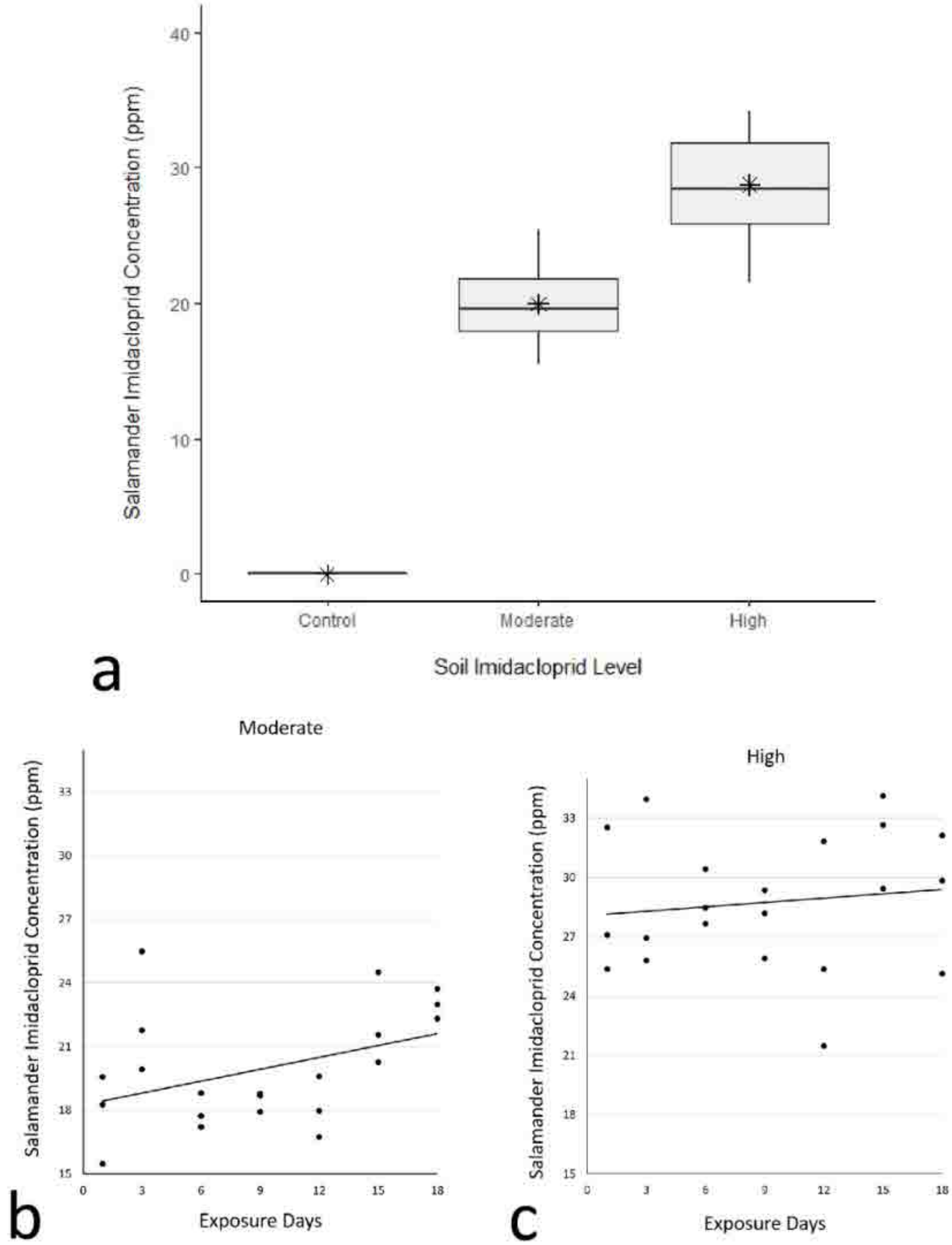

Figure 1. Spotted salamander (*Ambystoma maculatum*) imidacloprid concentrations for 3 soil imidacloprid treatment levels (control, moderate, high) and days of exposure (1–18). (a) Boxplot summaries of concentrations per treatment. Relationship between salamander imidacloprid concentration and number of days of exposure to moderate (b) and high (c) treatment levels of imidacloprid in soil. Dots represent individual salamander values, and lines represent a least squares line of best fit.

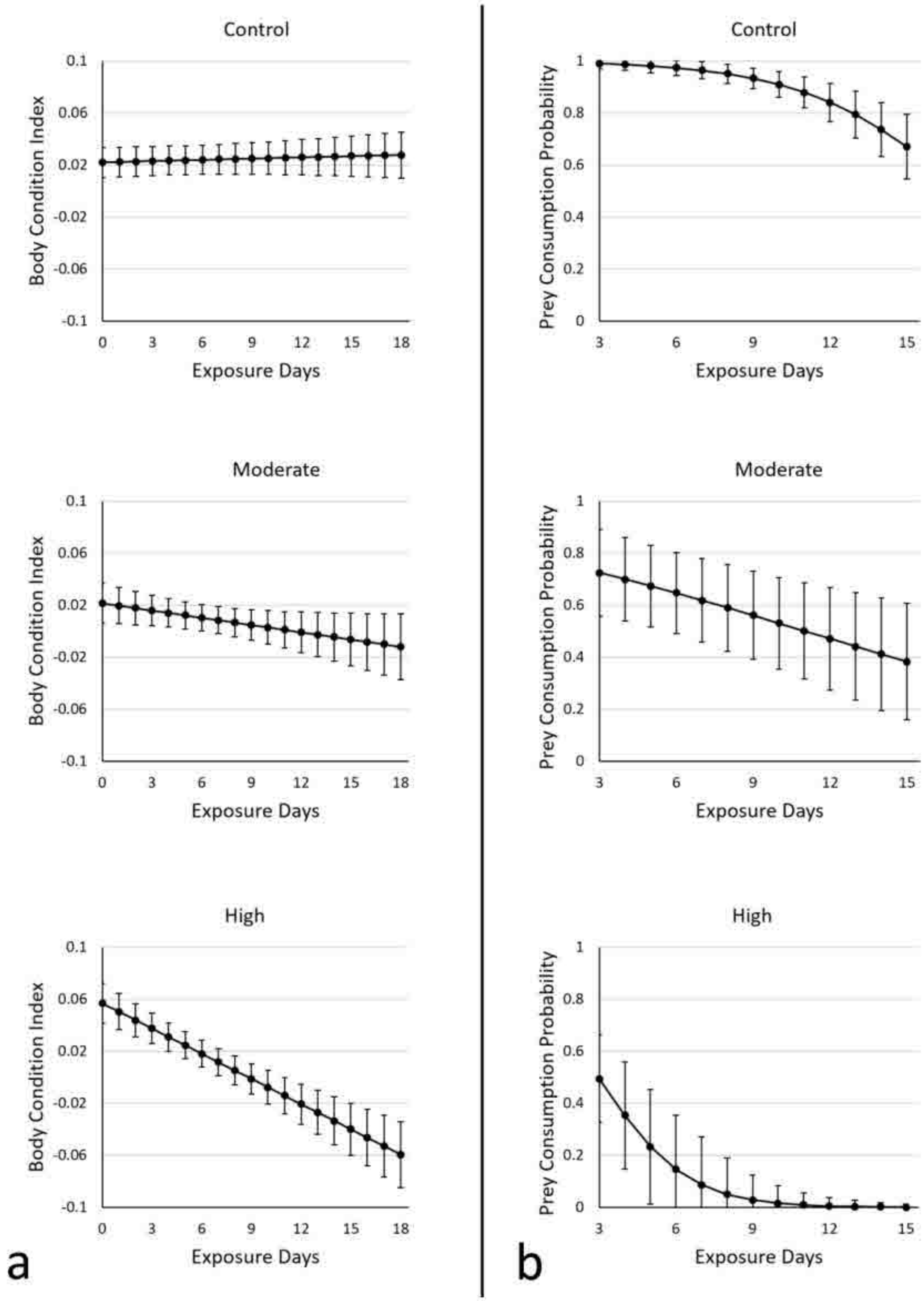

Figure 2. Model-predicted influence of soil imidacloprid concentration (control, moderate, high) and time of exposure (exposure days) on (a) body condition index and (b) prey consumption of terrestrial juvenile spotted salamanders (*Ambystoma maculatum*). Bars represent model standard errors.

CHAPTER 3: EFFECTS OF IMIDACLOPRID EXPOSURE ON STREAM SALAMANDER ABUNDANCES

ABSTRACT

Amphibians are declining globally due to anthropogenic changes in the environment, including exposure to chemical contaminants. Imidacloprid is a neonicotinoid pesticide that is used worldwide and is the most effective method of mitigating hemlock tree loss from the invasive hemlock woolly adelgid. Although neonicotinoids are generally considered safe for vertebrates, imidacloprid has been found to decrease survival and have genotoxic effects on anurans. Research on the potential effects of imidacloprid exposure on salamanders is lacking. In this study, we assessed whether imidacloprid exposure affects stream salamander abundances. We surveyed stream salamanders 5–7 times at 48 study sites, 27 of which had been exposed to imidacloprid treatments. We used *N*-mixture models and a model selection approach to identify important predictors of salamander abundance and detection probability for adult *Desmognathus fuscus*, adult *D. monticola*, adult *D. ochrophaeus*, adult *Eurycea* spp., and *Gyrinophilus porphyriticus* larvae. We first selected the most parsimonious detection submodels and habitat variables, and then individually tested and ranked four predictors of imidacloprid exposure: imidacloprid water concentration (ng/mL), number of imidacloprid applications, presence/absence of treated trees, and presence/absence of environmental imidacloprid. For treated sites, we also tested the effect of number of years since imidacloprid treatment. There was support for models containing predictors of imidacloprid exposure for all species, but in most cases the confidence intervals overlapped 0. There was a negative correlation between number of years since treatment and the abundances of *D. ochrophaeus* adults and *G. porphyriticus* larva, suggesting that population-level impacts of imidacloprid exposure may be delayed.

1. INTRODUCTION

Amphibians are currently facing a global conservation crisis with nearly half of amphibian populations in decline (Houlahan et al. 2000, Stuart et al. 2004). Many of these declines have been directly linked to anthropogenic changes, including exposure to chemical contaminants from human activities (Davidson 2004, Davidson and Knapp 2007, Sparling et al.

2001). Amphibians are more vulnerable to chemical contamination than birds or mammals because amphibian skin is highly permeable to allow dermal respiration and regulation of water and ions, thereby providing a route of entry for contaminants into tissues (Quaranta et al. 2009). Additionally, most amphibian species use both aquatic and terrestrial environments and are therefore exposed to contamination in both (Brühl et al. 2011). Most research on the effects of chemical contaminants on amphibians has focused on physiological effects, such as reductions in body size, growth rate, body condition, and development (e.g. Gabor et al. 2018, Larson et al. 1998, Relyea and Diecks 2008).

Imidacloprid is a neonicotinoid insecticide that is a common and effective treatment to protect eastern hemlock (*Tsuga canadensis*) and Carolina hemlock (*T. caroliniana*) trees from the non-native invasive pest, hemlock woolly adelgid (HWA; *Adelges tsugae*; Havill et al. 2014). Hemlocks have a large geographical distribution across the eastern United States and provide important habitat for diverse invertebrate and vertebrate species (Becker et al. 2008, Ellison 2014, Havill et al. 2014, Snyder et al. 2002, Tingley et al. 2002). The HWA has spread to ca. 50% of hemlock's geographical range and has caused wide-spread declines in hemlock populations, necessitating chemical mitigation (Havill et al. 2014, Orwig et al. 2008).

Previous studies have documented imidacloprid leaching from HWA treatment areas into adjacent streams (Benton et al. 2016, Churchel et al. 2011, Wiggins et al. 2018). Imidacloprid's high water solubility allows for leaching into groundwater and streams (US EPA 2003), while its low volatility and a low soil adsorption coefficient makes it highly mobile in soil with low organic matter (Ding et al. 2011, Liu et al. 2002). These characteristics, in conjunction with the general proximity of hemlock forests to riparian areas, increase the risk of imidacloprid leaching into stream systems (Ding et al. 2011). Although imidacloprid begins to break down quickly in surface water when exposed to sunlight, continual leaching may maintain imidacloprid presence in stream systems near treated hemlocks (Benton et al. 2016, Wamhoff and Schneider, 1999).

Neonicotinoids are commonly considered to be non-harmful to vertebrates because they are highly selective for insect nicotinic acetylcholine receptors (nAChR), but concern has recently been expressed about non-target impacts of these pesticides (Hallman et al. 2014, Matsuda et al. 2001). A variety of sublethal effects of imidacloprid on mammals, birds, fish, and frogs, including impacts on reproduction and growth, have been identified (reviewed by Gibbons et al. 2015). The proximity of stream salamanders to HWA treatments, sensitivity of salamanders to chemical contaminants, and the global decline of amphibians all necessitate research investigating potential impacts of imidacloprid exposure on salamanders (Brühl et al. 2011, Stuart et al. 2004). Research on neonicotinoids and salamanders is lacking, but research has been conducted on the physiological effects of imidacloprid exposure on anurans (e.g. Ade et al. 2010, Pérez-Iglesias et al. 2014). Feng et al. (2004) demonstrated that imidacloprid is genotoxic to the black-spotted pond frog (*Pelophylax nigromaculatus*) with DNA damage increasing as aquatic concentrations increased. Similarly, imidacloprid exposure led to DNA lesions in Montevideo tree frog (*Hypsiboas pulchellus*) tadpoles, although this effect was only displayed at concentrations higher than typical field conditions (Pérez-Iglesias et al. 2014). Bioaccumulation of imidacloprid was documented in four anuran species after eight hours of exposure in a laboratory (Glinski et al. 2018, Van Meter et al. 2014, 2015). Imidacloprid exposure also decreased survival rates in northern cricket frogs (*Acris crepitans*; Ade et al. 2010).

North America is a global hotspot for salamander diversity (Yap et al. 2015), and salamanders are particularly abundant in the Appalachian Mountains (Petranka and Murray 2001). In headwater streams, salamanders are often the dominant vertebrates in terms of abundance and biomass (Burton and Likens 1975, Davic and Welsh 2004). Loss of salamander populations from headwater streams can have ecosystem-wide consequences because salamanders can influence insect population dynamics, regulate detritus food webs, and link stream and terrestrial food webs (Petranka 1998). Thus, salamander occupancy and abundance can serve as an indicator of stream quality (Southerland et al. 2004) and ecosystem stress (Lowe and Bolger 2002, Welsh and Ollivier 1998, Wood and Williams 2013).

The purpose of this study was to assess whether abundances of adult and larval salamanders are associated with stream water imidacloprid concentrations, the presence of imidacloprid or its metabolites in the environment, the presence of treated trees, the number of imidacloprid-treated hemlock trees adjacent to a stream, or the number of years since the last imidacloprid application. We hypothesized that salamander abundances would be lower in streams exposed to imidacloprid and would have a negative relationship with water imidacloprid concentration and number of imidacloprid applications. We also hypothesized that, for treated sites, salamander abundances would be negatively correlated with years since treatment, because sublethal effects could have delayed impacts on abundance (Dively et al. 2015).

2. METHODS

2.1 Study Sites

This study was conducted in the Monongahela National Forest (MNF) and two units of the National Park Service (NPS): Gauley River National Recreational Area (GARI) and New River Gorge National River (NERI) in West Virginia, USA (Fig. 1-1). Hemlock trees in the MNF were treated with a single application of imidacloprid in 2014 or 2015. Hemlock stand treatments in NPS units began in 2006 and have continued annually, including multiple applications (2–7 times) at 10 of the sampling locations (Appendix 2-1). We did not select NPS treatment sites if the last treatment occurred prior to 2011. We used ArcGIS 10.4 to identify candidate headwater streams based on proximity to HWA treatments. Candidate streams were visited to determine whether the stream depth, stream substrate, and water flow speeds were suitable for sampling salamanders and stream invertebrates. Final study sites were selected based on the suitability of the streams for sampling, the proximity of treated trees, or the absence of known treatments for non-treated sites. They were also selected to be similar in habitat characteristics such as stream size, water flow, water chemistry, and surrounding vegetative community. Generally, the streams selected were too shallow and narrow to support fish populations. Sites adjacent to HWA treatments had on average 306 ± 158.7 treated trees (range = 5–3927 trees), with applications representing individual tree treatments. Hemlock trees that were treated multiple years were counted as multiple trees (i.e. a tree that was treated for two years was counted as two trees to represent treatment intensity).

We sampled 1st- and 2nd-order headwater streams for stream salamanders in 24 sites in MNF, 14 sites in NERI, and ten sites in GARI. Of these 48 sites, 27 were directly adjacent to HWA treatments and 21 were not adjacent to HWA treatments. Sites that were not adjacent to HWA treatments were either a minimum of 100 m upstream of imidacloprid application or were in a watershed without known HWA treatments. We selected 100 m as a minimum distance because Benton et al. (2015) did not detect imidacloprid in stream sites that were 10–100 m upstream of treated trees, and because stream salamanders typically have home ranges smaller than 100 m (reviewed by Petranka 1998).

2.2 Water and Sediment Imidacloprid Extraction and Quantification

See chapter 2, sections 2.2 and 2.6 for water and sediment sampling, imidacloprid extraction, and imidacloprid quantification methods.

2.3 Salamander Sampling

Within each of the 48 sites, we established three 3.3 x 2 m subplots for a total plot area of 10 x 2 m. One m of the subplot width was on the bank and one m was within the wetted stream channel (Appendix 3-1). We primarily placed subplots in riffles (n = 123) but placed subplots in runs (n = 13) or pools (n = 8) if the site did not have enough riffle habitat. We chose subplots that were similar in terms of stream depth, substrate, canopy cover, vegetative community, and flow regime. We completed salamander sampling in the NPS sites between April and July of 2017 and in the MNF sites between April and July of 2018, sampling each site 5–7 times during the year. We conducted surveys only during baseflow conditions. While moving upstream to prevent stream sediment from flowing downstream and obscuring our view, we flipped every cover object greater than 50 mm in diameter and searched through leaf packs. We recorded the number of cover objects flipped while sampling.

We removed all captured salamanders and placed them in plastic bags. We identified all salamanders to species, or genus when identification to species was not possible. After processing, we returned salamanders to their point of capture. We noted the genus or species of any escaped salamanders when possible. We considered *Eurycea* spp. and *Gyrinophilus porphyriticus* with gills to be juveniles. We also classified *Desmognathus monticola* <18 mm, *D. fuscus* <15 mm, and *D. ochrophaeus* <12 mm as juveniles (Bruce 1989, Danstedt 1975, Tilley 1980). When possible, we recorded whether escaped salamanders were juveniles or adults.

2.4 Habitat variables measured

At each subplot during salamander sampling, we measured air temperature (°C) and relative humidity with a weather meter (Kestrel 3000, Kestrel Instruments, Boothwyn, Pennsylvania). After every sampling event, we measured stream depth (cm) in the center of the plot. After most sampling events (5–6/year), we measured total dissolved solids (g/L), water temperature (°C), and pH at each subplot using a low range pH/conductivity/TDS tester (HI98129, Hanna Instruments, Woonsocket, Rhode Island). We measured canopy cover at each subplot once during each sampling season using a 25 cm x 25 cm plexiglass grid which was divided into 5 cm x 5 cm cells. We held the plexiglass grid overhead and visually estimated how many cells were covered by the tree canopy and calculated % canopy cover (Haché et al. 2013). We averaged the canopy cover measurements from the three subplots. Additionally, we estimated live hemlock basal area per hectare using a prism with a basal area factor of 10. At each subplot, we sited trees through the prism to determine whether they should be tallied or tallied as borderline. Borderline trees were counted as a half of a tree. We calculated basal area per hectare by dividing the total tree tally by the number of sampling points (3) and multiplying by the basal area factor (10). Once per season, we also visually estimated what percentage of the stream portion of the subplots was cover by cobble (5–256 mm) or boulders (>256 mm). We added % cobble and % boulder together to assess what percentage of the subplots were rocky cover and averaged the percentages across the three subplots.

2.5 Benthic surveys

During May – June 2017 and May – July 2018, we sampled macroinvertebrates at three 0.3 x 2 m subplots within each stream site so that total area sampled per stream was 0.3 x 6 m. We collected the samples adjacent to salamander sampling plots. We collected the samples in riffles (n = 128), except in several instances where riffles were not present. In these instances, we collected samples in runs (n = 12) or pools (n = 1). We placed a 0.3 m wide D-net flush with the bottom of the stream and disturbed the substrate upstream of the D-net for 30 seconds. We only sampled sites in base flow conditions. We composited the three samples from each stream site into one sample and stored the invertebrates in 75% ethanol. All organisms in each sample were counted and body length of each was measured to the nearest 1 mm using a millimeter grid placed underneath a dissecting microscope (Carl Zeiss Microscope, Thornwood, New York). We estimated macroinvertebrate biomass by using the length of each individual and length-weight equations found in the literature (e.g., Benke et al. 1990; Sabo et al. 2002) and summed the biomass estimates to obtain total biomass for each site.

2.6 Statistical Methods

We used single-season *N*-mixture models and a model selection approach to determine influential predictors of salamander abundance (Kéry and Royle, 2016). *N*-mixture models use both spatial and temporal replication of count data to jointly estimate abundance and detection probability (*p*), and thus they account for observed numbers being a product of both ecological and observational processes (Royle, 2004). We separated species capture datasets into adults and juveniles because we would expect individual-level detection probability to differ between the two groups. We estimated abundance for *Desmognathus fuscus* adults, *D. monticola* adults, *D. ochrophaeus* adults, *Eurycea* spp. adults, and *G. porphyriticus* juveniles. We excluded juvenile *D. fuscus*, *D. monticola*, and *D. ochrophaeus* and adult *G. porphyriticus* due to low sample sizes and excluded juvenile *Eurycea* spp. due to high model overdispersion (c-hat >4).

For each abundance submodel, we tested Poisson, Zero-Inflated Poisson (ZIP), and negative binomial (NB) distributions. We selected distributions based on the model's AIC_c value and whether the models converged. We selected the ZIP distribution for *D. fuscus* adults and *D. ochrophaeus* adults. We selected the Poisson distribution for *D. monticola* adults, *Eurycea* spp. adults, and *G. porphyriticus* larvae. No models converged when the NB distribution was used. We assessed goodness-of-fit using the most complex candidate model and a 1,000-replication parametric bootstrap of the Pearson chi-square statistic (Kéry and Royle, 2016). Goodness-of-fit tests revealed some overdispersion in the models for all species (*D. fuscus* c-hat = 1.19; *D. monticola* c-hat = 2.32; *D. ochrophaeus* c-hat = 1.57; *Eurycea* spp. adults c-hat = 2.15; *G. porphyriticus* c-hat = 1.84). We accounted for this overdispersion by ranking models using Quasi Akaike's information criterion, corrected for small sample ($QAIC_c$; Symonds and Moussalli, 2011).

We first determined the strongest predictor(s) of detection probability (*p*) for each salamander species. We standardized all continuous detection, habitat, and imidacloprid predictors to facilitate model convergence. We tested relative humidity (%), number of cover objects flipped, water temperature (°C; linear and quadratic), air temperature (°C; linear and quadratic), and water depth (linear and quadratic). For all species, we also tested one additive model containing the two predictors with the lowest $QAIC_c$ (Table 3-1). We retained the most parsimonious *p* submodel for all further analyses. Next, we determined the strongest habitat predictors of stream salamander abundances for each species. We tested water total dissolved solids (TDS; ng/mL), water pH, hemlock basal area/ha, total canopy cover (%), benthic macroinvertebrate biomass, locality (MNF or NPS), and % rock for all species. We also tested bank leaf cover (%) for *D. ochrophaeus* because they are more terrestrial than the other tested species (Moore et al. 2000). We tested one additive model for each species containing the two predictors with the lowest $QAIC_c$ (Table 3-2). We retained the habitat variables from the most parsimonious model for each species for all further analyses.

After selecting the most parsimonious p and habitat submodels, we individually tested and ranked four predictors of imidacloprid exposure: imidacloprid water concentration (ng/mL), number of imidacloprid-treated trees, presence/absence of treated trees, and presence/absence of environmental imidacloprid. We defined presence of environmental imidacloprid as imidacloprid being detected in the stream water or sediment, imidacloprid metabolites being detected in the stream water or sediment, or treated trees being present. We also tested an interactive effect with each imidacloprid predictor and locality (Table 3-3).

We used a reduced dataset consisting only of sites that had received imidacloprid treatments to assess relationships between abundance and time since imidacloprid treatment. We maintained the most parsimonious p and habitat submodels from the full dataset and tested the number of years since the last imidacloprid treatment (hereafter YST). We also tested models with interactive terms between YST and locality and number of treated trees (Table 3-5). We assessed goodness-of-fit for the reduced (treatment only) dataset, which indicated some overdispersion in the models (*D. fuscus* c-hat = 2.45; *D. monticola* c-hat = 2.34; *D. ochrophaeus* c-hat = 2.1; *Eurycea* spp. adults c-hat = 1.38; *G. porphyriticus* c-hat = 1.56).

We used $\Delta QAIC_c$ and Akaike weight (w_i) to assess model support, and considered candidate models to have some support when $\Delta AIC_c < 7$ (Burnham et al. 2011). We conducted *N*-mixture model analyses using the package unmarked (Fiske et al. 2019; version 0.12 – 2) in program R (R Core Team 2019; version 3.4.1), and model selection analyses using the package AICcmodavg (Mazerolle 2019; version 2.1–1) in program R.

3. RESULTS

3.1 Water and Sediment Imidacloprid Concentration

Of the 48 sampled sites, 27 were directly adjacent to HWA treatments. Imidacloprid was detected in the stream water at 24 sites, with a mean concentration of 49.83 ± 20.22 ng/mL (range = 6.52 – 489.56 ng/mL; Appendix 2-1). Imidacloprid-urea was not detected in the stream water at any site. We detected imidacloprid-olefin in the water at two sites, and we detected imidacloprid in the water at both sites with detectable levels of imidacloprid-olefin. Imidacloprid was detected in sediment at four sites, three of which were adjacent to HWA treatments. We did not detect imidacloprid-olefin or imidacloprid-urea in the sediment at any site.

3.2. Salamander Abundances

We captured 431 *D. fuscus* adults, 496 *D. monticola* adults, 269 *D. ochrophaeus* adults, 125 *Eurycea* spp. adults, and 249 *G. porphyriticus* larvae. Of the 48 sampled sites, we detected *D. fuscus* adults at 36 sites, *D. monticola* adults at 40 sites, *D. ochrophaeus* adults at 35 sites, *Eurycea* spp. adults at 34 sites, *and G. porphyriticus* larvae at 41 sites. Mean estimated abundance per site was 4.9 for *D. fuscus* adults, 5.4 for *D. monticola* adults, 6.6 for *D. ochrophaeus* adults, 6 for *Eurycea* spp. adults, and 4.1 for *G. porphyriticus* larvae.

3.3. Detection Probability

The variables included in the most parsimonious *p* submodels varied among species (Table 3-1). Number of cover objects flipped was a strong predictor for *D. monticola, D. fuscus* and *G. porphyriticus*. Julian date was important for *D. ochrophaeus*, *D. fuscus*, and *Eurycea spp.* and relative humidity was a strong predictor for *D. monticola* and *Eurycea* spp. Additionally, water depth (quadratic) was an important variable for *D. ochrophaeus*.

3.4 Habitat Variables

The most influential habitat variables also varied among species (Table 3-2). The most parsimonious habitat submodels for *D. fuscus* and *G. porphyriticus* included % rock and invertebrate biomass (w_i = 0.63 and 0.49, respectively). The most parsimonious submodel for *D. monticola* abundance included pH and hemlock basal area/ha (w_i = 0.73), the most supported abundance submodel for *D. ochrophaeus* included total canopy (%) (w_i = 0.26), and the most supported abundance submodel for *Eurycea* spp. included TDS (w_i = 0.54).

3.5 Imidacloprid Exposure

For all species, models containing predictors of imidacloprid exposure had some support (Table 3-3). For *D. fuscus* and *D. monticola,* the most supported abundance submodel contained an interaction term between the presence of treated trees and locality (w_i = 0.84 and 0.30, respectively). An interaction term between the presence of treated trees and locality was also included in the second most supported submodel for *D ochrophaeus* ($w_i = 0.25$). However, for all three *Desmognathus* species, the confidence interval for presence of treated trees overlapped 0. The most supported submodel for *D. ochrophaeus* contained an interaction term between number of treated trees and locality ($w_i = 0.34$) but the confidence interval overlapped 0 (Table 3-4). Concentration was positively associated with *D. ochrophaeus* abundances and the confidence interval did not overlap 0.

For *Eurycea* spp., the most supported submodel was the null model and the second most supported submodel contained presence of environmental imidacloprid ($w_i = 0.19$; Table 3-3). The second most supported submodel for *G. porphyriticus* also contained presence of environmental imidacloprid ($w_i = 0.29$). Both presence of environmental imidacloprid and concentration positively correlated with abundance in *G. porphyriticus* and the confidence intervals did not overlap 0 (Table 3-4).

For all the *Desmognathus* species and *Eurycea* spp., the null model was the most parsimonious model, but models containing YST had some support (Table 3-5). The model containing YST was more supported than the null model for *G. porphyriticus* larvae ($w_i = 0.52$). Years since treatment was negatively correlated with abundance for all species except *Eurycea* spp., but the confidence intervals overlapped 0 for *Eurycea* spp., *D. fuscus*, and *D. monticola* (Table 3-6). There was a negative correlation between YST and salamander abundances for *D. ochrophaeus* adults and *G. porphyriticus* larva (Table 3-6). The model-estimated abundance for *G. porphyriticus* larvae was 6.9 salamanders at one year post-treatment and 1.94 salamanders at five years post-treatment. The model-estimated abundance for *Eurycea* spp. was 24.6 salamanders at one year post-treatment and 0.4 salamanders at five years post-treatment. For all species, models containing YST were more highly supported than models containing interactive effects with locality and number of treated trees.

4. **DISCUSSION**

Our study presents evidence that the abundances of *D. ochrophaeus* adults and *G. porphyriticus* larva may be negatively affected by imidacloprid treatments. We found a negative correlation between YST and abundances of *D. ochrophaeus* adults and *G. porphyriticus* larva, suggesting that stream salamanders may be negatively affected by imidacloprid exposure, but that detectable effects on population abundances do not occur immediately after treatments. In two concurrent studies, we documented physiological differences in salamanders associated with HWA treatments and imidacloprid exposure. Sublethal effects of imidacloprid exposure on salamanders included bioaccumulation, reduced body condition indices, increased levels of the stress hormone corticosterone, and impeded feeding behavior (see chapter 2 and appendix 2-2). It is possible that these sublethal effects reduce salamander abundances over the course of multiple years by altering survival probabilities or reproductive potential. Future research will benefit from examining relationships between sublethal effects and population level effects for diverse amphibian species. Assessing at what level of sublethal effects will correspond with a population level effect will also be beneficial to forest managers. Additionally, long-term monitoring of amphibian populations adjacent to imidacloprid applications will provide important information on any potential delayed population effects.

Models containing imidacloprid predictors were supported in all species, but nearly all confidence intervals overlapped 0. The models in which the confidence intervals did not overlap 0 were the *G. porphyriticus* models containing presence of environmental imidacloprid and concentration and the *D. ochrophaeus* model containing concentration, and we found that these imidacloprid predictors had a positive effect on abundance. This relationship may be due to positive effects of imidacloprid treatments for the adjacent forest habitat. Specifically, the purpose of applying imidacloprid is to maintain healthy hemlock trees in the forest surrounding streams, which maintains cool soil and stream conditions (Snyder et al. 2002).

Widespread application of pesticides and herbicides to the global environment has prompted studies which thus far have largely focused on physiological changes or impacts of agricultural pesticides on amphibian populations (Brühl et al. 2011). Substantial anuran declines in agricultural regions of California have been linked to pesticide exposure (Davidson 2004, Sparling et al. 2001). Laboratory studies have shown that common pesticides can be lethally toxic, decrease survival and survival to metamorphosis, and induce sublethal effects such as altered behavior (Brühl et al. 2011, Metts et al. 2005). Exposure to chemical contaminants may cause physiological changes in salamanders for months after exposure (Rohr 2009). Exposure to pesticides and insecticides also induces immune system suppression and may increase susceptibility to infectious diseases (Forson and Storfer 2006, Kerby and Storfer 2009). To our knowledge, this was the first field-based study investigating the effects of imidacloprid treatments on salamanders.

In this study, we were only able to assess the effects of imidacloprid on salamander juveniles for *G. porphyriticus* because of a low sample size for *Desmognathus* larva and because capturing large numbers of *Eurycea* spp. larvae in a few pools caused us to have poorly fitting models. Researching potential impacts on juvenile amphibians is an important avenue for future research on HWA treatments because previous research has shown that larval and subadult amphibians have strong responses to pesticide exposure, likely due to their high surface-to-volume ratio (Brühl et al. 2011). Additionally, studies examining effects of HWA treatments on terrestrial salamanders are needed because terrestrial salamanders are likely exposed to higher levels of imidacloprid due to closer proximity to treated hemlock trees.

The goal of this study was to inform managers of any unintended effects of imidacloprid treatment on adjacent stream salamander populations. Hemlocks are a foundation species and imidacloprid application will be necessary throughout much of the Eastern U.S. until other alternatives to imidacloprid are developed (Ellison 2014, Havill et al. 2014). We did not detect strong relationships between salamander abundances and the four imidacloprid predictors, but we did detect a negative relationship between YST and abundances of *D. ochrophaeus* adults and *G. porphyriticus* larva. We thus encourage managers to use caution when applying imidacloprid near streams or in areas with the potential for imidacloprid to move into a stream. More field-based studies assessing the real-world consequences of HWA treatment are necessary to allow for well-informed forest management decisions. Continuing research on whether sub-lethal effects of imidacloprid can lead to salamander population declines will be essential information for land managers.

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Table 3-1. Model selection results for detection (p) submodels. Detection predictors tested included relative humidity (%), number of cover objects flipped, water temperature (°C; linear and quadratic), air temperature (°C; linear and quadratic), and water depth (linear and quadratic). For all species, we also tested one additive model containing the two predictors with the lowest $QAIC_c$. Model selection was based on Quasi Akaike's Information Criterion corrected for small sample size ($QAIC_c$). The null model (.) only included the intercept.

Model	**Parameters**	**$QAIC_c$**	**$\Delta QAIC_c$**	**w_i**
***D. fuscus* adults**				
Cover Objects + Julian Date	6	670.16	0.00	0.72
Cover Objects	5	673.35	3.19	0.15
Julian Date	5	674.60	4.43	0.08
Air Temperature (L)	5	677.35	7.19	0.02
Air Temperature (Q)	6	677.85	7.69	0.02
Water Depth (L)	5	678.53	8.37	0.01
(.)	4	681.80	11.64	0.00
Water Depth (Q)	6	681.95	11.79	0.00
Water Temperature (L)	5	683.32	13.16	0.00
Relative Humidity	5	684.13	13.97	0.00
Water Temperature (Q)	6	685.37	15.21	0.00
***D. monticola* adults**				
Cover Objects + Relative Humidity	5	414.59	0.00	0.90
Cover Objects	4	418.90	4.31	0.10
Relative Humidity	4	434.84	20.25	0.00
Air Temperature (L)	4	435.06	20.47	0.00
Air Temperature (Q)	5	436.27	21.68	0.00
(.)	3	437.32	22.72	0.00
Julian Date	4	437.98	23.38	0.00
Water Temperature (L)	4	437.98	23.39	0.00
Water Temperature (Q)	5	438.57	23.98	0.00
Water Depth (L)	4	439.66	25.07	0.00
Water Depth (Q)	5	441.14	26.55	0.00
***D. ochrophaeus* adults**				
Julian Date + Water Depth (Q)	7	499.17	0.00	0.96
Julian Date	5	506.77	7.60	0.02
Water Depth (Q)	6	508.23	9.06	0.01
Relative Humidity	5	510.94	11.77	0.00
Water Depth (L)	5	514.76	15.59	0.00
Cover Objects	5	514.96	15.79	0.00

(.)	4	515.27	16.10	0.00
Air Temperature (L)	5	516.87	17.71	0.00
Water Temperature (L)	5	517.60	18.43	0.00
Air Temperature (Q)	6	517.76	18.59	0.00
Water Temperature (Q)	6	519.71	20.54	0.00
***Eurycea* spp. adults**				
Relative Humidity + Julian Date	5	238.93	0.00	0.49
Relative Humidity	4	239.51	0.58	0.37
Julian Date	4	241.34	2.42	0.15
Air Temperature (L)	4	252.34	13.41	0.00
Air Temperature (Q)	5	253.12	14.20	0.00
Water Depth (L)	4	261.08	22.15	0.00
Water Depth (Q)	5	261.83	22.91	0.00
Water Temperature (Q)	5	265.97	27.05	0.00
(.)	3	266.06	27.13	0.00
Water Temperature (L)	4	266.79	27.87	0.00
Cover Objects	4	267.47	28.54	0.00
***G. porphyriticus* larva**				
Cover Objects	4	406.55	0.00	0.24
(.)	3	406.63	0.08	0.23
Cover Objects + Julian Date	5	408.27	1.72	0.10
Julian Date	4	408.70	2.15	0.08
Air Temperature (L)	4	408.92	2.37	0.07
Relative Humidity	4	408.99	2.44	0.07
Water Temperature (L)	4	408.99	2.44	0.07
Water Depth (L)	4	409.00	2.45	0.07
Water Temperature (Q)	5	410.87	4.32	0.03
Air Temperature (Q)	5	411.39	4.84	0.02
Water Depth (Q)	5	411.49	4.94	0.02

Table 3-2. Model selection results for habitat variables submodels. Habitat predictors tested included water total dissolved solids (TDS; ppm), water pH, hemlock basal area per hectare, total canopy cover (%), % of plot covered by boulders or cobble (% rock), and benthic macroinvertebrate biomass. We also tested the predictor % bank leaf cover for *D. ochrophaeus*. For all species, we also tested one additive model containing the two predictors with the lowest $QAIC_c$. Model selection was based on Quasi Akaike's Information Criterion corrected for small sample size ($QAIC_c$). The null model (.) included the most parsimonious detection (p) model.

Model	**Parameters**	**$QAIC_c$**	**$\Delta QAIC_c$**	**w_i**
***D. fuscus* adults**				
% Rock + Biomass	8	645.66	0.00	0.63
% Rock	7	646.72	1.05	0.37
Biomass	7	661.91	16.24	0.00
% Total Canopy	7	664.03	18.37	0.00
TDS	7	666.51	20.85	0.00
(.)	6	670.16	24.50	0.00
Hemlock Basal Area/ha	7	671.91	26.25	0.00
pH	7	671.96	26.30	0.00
***D. monticola* adults**				
pH + Hemlock Basal Area/ha	7	402.11	0.00	0.73
pH	6	404.88	2.77	0.18
Hemlock Basal Area/ha	6	406.56	4.45	0.08
(.)	5	414.59	12.48	0.00
% Total Canopy	6	415.53	13.41	0.00
Biomass	6	416.09	13.98	0.00
% Rock	6	416.98	14.87	0.00
TDS	6	417.18	15.07	0.00
***D. ochrophaeus* adults**				
% Total Canopy	8	497.96	0.00	0.26
% Total Canopy + pH	9	498.28	0.32	0.22
(.)	7	499.14	1.18	0.14
pH	8	499.22	1.26	0.14
TDS	8	500.85	2.89	0.06
% Bank Leaf Cover	8	500.86	2.90	0.06
Biomass	8	501.51	3.55	0.04
% Rock	8	501.68	3.72	0.04
Hemlock Basal Area/ha	8	502.01	4.05	0.03

***Eurycea* spp. adults**				
TDS	6	238.25	0.00	0.54
TDS + pH	7	240.98	2.73	0.14
pH	6	241.52	3.26	0.11
(.)	5	242.12	3.87	0.08
% Total Canopy	6	242.41	4.16	0.07
% Rock	6	244.01	5.76	0.03
Biomass	6	244.67	6.41	0.02
Hemlock Basal Area/ha	6	244.70	6.45	0.02
***G. porphyriticus* larva**				
% Rock + Biomass	6	399.24	0.00	0.49
% Rock	5	400.51	1.27	0.26
Biomass	5	401.23	1.98	0.18
TDS	5	404.33	5.09	0.04
(.)	4	406.55	7.31	0.01
% Total Canopy	5	407.48	8.24	0.01
pH	5	408.28	9.03	0.01
Hemlock Basal Area/ha	5	408.82	9.58	0.00

Table 3-3. Model selection results for imidacloprid predictors. Predictors include imidacloprid concentration in the water (ng/mL; Concentration), number of imidacloprid-treated trees, presence of environmental imidacloprid (Presence), and presence of treated trees (Trees). Model selection was based on Quasi Akaike's Information Criterion corrected for small sample size ($QAIC_c$). The null model included the most parsimonious detection (p) model and the most parsimonious habitat model.

Model	Parameters	$QAIC_c$	$\Delta QAIC_c$	w_i
***D. fuscus* adults**				
Trees × Locality	11	639.54	0.00	0.84
Presence × Locality	11	645.28	5.74	0.05
(.)	8	645.66	6.12	0.04
# Treated Trees	9	646.90	7.36	0.02
Trees	9	647.27	7.73	0.01
Concentration	9	648.25	8.71	0.01
Presence	9	648.30	8.76	0.01
Concentration × Locality	11	648.62	9.07	0.01
# Treated Trees × Locality	11	649.59	10.04	0.00
***D. monticola* adults**				
Trees × Locality	10	400.45	0.00	0.30
Concentration × Locality	10	401.18	0.73	0.21
# Treated Trees × Locality	10	401.49	1.04	0.18
(.)	7	402.11	1.66	0.13
Presence × Locality	10	403.69	3.24	0.06
# Treated Trees	8	404.70	4.25	0.04
Trees	8	404.89	4.44	0.03
Concentration	8	404.90	4.45	0.03
Presence	8	404.93	4.48	0.03
***D. ochrophaeus* adults**				
# Treated Trees × Locality	11	490.46	0.00	0.34
Trees × Locality	11	491.05	0.60	0.25
Presence × Locality	11	491.54	1.08	0.20
Concentration × Locality	11	491.57	1.12	0.19
(.)	8	497.96	7.50	0.01
Concentration	9	498.27	7.81	0.01
Trees	9	498.98	8.52	0.00
Presence	9	499.69	9.24	0.00
# Treated Trees	9	499.78	9.32	0.00
***Eurycea* spp. adults**				
(.)	6	238.25	0.00	0.36
Presence	7	239.58	1.33	0.19

Concentration	7	240.22	1.97	0.13
# Treated Trees	7	240.64	2.39	0.11
Trees	7	240.74	2.48	0.10
Concentration × Locality	9	242.11	3.86	0.05
Trees × Locality	9	243.47	5.22	0.03
Presence × Locality	9	243.91	5.66	0.02
# Treated Trees × Locality	9	246.39	8.14	0.01
***G. porphyriticus* larva**				
(.)	6	399.24	0.00	0.29
Presence	7	399.25	0.01	0.29
Concentration	7	400.10	0.85	0.19
# Trees Treated	7	401.79	2.54	0.08
Trees	7	401.90	2.66	0.08
Presence × Locality	9	403.69	4.44	0.03
Concentration × Locality	9	404.65	5.41	0.02
# Treated Trees × Locality	9	406.43	7.18	0.01
Trees × Locality	9	406.77	7.52	0.01

Table 3-4. Parameter estimate (β) and standard errors (SE) for imidacloprid predictors. Predictors include imidacloprid concentration in the water (ng/mL; Concentration), number of imidacloprid-treated trees, presence of environmental imidacloprid (Presence), and presence of treated trees (Trees).

Imidacloprid Predictor	β	SE	95% CI
***D. fuscus* adults**			
Concentration	0.050	0.065	(-0.077, 0.178)
# Treated Trees	-0.104	0.078	(-0.257, 0.049)
Presence	0.130	0.188	(-0.238, 0.498)
Trees	-0.210	0.161	(-0.525, 0.104)
***D. monticola* adults**			
Concentration	0.049	0.097	(-0.140, 0.289)
# Treated Trees	-0.096	0.127	(-0.346, 0.153)
Presence	-0.065	0.160	(-0.379, 0.249)
Trees	-0.081	0.157	(-0.389, 0.227)
***D. ochrophaeus* adults**			
Concentration	0.146	0.065	(0.018, 0.273)
# Treated Trees	-0.401	0.300	(-0.990, 0.187)
Presence	-0.258	0.176	(-0.603, 0.087)
Trees	-0.285	0.158	(-0.595, 0.025)
***Eurycea* spp. adults**			
Concentration	-0.153	0.137	(-0.420, 0.115)
# Treated Trees	0.078	0.081	(-0.082 0.237)
Presence	0.410	0.242	(-0.064, 0.885)
Trees	0.158	0.208	(-0.250, 0.565)
***G. porphyriticus* larva**			
Concentration	0.151	0.072	(0.011, 0.291)
# Treated Trees	-0.057	0.097	(-0.247, 0.134)
Presence	0.470	0.220	(0.039, 0.900)
Trees	-0.074	0.179	(-0.425, 0.276)

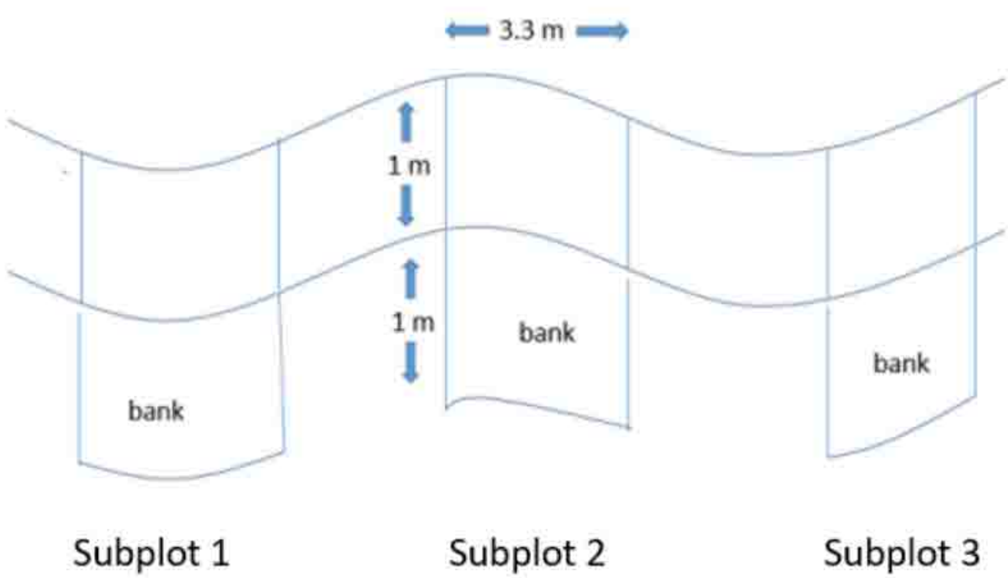
Table 3-5. Model selection results for years since imidacloprid treatment (YST). Model selection was based on Quasi Akaike's Information Criterion corrected for small sample size ($QAIC_c$). The null model included the most parsimonious detection (p) model and the most parsimonious habitat model.

Model	Parameters	$QAIC_c$	$\Delta QAIC_c$	w_i
***D. fuscus* adults**				
(.)	8	189.25	0.00	0.90
YST	9	193.59	4.34	0.10
YST × Locality	11	204.27	15.02	0.00
YST × # Treated Trees	11	204.47	15.22	0.00
***D. monticola* adults**				
(.)	7	219.36	0.00	0.88
YST	8	223.29	3.93	0.12
YST × # Treated Trees	10	232.59	13.23	0.00
YST × Locality	10	233.04	13.68	0.00
***D. ochrophaeus* adults**				
(.)	8	230.43	0.00	0.49
YST	9	230.72	0.30	0.42
YST × Locality	11	233.87	3.45	0.09
YST × # Treated Trees	11	241.28	10.85	0.00
***Eurycea* spp. adults**				
(.)	6	209.45	0.00	0.77
YST	7	211.97	2.52	0.22
YST × # Treated Trees	9	218.77	9.32	0.01
YST × Locality	9	220.65	11.20	0.00
***G. porphyriticus* larva**				
YST	7	256.51	0.00	0.53
(.)	6	256.79	0.28	0.46
YST × # Treated Trees	9	264.93	8.41	0.01
YST × Locality	9	265.00	8.49	0.01

Table 3-6. Parameter estimate (β) and standard errors (SE) for years since imidacloprid treatment (YST) for each species.

Species	**β**	**SE**	**95% CI**
D. fuscus adults	-0.098	0.126	(-0.344, 0.149)
D. monticola adults	-0.074	0.116	(-0.301, 0.153)
D. ochrophaeus adults	-1.160	0.467	(-2.078, -0.248)
Eurycea spp. adults	0.204	0.163	(-0.116, 0.523)
G. porphyriticus larva	-0.334	0.131	(-0.591, -0.078)

Appendix 3-1. Salamander sampling subplot layout. Each site had three 3.3 x 2 m subplots with 1 m of the width on the bank and 1 m of the width in the stream channel.



Appendix 3-2. Summary of means ± SE for multiple measures of stream habitat for sites without environmental imidacloprid (absent; n = 14) and with environmental imidacloprid (present; n=34). We defined sites as having environmental imidacloprid if imidacloprid or its metabolites were detected in the water or sediment, or if the stream was adjacent to HWA treatments.

	Absent	**Present**
Water Temp (°C)	14.71 ± 0.57	14.25 ± 0.21
Water pH	6.9 ± 0.17	6.9 ± 0.08
Water Conductivity (ng/mL)	62730 ± 23000	46760 ± 10110
Water TDS (ng/mL)	31520 ± 12330	23050 ± 5080
Bank Leaf Cover (%)	32.88 ± 5.71	32.65 ± 3.48
Water Depth (cm)	7.68 ± 1.79	5.77 ± 0.66
Wetted Stream Width (cm)	123.24 ± 14.07	133.34 ± 12.98
Stream Gradient (°)	8.12 ± 1.30	6.75 ± 0.66
Total Canopy Cover (%)	49.79 ± 9.07	58.94 ± 6.11
Stream Substrate (%)		
Sand	14.79 ± 3.85	16.82 ± 2.68
Gravel	12.67 ± 2.85	14.2 ± 2.19
Cobble	33.24 ± 4.86	30.1 ± 4.05
Boulder	8.98 ± 2.69	16.67 ± 3.4
Bedrock	3.57 ± 2.38	0.87 ± 0.53
Pebble	8.26 ± 1.79	7.35 ± 1.37
Silt	12.05 ± 4.29	7.38 ± 1.82
Detritus	5.26 ± 1.81	4.76 ± 1.01
Hemlock basal area (m^2/ha)	61.46 ± 13.49	86.94 ± 11.24
Biomass (g)	227.29 ± 43.21	201.22 ± 33.82

Appendix 3-3. Mean number of salamanders (± SE) captured across sites and surveys in either the Monongahela National Forest (MNF) or two units of the National Park Service (NPS). Absent = environmental imidacloprid absent; present = environmental imidacloprid present.

	MNF		NPS	
	Absent	Present	Absent	Present
D. fuscus				
adult	0.28 ± 0.15	1.29 ± 0.34	1.75 ± 0.75	1.53 ± 0.45
juvenile	0.02 ± 0.02	0.01 ± 0.01	0.14 ± 0.12	0.10 ± 0.09
D. monticola				
adult	2.25 ± 0.58	2.10 ± 0.46	1.17 ± 0.28	1.10 ± 0.36
juvenile	0.13 ± 0.11	0.20 ± 0.15	0.11 ± 0.09	0.2 ± 0.13
D. ochrophaeus				
adult	1.42 ± 0.60	1.24 ± 0.54	0.28 ± 0.18	0.55 ± 0.19
juvenile	0.00 ± 0.00	0.08 ± 0.08	0.00 ± 0.00	0.02 ± 0.02
Desmognathus spp.				
adult	0.14 ± 0.14	0.27 ± 0.17	0.89 ± 0.39	0.59 ± 0.28
juvenile	0.04 ± 0.04	0.04 ± 0.04	0.19 ± 0.15	0.25 ± 0.17
Eurycea spp.				
adult	0.22 ± 0.16	0.32 ± 0.21	0.64 ± 0.34	0.56 ± 0.33
juvenile	0.21 ± 0.17	0.70 ± 0.65	6.11 ± 2.49	2.68 ± 0.99
G. porphyriticus				
adult	0.00 ± 0.00	0.10 ± 0.06	0.00 ± 0.00	0.00 ± 0.00
juvenile	0.64 ± 0.25	0.81 ± 0.31	0.56 ± 0.21	1.06 ± 0.41
Total captures				
adult	4.26 ± 0.88	4.84 ± 0.95	4.72 ± 1.11	4.31 ± 1.01
juvenile	1.04 ± 0.40	1.84 ± 0.94	7.11 ± 2.58	4.07 ± 1.15

CHAPTER 4: BENTHIC MACROINVERTEBRATE COMMUNITY RESPONSES TO IMIDACLOPRID EXPOSURE

ABSTRACT

Hemlock woolly adelgid is an invasive insect that is causing widespread declines in eastern hemlock (*Tsuga canadensis*). Currently, the most effective method of preventing hemlock loss is application of imidacloprid, a neonicotinoid insecticide. Concerns have been raised about the negative effects of imidacloprid application on non-target insects. Imidacloprid exposure can inhibit feeding and foraging, cause immobility, and lead to declines in emergence in benthic macroinvertebrates. In this study, we assessed the effects of imidacloprid application to benthic macroinvertebrate communities in adjacent streams. We sampled benthic macroinvertebrates in 48 headwater streams in the Monongahela National Forest (MNF) and two National Park Service (NPS) units, New River Gorge National River and Gauley River National Recreation Area, in West Virginia, 27 of which were directly adjacent to or downstream of imidacloprid applications. We calculated seven metrics of biotic integrity, including GLIMPSS, WVSCI, and biomass, and compared them to four measures of imidacloprid exposure. We found negative relationships between treated streams and community metrics at MNF sites, but not NPS sites, indicating that responses to imidacloprid exposure may vary by geographic region due to other past or current environmental factors. We also completed a community functional traits analysis and compared the traits to presence of imidacloprid in the environment and presence of treated trees. Functional traits did not differ between sites with and without environmental imidacloprid or treated trees, but variation in functional traits did differ in MNF. We conclude that application of imidacloprid appears to be negatively affecting benthic macroinvertebrate community composition in the MNF, but impacts are not strong in the NPS units.

1. INTRODUCTION

Eastern hemlock (*Tsuga canadensis*) is a late-successional and ecologically important species that provides critical habitat for diverse taxa such as birds, mammals, herpetofauna, and fish (Becker et al. 2008, Ellison 2014, Snyder et al. 2002, Tingley et al. 2002). Hemlocks typically grow near headwater streams and influence stream characteristics such as temperature, nutrient cycling, and the biotic communities within the streams (Ellison et al. 2010, Havill et al. 2014). Hemlock-dominated stands produce deep shade and slowly-decomposing litter, creating damp and cool microclimates (Mathewson 2009). These characteristics enable aquatic macroinvertebrate species that are intolerant of seasonal drying to persist in streams within hemlock forests, resulting in high macroinvertebrate diversity (Snyder et al. 2002). Several macroinvertebrate taxa show strong associations with hemlock forests (Snyder et al. 2002). However, hemlock populations are declining due to infestations by the invasive hemlock woolly adelgid (HWA; *Adelges tsugae*), which causes mortality in both eastern hemlock and the less widely distributed Carolina Hemlock (*T. caroliniana*) (Havill et al. 2014, Ward et al. 2004).

Treatment with the neonicotinic insecticide imidacloprid is one of the most commonly used and effective methods to manage HWA infestations (Webb et al. 2003), but it can leach from HWA treatment areas into adjacent stream systems (Benton et al. 2016, Churchel et al. 2011, Wiggins et al. 2018). Several characteristics of imidacloprid make it more susceptible to leaching than many other pesticides. Its high solubility in water allows for leaching into groundwater and streams (US EPA 2003), while its low volatility and a low soil adsorption coefficient makes it highly mobile in soil with low organic matter (Ding et al. 2011, Liu et al. 2002). These characteristics, in conjunction with the general proximity of hemlock forests to riparian areas, increase the risk of imidacloprid leaching into stream systems (Ding et al. 2011). Although imidacloprid begins to break down quickly in surface water when exposed to sunlight, continual leaching into stream systems may maintain imidacloprid presence in stream systems near treated hemlocks (Benton et al. 2016, Wamhoff and Schneider 1999).

Numerous laboratory and mesocosm studies have demonstrated both sub-lethal and lethal impacts of imidacloprid on benthic macroinvertebrates. Imidacloprid can inhibit feeding and foraging behavior (Alexander et al. 2007, Kreutzweiser et al. 2008), cause immobility (Alexander et al. 2007), and prompt downstream drift, which is a reaction to environmental disturbances in which stressors such as toxicants cause invertebrates to become dislodged and move downstream (Beketov and Liess 2008, Berghahn et al. 2012). Pulses of low concentrations of imidacloprid led to decreases in survival and emergence of Ephemeroptera, Tanypodinae, and Orthocladiinae, and an increase in the survival of *Radix* spp., which is a non-sensitive genus of snail (Columbo et al. 2013). Pulses of imidacloprid simulating runoff during rain events caused significant declines in benthic macroinvertebrate abundances and community diversity (Pestana et al. 2009).

While laboratory studies have clearly shown that exposure to imidacloprid impacts benthic macroinvertebrates, previous field studies have found that effects are not always strong in real-world systems. In an agricultural system in the Netherlands, concentration of imidacloprid in surface water was strongly negatively correlated with abundance of aquatic macroinvertebrates (Van Dijk et al. 2013). In contrast, macroinvertebrate functional feeding group richness and life habit (i.e. burrower, clinger) richness did not differ between control streams and streams with known imidacloprid presence from HWA treatments in Great Smoky Mountains National Park (Benton et al. 2017). Similarly, benthic macroinvertebrate communities in streams adjacent to HWA treatments in Georgia and North Carolina did not respond negatively to imidacloprid exposure, however, imidacloprid was only detected in one study stream over the course of the study (Churchel et al. 2011).

The purpose of our study was to investigate whether HWA treatments using imidacloprid are adversely affecting benthic macroinvertebrate communities in adjacent headwater streams. To accomplish this goal, our objectives included: 1) quantify the concentration of imidacloprid and its metabolites, imidacloprid-urea and imidacloprid-olefin in the water and identify presence of imidacloprid and metabolites in sediment of streams near HWA treatments, and compare four measures of imidacloprid exposure to: 2) metrics of benthic macroinvertebrate abundance, diversity, and biomass, and 3) benthic macroinvertebrate traits and functional groups.

2. METHODS

2.1 Study Sites

This study was conducted in the Monongahela National Forest (MNF) and two units of the National Park Service (NPS): Gauley River National Recreational Area (GARI) and New River Gorge National River (NERI) in West Virginia, USA (Fig. 4-1). Hemlock stands in the MNF were treated with a single application of imidacloprid in 2014 or 2015. Hemlock stand treatments in NPS units began in 2006 and have continued annually, including multiple applications (1–7 times) at 10 of the sampling locations (Appendix 2-1). We did not select NPS treatment sites if the last treatment occurred prior to 2011.

We used ArcGIS 10.4 (ESRI 2016) to identify candidate streams based on proximity to HWA treatments. We visited candidate streams to determine whether the stream depth, stream substrate, and water flow speeds were suitable for sampling benthic macroinvertebrates. We made our final study site selections based on the suitability of the streams for sampling, the proximity of treated trees, or the absence of treatments for non-impacted sites. The average site adjacent to HWA treatments had 268.7 ± 148.9 occurrences of imidacloprid applications (range = 5–3927 applications), with applications representing individual tree treatments.

We sampled 1^{st}- and 2^{nd}-order headwater streams for benthic macroinvertebrates in 24 sites in MNF, 14 sites in NERI, and ten sites in GARI. Of these 48 sites, 27 were directly adjacent to HWA treatments and 21 were not adjacent to HWA treatments. Sites that were not adjacent to HWA treatments were either a minimum of 100 m upstream of imidacloprid application or were in a watershed without known HWA treatments. We selected 100 m as a minimum distance because Benton et al. (2016) did not detect imidacloprid in stream sites that were 10–100 m upstream of HWA treatments. For all analyses, however, we excluded one sampled site in GARI that was an extreme outlier for its imidacloprid concentration and the number of invertebrates collected. This stream was an ephemeral, drying stream with only 1 pool of water available by the time sampling occurred. Only 1 macroinvertebrate was collected, and the site had the highest imidacloprid concentration (489.6 ng/mL in the water).

2.2 Water and Sediment Sampling and Imidacloprid Extraction and Quantification

See chapter 2, sections 2.2 and 2.3 for water and sediment sampling, imidacloprid extraction, and imidacloprid quantification methods.

2.3 Benthic macroinvertebrate sampling

During May–June 2017 and May–July 2018, we sampled macroinvertebrates at three 0.3 x 2 m subplots within each stream site so that total area sampled per stream was 0.3 x 6 m. Because this study was concurrent with a study on stream salamanders, we collected samples adjacent to the salamander sampling plots (see chapter 3, section 2.3). We collected the samples in riffles when available (n=128 subplots). When riffles were not present on sampling plots, we collected samples in runs (n=12) or pools (n=1). We collected invertebrates by placing a 0.3 m wide D-net flush with the bottom of the stream and disturbing the substrate upstream of the D-net for 30 seconds. We only conducted sampling in base flow conditions. We composited the three samples from each stream site into one sample and stored the invertebrates in 75% ethanol until identification.

All invertebrates were identified by a certified taxonomist to the lowest possible taxonomic level, except for Chironomidae, which were identified as either Tanypodinae or non-Tanypodinae due to the high diversity of Chironomidae in WV (over 100 genera) and difficulty of identification to the genus level (Pond et al. 2011). All organisms in each sample were counted and body length of each was measured to the nearest mm using a millimeter grid placed underneath a Zeiss dissecting microscope (Carl Zeiss Microscope, Thornwood, New York). We estimated macroinvertebrate biomass by using the length of each individual and length-weight equations published in the literature (e.g. Benke et al. 1990; Sabo et al. 2002) and summed the biomass estimates to obtain total estimated biomass for each site.

2.4 Benthic macroinvertebrate response metrics

We calculated two assemblage-level multi-metric indices (MMI) to evaluate stream impairment status, GLIMPSS (CF) (genus level index of most probable stream status) and WVSCI (West Virginia Stream Condition Index). GLIMPSS (CF) is a variation of GLIMPSS that does not require genus-level identification of Chironomidae (Pond et al. 2011). GLIMPSS is calibrated by season and region and assigns metric values to each stream on a 100-point scale and then averages the scores to create the GLIMPSS score. If a sample was collected before June 1 of each year, we used the "mountain spring calculator", and if a sample was collected after June 1 of each year, we used the "mountain summer calculator" (Pond et al. 2011). We used slightly modified sampling methods (i.e. full sample processing and sampling a 0.3 x 6 m area) for calculating GLIMPSS, and therefore the GLIMPSS values in this study are not useable for their original purpose of identifying reference and stressed streams relative to all streams in WV. However, the GLIMPSS values are valid for comparing the sites in this study among each other. It is impossible to directly compare GLIMPSS scores across different seasons or regions, so we calculated a "percent of threshold" value for each sample by dividing the GLIMPPS score by the

5^{th} percentile for that region and multiplying by 100. The 5^{th} percentile for the mountain spring sites was 53 and the 5^{th} percentile for the mountain summer sites was 55. When comparing to the 5^{th} percentile of the reference distribution, streams with a percent of threshold value of >100% are considered to be unimpaired and streams with a percent of threshold value of <100% are considered to be impaired (Pond et al. 2011). WVSCI is a family-level MMI that is not stratified by season or region (Gerristen et al. 2000). It is calculated from six metrics: total number of families, number of Ephemeroptera + Plecoptera + Trichoptera (EPT) families, family-level Hilsenhoff Biotic Index (HBI), % 2 dominant families, and % Chironomidae individuals to give streams scores from 0 – 100 (Gerristen et al. 2000).

In addition to GLIMPSS and WVSCI, we assessed total benthic macroinvertebrate biomass and four individual indices of biotic integrity that are used to calculate GLIMPSS values. These variables were genus richness, percentage of taxa which are EPT taxa (% EPT), percent of taxa which are Chironomidae and Annelida (% Chironomidae and Annelida), and percent of genera which are of the five most dominant genera (%5 Dominant Genera). We predicted that GLIMPSS, WVSCI, and biomass would be lower in streams with imidacloprid presence. We also predicted that genus richness and percentage of taxa which are EPT taxa would be lower with imidacloprid presence, and that percentage of taxa which are Chironomidae and Annelida and percent of genera which are of the five most dominant genera would increase with imidacloprid presence.

2.5 Statistical Analysis

Prior to assessing responses of macroinvertebrate community metrics to imidacloprid exposure, we determined if there was strong geographic variation in site-level community composition, independent of imidacloprid application. We used non-metric multidimensional scaling (NMDS) to determine if site-level community composition varied among our study areas (i.e., MNF, NERI, and GARI). We also used permutational analysis of variance (perMANOVA) to test the null hypothesis that there were not significant differences in site-level community composition between study areas (Anderson 2001). The NMDS showed a strong geographic split between MNF and the two NPS localities (NERI and GARI) and perMANOVA detected significant differences in community composition between the MNF and NPS sites (Appendix 4-1). Thus, we included locality (MNF or NPS) as a predictor in all models containing predictors of imidacloprid exposure. We conducted the NMDS using the package vegan (Oksanen 2019; version 2.5 – 5) in program R (R Core Team 2019; version 3.4.1).

We used linear regressions or beta regressions and a model selection approach using Akaike's Information Criterion corrected for small sample size (AIC_c) to assess responses of the seven community metrics to imidacloprid exposure (Burnham et al. 2011, Zuur et al. 2009). We used beta regressions for the metrics that represented percentages (transformed to proportions; Ferrari and Cribari-Neto 2004). We visually assessed assumptions of normality and heteroscedasticity using graphical diagnostics (Cribari-Neto and Zeileis 2010, Zuur et al. 2010). We square root transformed total biomass to satisfy the assumption of normality. For the % EPT analysis, we removed three sites that represented proportions of 0 or 1 to facilitate model convergence. We created linear regressions using the generalized least squares (GLS) function and a constant variance structure in the package nlme (Pinheiro et al. 2016; version 3.1 – 137). We created beta regressions using the package betareg (Zeileis and Cribari-Neto 2018; version 3.1 – 2).

For each model selection, candidate models included an intercept-only (null) model, locality, and four predictors of imidacloprid exposure in our analyses: imidacloprid water concentration (ng/mL), number of imidacloprid-treated trees, presence/absence of treated trees, and presence/absence of environmental imidacloprid (Table 4-1). The number of imidacloprid-treated trees represented the total number of trees treated at a site. Hemlock trees that were treated multiple years were counted as multiple trees (i.e. a tree that was treated for two years was counted as two trees to better represent treatment intensity). We defined presence of environmental imidacloprid as imidacloprid being detected in the stream water or sediment, imidacloprid metabolites being detected in the stream water or sediment, or treated trees being present. For each imidacloprid exposure predictor, we included models containing additive and interactive effects with locality. We used ΔAIC_c and Akaike weight (w_i) to assess model support, and considered candidate models to have support when $\Delta AIC_c < 7$.

Finally, we assessed how imidacloprid in the environment relates to the prevalence of functional traits (e.g., feeding group, respiration type) within the macroinvertebrate communities. Functional traits analyses investigate changes in function across a community rather than only changes in taxa (Poff et al. 2006, Cummins 2016). We assigned 20 functional traits to each taxon using Poff et al. (2006), the EPA database (U.S. EPA 2012) when appropriate, or the next most similar known taxa (Appendix 4-2). We used NMDS and the Jaccard distance metric to compare functional groups between sites with and without environmental imidacloprid exposure, and between sites with and without treated trees (Legendre and Legendre 2012). We used permutational analysis of variance (perMANOVA) to test the null hypothesis that there were not significant differences in functional traits between groups (Anderson 2001). We also assessed differences in group variance using a multivariate homogeneity of groups dispersions test (Anderson 2006). We conducted the functional traits analyses using the package vegan in program R.

3. RESULTS

3.1 Water and Sediment Imidacloprid Concentration

Imidacloprid was detected in the stream water at 24 sites (Appendix 4-3). Excluding the one outlier site described in section 1.1, stream water had a mean concentration of 15.03 ± 4.02 ng/mL (range = 6.52 – 121.43 ng/mL). Imidacloprid-urea was not detected in the stream water at any site. We detected imidacloprid-olefin in the water at two sites, and we detected imidacloprid in the water at both sites with detectable levels of imidacloprid-olefin. Imidacloprid was detected in sediment at seven sites, four of which were adjacent to HWA treatments, and two of which had no imidacloprid detected in water (Appendix 2-1). We did not detect imidacloprid-olefin or imidacloprid-urea in the sediment at any site. Of the 47 sites used for analyses, we classified 33 sites as present and 14 sites as absent for environmental imidacloprid (Appendix 4-3).

3.2 Community Metrics

We collected 8764 benthic macroinvertebrates in this study, 7999 of which were identified to genus. Mean invertebrate abundance per site was 186.4±24.4 and abundances per site ranged from 6 to 842 individuals.

The most parsimonious models for GLIMPSS and WVSCI included an interaction between locality and presence of environmental imidacloprid, and the second most supported model for biomass contained an interaction between locality and presence of environmental imidacloprid (Table 4-1). An additive model containing presence of treated trees was the second most supported model for genus richness. Additionally, there was support for all four imidacloprid predictors for % EPT, % Chironomidae + Annelida, and % 5 Dominant Genera. For

% EPT, % Chironomidae + Annelida, and % 5 Dominant Genera, the null models and models containing only locality were the most supported models.

The directional effects of presence of environmental imidacloprid differed depending on locality (MNF or NPS) in all three models containing an interaction term (Table 4-2). GLIMPSS score, WVSCI score, and biomass were lower at sites with environmental imidacloprid in MNF and higher at sites with environmental imidacloprid in NPS (Fig. 4-2). Confidence intervals (95% CI) for model predicted values mostly did not overlap for GLIMPSS, WVSCI, or biomass in presence/absence MNF sites, but CIs overlapped for GLIMPSS and WVSCI in the NPS sites. Genus richness was negatively associated with presence of treated trees, but the CI overlapped 0 (Table 4-2). Percent 5 dominant genera was negatively associated with presence of environmental imidacloprid, but the CI overlapped 0 (Table 4-2).

For presence/absence of environmental imidacloprid, a jaccard-based NMDS of MNF sites (stress = 0.0183) did not result in significantly different groups based on functional traits (p = 0.93), however, the difference in variation between sites with and without environmental imidacloprid was significant ($p < 0.05$). A jaccard-based NMDS of NPS sites (stress = 0.0231) also did not result in significantly different groups (p = 0.31) but the difference in variation between sites with and without environmental imidacloprid was non-significant (p = 0.55; Fig. 4-3).

For presence/absence of treated trees, a jaccard-based NMDS of MNF sites (stress = 0.0183) did not result in significantly different groups based on functional traits (p = 0.93), and the difference in variation between sites with and without treated trees was not significant (p = 0.74). A jaccard-based NMDS of NPS sites (stress = 0.0231) also did not result in significantly different groups (p = 0.74) and the difference in variation between sites with and without treated trees was non-significant (p = 0.37; Fig. 4-4).

4. DISCUSSION

The presence of environmental imidacloprid was an influential predictor of several indices of biotic integrity. We hypothesized that GLIMPSS, WVSCI, and biomass would be lower in sites with environmental imidacloprid, but this was only true for sites within MNF. In NPS, they were higher in streams with environmental imidacloprid. Thus, imidacloprid exposure appeared to have a negative impact on benthic macroinvertebrate communities in MNF, but not NPS, sites.

There may be intrinsic differences in imidacloprid treatments or sites between MNF and NPS that we did not account for in this study that influenced the differences in community responses. For example, historical land uses continue to impact the abiotic and biotic environment in the Appalachian region (e.g. McTammany et al. 2007) and historical land use may be more influential than current land use on benthic macroinvertebrate diversity (Harding et al. 1998, Maloney et al. 2008). Differences in historical land disturbances between MNF and NPS may have contributed to the different responses to imidacloprid exposure. During the early 20th century, MNF was widely logged and clearcut while the NPS units were logged, mined, and disturbed by railroads (Good and Stasick 2008, Shands 1991). Mining can have strong and long-lasting effects on benthic communities (Pond et al. 2014). Additionally, most MNF sites were treated with imidacloprid more recently than NPS sites, which also could have influenced the results. Imidacloprid concentrations are at their highest soon after treatment and during rain events (Churchel et al. 2011). It is possible that larger effects on invertebrate communities can be detected after precipitation washes high imidacloprid concentrations into streams. The assumption that additional external factors influenced responses at NPS sites is supported by the wide CI for every community metric (see Fig. 4-2), indicating there was a large amount of variance at these sites that our models did not explain.

We calculated both GLIMPSS and WVSCI to assess whether genus-level identification was necessary to detect changes in community composition. GLIMPSS and WVSCI had the same directional responses to presence of environmental imidacloprid and similar response magnitudes. Future studies assessing effects of HWA treatments in WV may be able to save resources by identifying samples only to family without decreasing the ability to detect changes.

We did not detect a difference in community composition based on functional traits between sites with/without environmental imidacloprid or treated trees, but we did detect a difference in variation between sites with and without environmental imidacloprid in MNF. Variance increased in sites with environmental imidacloprid, indicating an increase in variation of which functional traits were present at each site. Increased variation may indicate the imidacloprid exposure is selectively removing certain traits from the communities (Eliason

2017). Further analyses are warranted investigating which functional traits or combinations of traits are more affected by imidacloprid treatments.

Although laboratory and mesocosm studies have documented sublethal and lethal effects of imidacloprid on benthic macroinvertebrates (Alexander et al. 2007, Beketov and Liess 2008, Berghahn et al. 2012, Kreutzweiser et al. 2008, Kreutzweiser et al. 2009), few previous studies have sampled streams adjacent to HWA treatments or sampled surface waters otherwise contaminated with imidacloprid. Although two previous studies found no effect on benthic communities (Benton et al. 2017, Churchel et al. 2011), our study did find a negative effect on the MNF. In addition, we did not assess crayfish populations in this study, but crayfish also are an important part of riparian trophic webs (Paul and Simonin 2006), and we encourage future research on effects of HWA treatments on crayfish. Continued research into community impacts of imidacloprid on stream arthropods is warranted given their importance as prey for many taxa.

Imidacloprid is being applied widely on public and private lands and continual imidacloprid application in forest systems will be needed to maintain ecosystem integrity until acceptable alternatives to pesticides treatment are developed (Havill et al. 2014). The wide-spread usage of neonicotinoids such as imidacloprid has raised concerns in recent years because of documented non-target impacts to diverse taxa (e.g. Gibbons et al. 2015, Hallman et al. 2014). The primary goal of our study was to assess the effects of imidacloprid application on benthic macroinvertebrate communities. We detected negative effects of imidacloprid exposure on multiple community metrics and differences in functional traits variation in MNF and conclude that the effects of imidacloprid on community metrics is occurring but may be variable depending on location and historical land uses. We encourage managers to use caution when applying imidacloprid to forest systems, especially when risk of leaching into streams is high.

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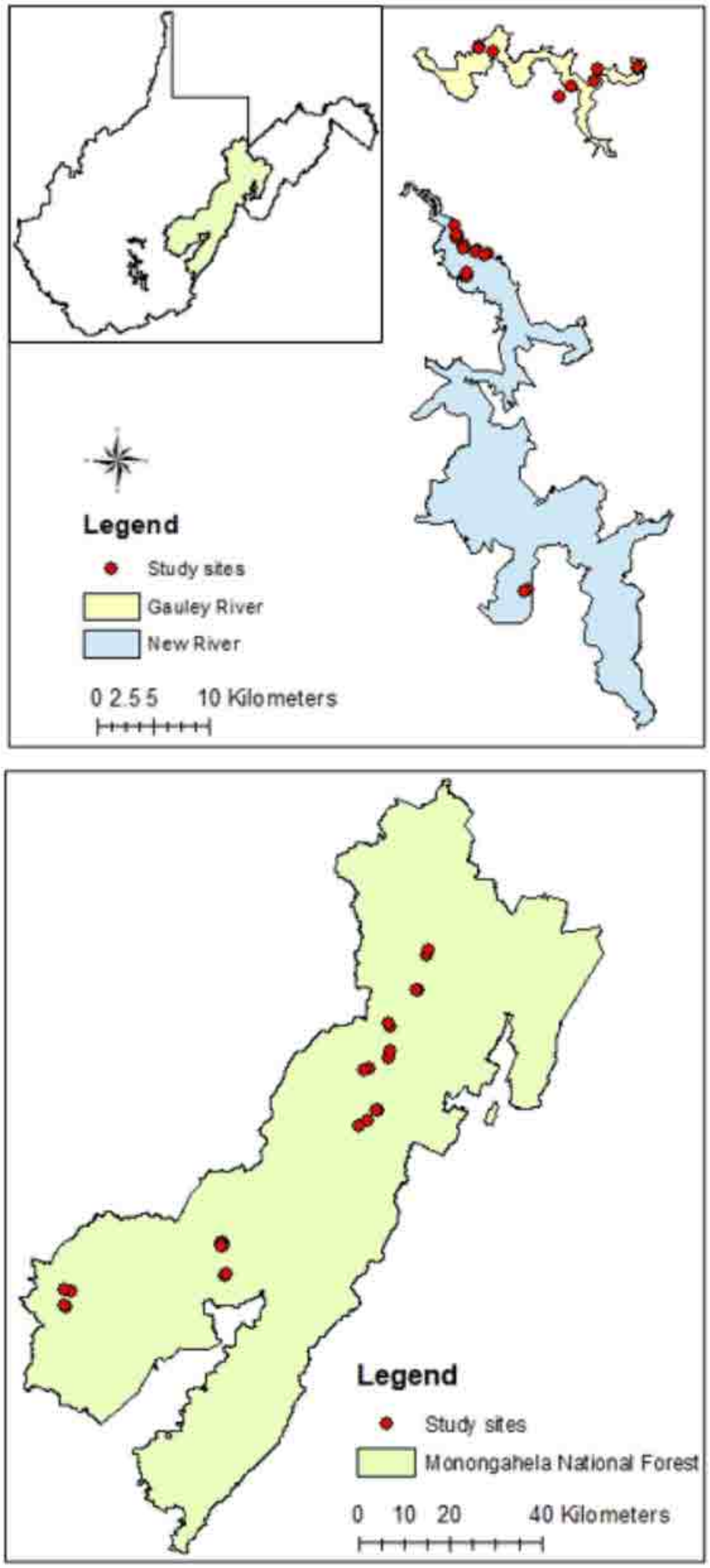


Figure 4-1. Locations of sampled streams within the Monongahela National Forest, New River Gorge National River, and Gauley River National Recreation Area. West Virginia (inset), USA.

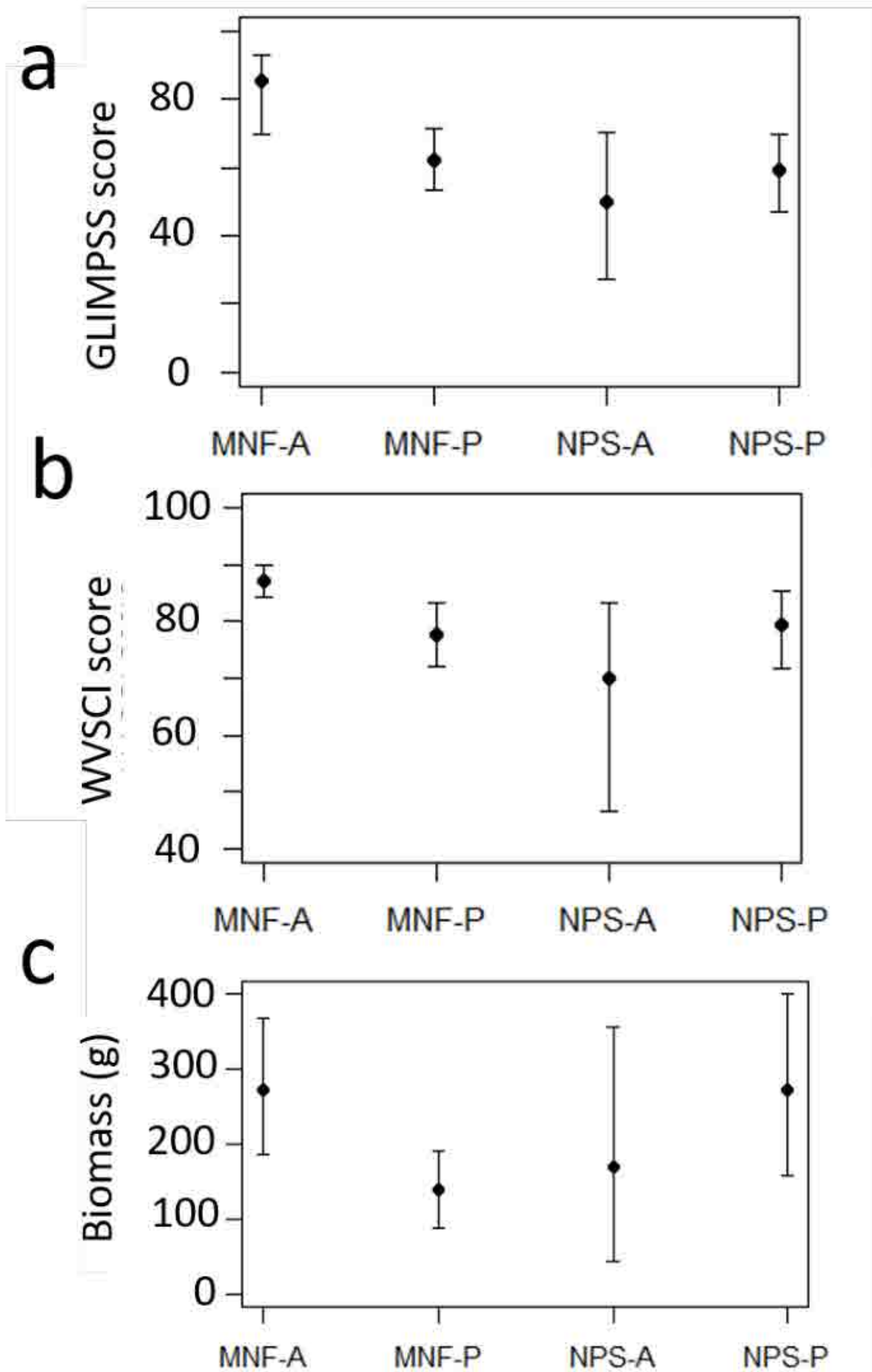


Figure 4-2. Model-estimated predictions and 95% confidence intervals (CI) for (a) GLIMPSS, (b) WVSCI, and (c) total biomass. Predictions shown are for sites in the Monongahela National Forest without imidacloprid exposure (MNF-A; n = 8) and with imidacloprid exposure (MNF-P; n = 16) and for National Park Service sites without imidacloprid exposure (NPS-A; n = 6) and with imidacloprid exposure (NPS-P; n = 17).

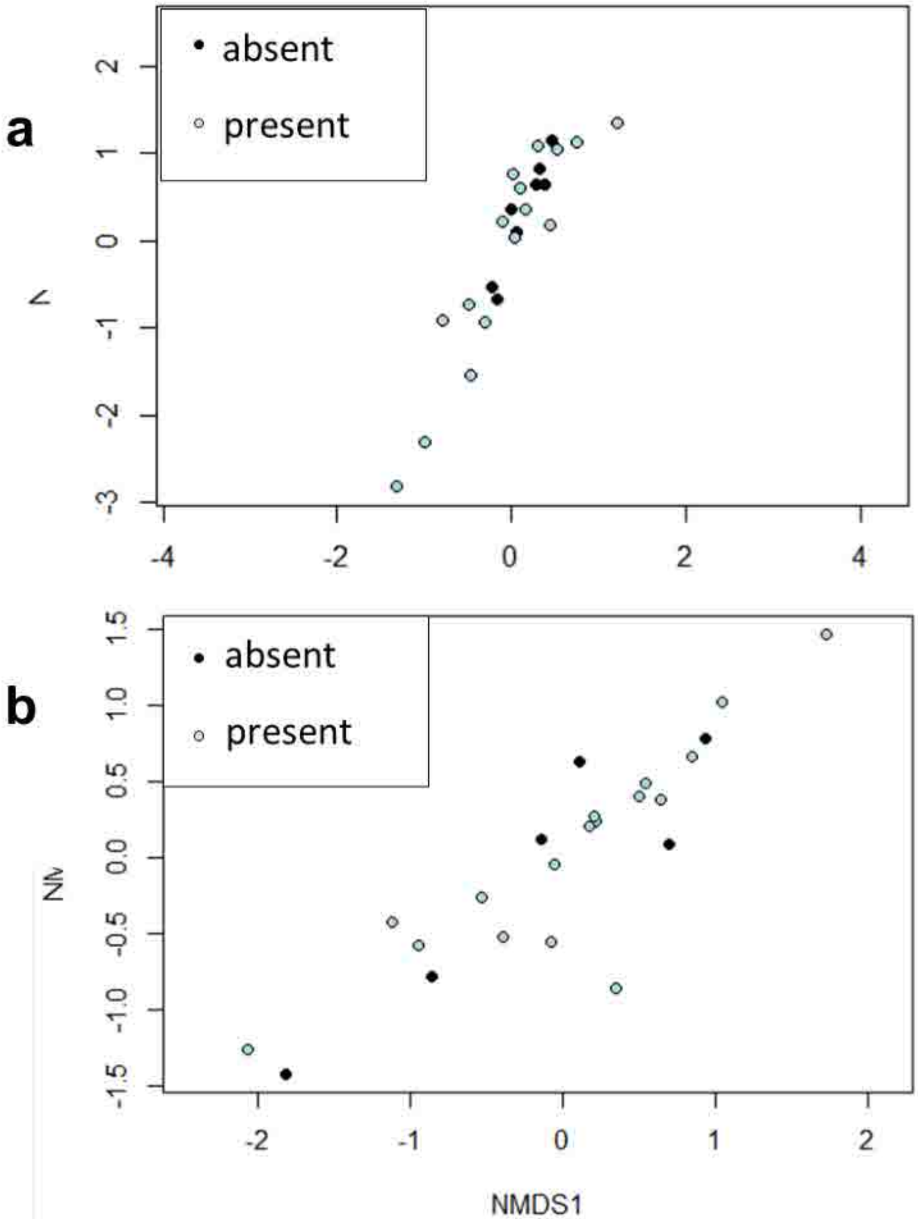


Figure 4-3. Non-metric multidimensional scaling (NMDS) plot showing differences in functional traits between sites exposed to environmental imidacloprid (present) and not exposed to environmental imidacloprid (absent) in the Monongahela National Forest (a) and two units of NPS in West Virginia (b). The presence and absence groups were not significantly different in MNF ($p = 0.93$) or NPS ($p = 0.31$). Variation was significantly different between groups in MNF ($p < 0.05$) but was not different between groups in NPS ($p = 0.55$).

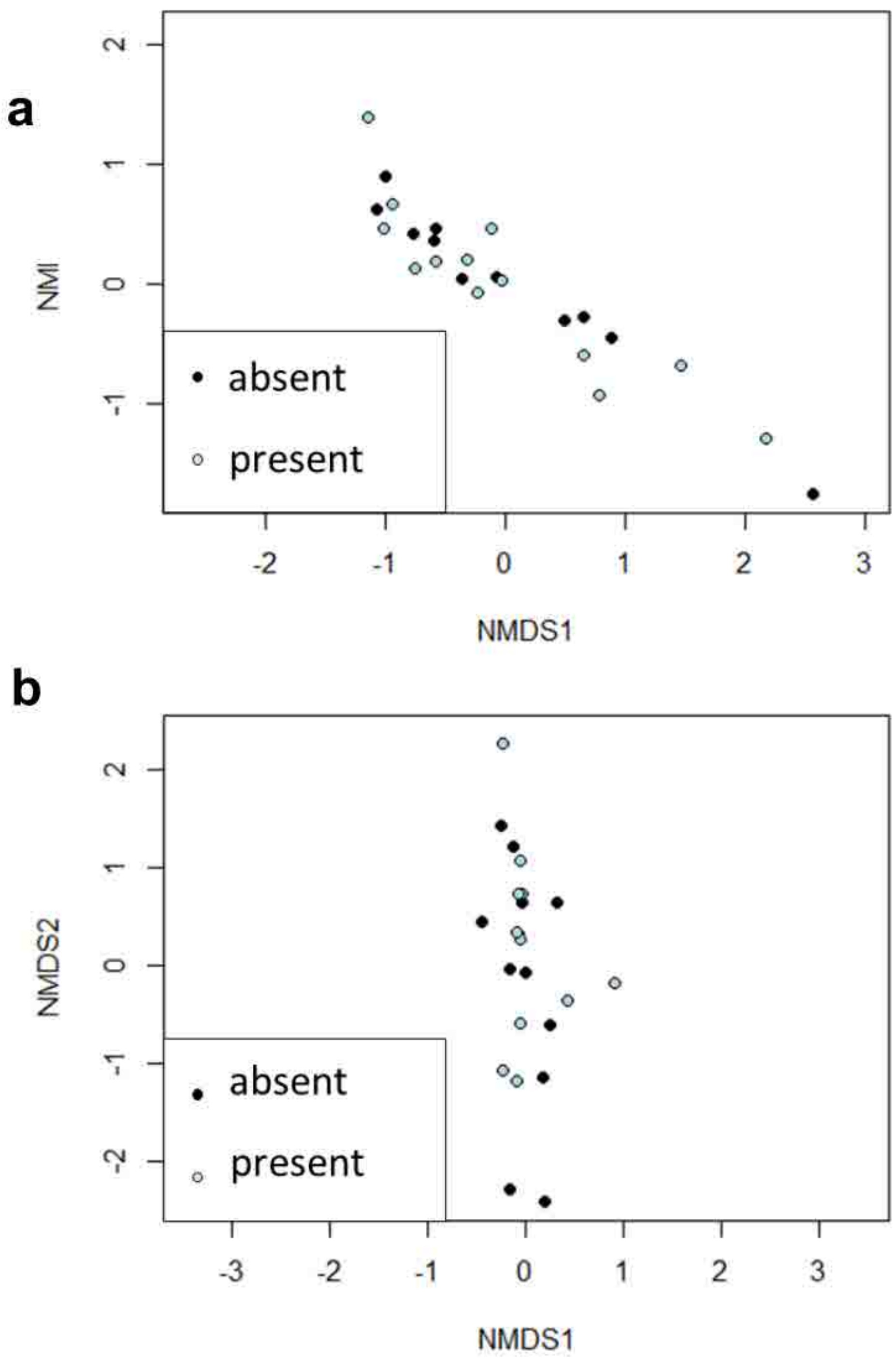


Figure 4-4. Non-metric multidimensional scaling (NMDS) plot showing differences in functional traits between sites with treated trees (present) and without treated trees (absent) in the Monongahela National Forest (a) and two units of NPS in West Virginia (b). The presence and absence groups were not significantly different in MNF (p = 0.93) or NPS (p = 0.74). Variation was not significantly different between groups in MNF (p = 0.74) or between groups in NPS (p = 0.37).

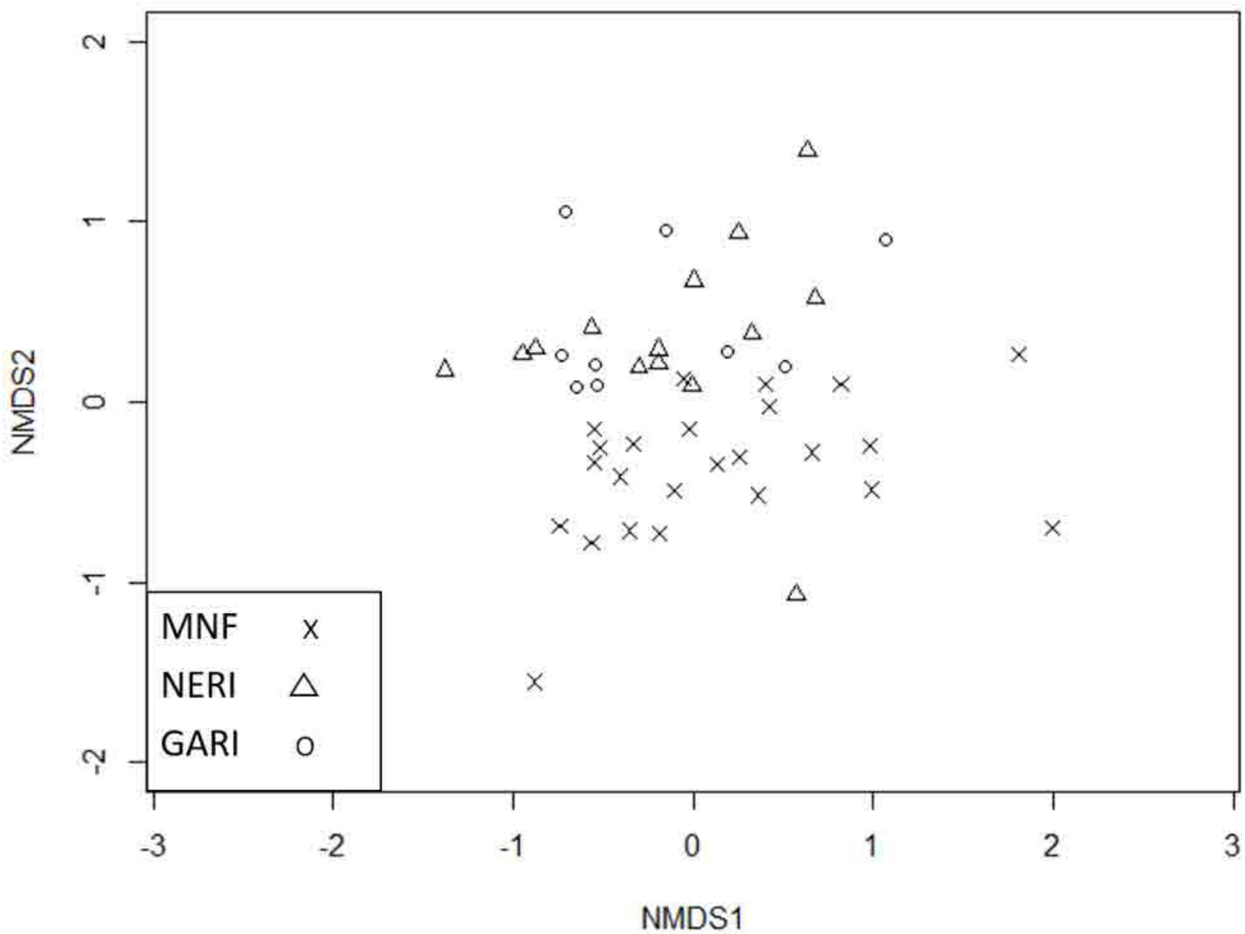
Table 4-1. Model selection results for the influence of locality, presence of environmental imidacloprid (Presence), presence of treated trees (Trees), number of imidacloprid-treated trees (Number), and imidacloprid concentration in the water (ng/mL; Concentration) on benthic macroinvertebrate community metrics. We used Akaike's Information Criterion corrected for small sample size (AIC_c) to rank candidate models. The null model is shown as (.) and included only the intercept. Akaike weights are represented as w_i.

Model	Parameters	AIC_c	ΔAIC_c	R^2	w_i
GLIMPSS				Pseudo-R^2	
Locality × Presence	5	-18.24	0.00	0.28	0.59
Locality × Trees	5	-16.02	2.22	0.24	0.19
Locality + Presence	4	-13.32	4.92	0.15	0.05
Locality	3	-12.96	5.28	0.09	0.04
Locality + Trees	4	-12.65	5.59	0.14	0.04
Locality × Concentration	5	-11.88	6.36	0.15	0.02
Locality × # Treated Trees	5	-11.65	6.59	0.16	0.02
Locality + # Treated Trees	4	-10.81	7.44	0.09	0.01
Locality + Concentration	4	-10.70	7.54	0.09	0.01
(.)	2	-9.95	8.29	NA	0.01
WVSCI				Pseudo-R^2	
Locality × Presence	5	-61.29	0.00	0.18	0.00
(.)	2	-61.17	0.12	NA	0.21
Locality	3	-60.25	1.04	0.03	0.13
Locality + Concentration	4	-59.85	1.44	0.08	0.11
Locality × Trees	5	-59.72	1.57	0.15	0.10
Locality × Concentration	5	-59.31	1.98	0.14	0.08
Locality + Trees	4	-58.15	3.14	0.05	0.05
Locality + Presence	4	-58.08	3.21	0.05	0.04
Locality + # Treated Trees	4	-57.91	3.38	0.04	0.04
Locality × # Treated Trees	5	-56.46	4.83	0.07	0.02
% Ephemeroptera + Plecoptera + Trichoptera				Pseudo-R^2	
Locality	3	-19.47	0.00	0.08	0.28
(.)	2	-18.95	0.52	NA	0.22
Locality + Concentration	4	-17.30	2.17	0.08	0.10
Locality + Trees	4	-17.28	2.19	0.08	0.09
Locality + Presence	4	-17.06	2.41	0.08	0.08
Locality + # Treated Trees	4	-17.05	2.42	0.08	0.08
Locality × Trees	5	-15.69	3.78	0.10	0.04
Locality × # Treated Trees	5	-15.48	3.99	0.10	0.04
Locality × Presence	5	-15.07	4.40	0.09	0.03
Locality × Concentration	5	-14.90	4.57	0.09	0.03
% Chironomidae + Annelida				Pseudo-R^2	
(.)	2	-192.63	0.00	NA	0.36

Locality	3	-191.89	0.73	0.03	0.25
Locality + Concentration	4	-189.66	2.97	0.03	0.08
Locality + Trees	4	-189.56	3.07	0.03	0.08
Locality + Presence	4	-189.51	3.12	0.03	0.07
Locality + # Treated Trees	4	-189.50	3.13	0.03	0.07
Locality × # Treated Trees	5	-187.34	5.29	0.03	0.03
Locality × Concentration	5	-187.18	5.45	0.03	0.02
Locality × Trees	5	-187.06	5.57	0.03	0.02
Locality × Presence	5	-187.05	5.58	0.03	0.02
% 5 Dominant Genera				Pseudo-R^2	
(.)	2	-44.37	0.00	NA	0.33
Locality	3	-43.41	0.96	0.01	0.20
Locality + Presence	4	-41.89	2.48	0.03	0.09
Locality + Concentration	4	-41.77	2.61	0.02	0.09
Locality × Presence	5	-41.14	3.24	0.05	0.06
Locality + # Treated Trees	4	-41.04	3.34	0.02	0.06
Locality + Trees	4	-41.02	3.35	0.01	0.06
Locality × # Treated Trees	5	-40.25	4.12	0.03	0.04
Locality × Concentration	5	-39.96	4.41	0.03	0.04
Locality × Trees	5	-39.30	5.07	0.02	0.03
Genus Richness				Adj-R^2	
Locality	3	344.32	0.00	0.08	0.30
Locality + Trees	4	346.10	1.79	0.08	0.12
Locality + Presence	4	346.11	1.80	0.08	0.12
Locality + Concentration	4	346.60	2.29	0.07	0.10
Locality + # Treated Trees	4	346.68	2.36	0.06	0.09
(.)	2	347.22	2.91	NA	0.07
Locality × Presence	5	347.26	2.94	0.08	0.07
Locality × Trees	5	347.69	3.38	0.07	0.06
Locality × Concentration	5	348.29	3.98	0.06	0.04
Locality × # Treated Trees	5	348.82	4.50	0.05	0.03
Biomass				Adj-R^2	
(.)	2	307.56	0.00	NA	0.31
Locality × Presence	5	308.17	0.62	0.07	0.23
Locality	3	309.21	1.65	-0.01	0.14
Locality × Trees	5	309.69	2.13	0.04	0.11
Locality + Trees	4	311.05	3.49	-0.02	0.05
Locality + Presence	4	311.23	3.67	-0.02	0.05
Locality + # Treated Trees	4	311.50	3.94	-0.03	0.04
Locality + Concentration	4	311.55	3.99	-0.03	0.04
Locality × # Treated Trees	5	313.72	6.17	-0.05	0.01
Locality × Concentration	5	314.05	6.49	-0.05	0.01

Table 4-2. Parameter estimates (β) and standard errors (SE) for predictor variables for the most parsimonious models (identified in Table 4-2) for each of seven community metrics.

Predictor	β	SE	95% CI
GLIMPSS			
Locality x Presence	1.65	0.59	(0.50 –2.81)
Locality	-1.78	0.51	(-2.77 – -0.79)
Presence	-1.27	0.42	(-2.09 – -0.45)
Intercept	1.77	0.36	(1.07 – 2.48)
WVSCI			
Locality x Presence	1.15	0.47	(0.23 – 2.06)
Locality	-1.06	0.39	(-1.83 – -0.29)
Presence	-0.65	0.34	(-1.31 – 0.01)
Intercept	1.90	0.29	(1.33 – 2.48)
% Ephemeroptera + Plecoptera + Trichoptera			
Locality	0.49	0.22	(-0.07 – 1.05)
Concentration	0.00	0.01	(-0.01 – 0.01)
Intercept	0.54	0.22	(0.10 – 0.97)
% Chironomidae + Annelida			
Concentration	0.00	0.01	(-0.01, 0.01)
Locality	-0.38	0.30	(-0.98, 0.21)
Intercept	-2.04	0.29	(-2.60, -1.48)
% 5 Dominant Genera			
Presence	-0.28	0.31	(-0.88, 0.32)
Locality	0.32	0.28	(-0.23, 0.86)
Intercept	1.28	0.29	(0.71, 1.85)
Genus Richness			
Trees	-2.01	2.65	(-7.21 – 3.19)
Locality	-6.14	2.64	(-11.31 – -0.96)
Intercept	22.88	2.41	(18.16 – 27.60)
Biomass			
Locality x Presence	8.88	3.82	(1.40 – 16.37)
Locality	-4.77	3.21	(-11.06 – 1.52)
Presence	-5.21	2.57	(-10.25 – -0.16)
Intercept	16.05	2.1	(11.93 – 20.16)



Appendix 4-1. Non-metric multidimensional scaling (NMDS) plots of benthic macroinvertebrate genus abundances for each stream site. Abundances differed based on geographic location between the Monongahela National Forest (MNF) and the NPS locations (Gauley River [GARI] and New River Gorge [NERI]). Stress was 0.216. NPS and MNF sites were significantly different ($p = 0.002$).

Appendix 4-2. List of functional traits used to categorize benthic macroinvertebrate taxa for functional traits analysis. Functional traits were assigned to each taxon using Poff et al. (2006), the EPA database (U.S. EPA 2012) when appropriate, or the next most similar known taxa.

Semi-voltine
Univoltine
Non-seasonal development
Slow seasonal development
Poor synchronized dispersal
Well synchronized dispersal
Long life
Short life
Very short life
High dispersal
Low dispersal
Strong flyer
Weak flyer
Non-emergent
Common drifter
Rare drifter
High crawling activity
Low crawling activity
Very low crawling activity
Weak swimmer
Free ranging
No armor
Poor armor
Riffle and pool habitat
Riffle habitat
No desiccation ability
Desiccation ability
Non-streamlined
Streamlined
Size medium
Climbing activity
Clinging activity
Swimming activity
Cold water habitat
Cool-warm water habitat
Gilled breathing
Tegument breathing

Appendix 4-3. Site-level values for imidacloprid and indices of biotic integrity used in analyses. Site locations are in Appendix 2-1.

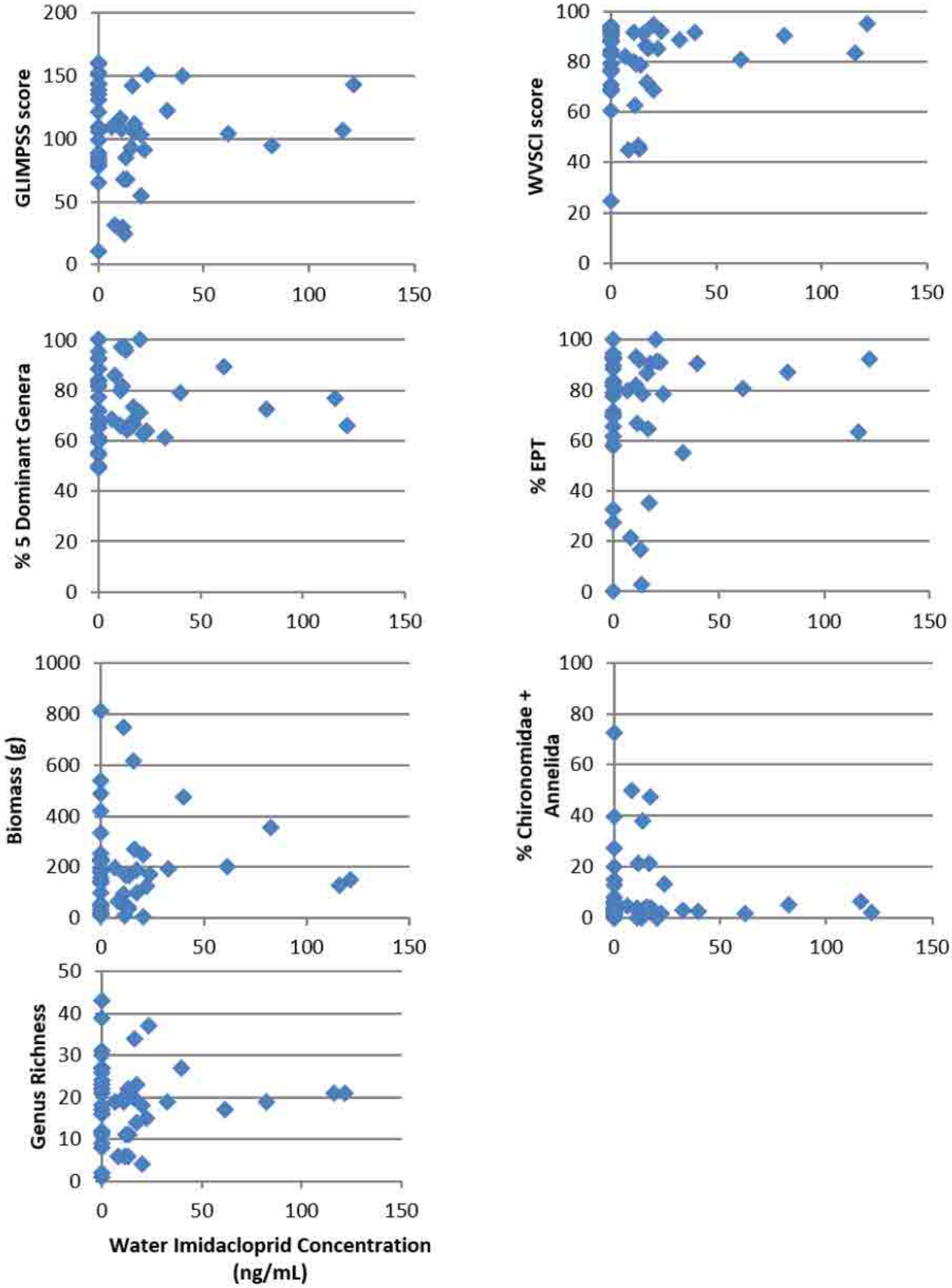
Site	Number of Imidacloprid Applications	Water Imidacloprid Concentration (ng/mL)	Environmental Imidacloprid	Total Biomass	GLIMPSS	WVSCI	Genus Richness	%EPT	% Chironomidae + Annelida	% 5 Dominant Taxa
1	0	0	absent	11.13	10.87	24.61	2	27.27	72.73	100.00
2	149	11.28	present	8.5	29.78	62.43	6	66.67	21.21	0.97
3	17	0	present	225.1	80.02	69.17	9	92.19	6.25	0.92
4	138	121.43	present	152.36	142.97	95.16	21	92.25	2.11	0.66
5	0	0	absent	23.42	85.89	68.14	11	69.23	0.00	0.82
6	214	17.38	present	97.51	111.54	85.3	14	90.57	3.77	0.74
7	5	20.21	present	4.42	54.77	68.79	4	100.00	0.00	1.00
8	66	0	present	36.05	77.74	77.01	8	100.00	0.00	0.67
9	0	0	present	252.03	143.84	92.86	26	92.75	0.48	0.77
10	494	61.54	present	202.12	103.67	80.88	17	80.73	1.56	0.90
11	0	0	absent	537.04	82.98	84.32	17	92.13	3.93	0.83
12	76	12.79	present	35.51	24.92	46.55	6	16.67	0.00	0.97
13	0	0	absent	145.97	88.21	69.17	12	94.41	0.56	0.96
14	3993	0	present	221.44	109.18	78.99	16	81.30	0.81	0.89
15	0	0	absent	157.55	99.07	82.51	22	58.24	3.53	0.72
16	23	6.52	present	197.4	109.27	81.95	19	79.69	4.69	0.69
17	0	0	absent	99.48	83.56	87.89	16	83.87	8.06	0.61
18	52	0	present	48.89	64.76	70.73	12	93.18	2.27	0.84
19	5	0	absent	16.86	88.11	84.24	16	81.63	6.12	0.65
20	60	23.59	present	171.53	150.78	92.02	37	78.30	13.19	0.64
21	0	0	absent	197.27	105.85	92.11	21	82.76	3.45	0.55
22	60	82.46	present	354.32	94.35	90.36	19	86.99	4.88	0.72
23	0	0	absent	180.05	150.50	91.13	23	71.43	5.29	0.49
24	120	32.73	present	190.95	122.40	88.77	19	55.00	2.86	0.61
25	0	22.1	present	125.71	91.42	84.96	15	91.04	1.49	0.63
26	82	13.81	present	165.75	67.44	78.72	11	78.57	3.57	0.64
27	0	0	present	184.86	131.15	83.03	27	65.33	27.48	0.72
28	60	17.15	present	190.54	104.71	71.58	23	35.40	47.20	0.66

29	0	10.68	present	749.29	116.37	79.94	19	81.77	3.65	0.80
30	169	0	present	810.57	109.33	76.11	18	89.88	1.31	0.93
31	0	0	absent	136	135.40	88.62	24	88.50	2.56	0.82
32	675	39.85	present	476.08	149.74	91.63	27	90.57	2.69	0.79
33	0	0	absent	331.96	121.19	93.67	31	70.34	6.21	0.54
34	34	0	present	231.19	143.29	92.49	30	77.71	4.22	0.61
35	0	0	absent	229.95	159.27	84.03	43	57.70	20.10	0.69
36	56	16.43	present	267.87	142.38	86.48	34	64.62	21.45	0.68
37	0	0	absent	224.2	152.47	89.89	39	61.54	15.02	0.59
38	47	13.28	present	41.64	85.16	45.24	22	2.68	38.13	0.96
39	0	12.01	present	169.24	68.06	78.84	11	91.84	2.04	0.82
40	42	15.68	present	615.26	92.83	91.05	20	86.60	4.12	0.65
41	0	10.93	present	96.62	107.17	91.71	20	93.18	0.00	0.66
42	762	20.31	present	247.38	103.41	94.6	18	91.50	0.00	0.71
43	0	8.12	present	63.69	31.64	44.81	6	21.43	50.00	0.86
44	237	489.55	present	3.03	37.27	33.21	1	0.00	0.00	1.00
45	0	0	absent	419.06	138.90	91.21	1	0.00	0.00	1.00
46	60	0	present	57.76	80.51	60.59	22	32.60	39.50	0.88
47	0	0	absent	488.97	160.37	94.2	27	78.88	12.75	0.50
48	120	116.04	present	130.03	106.55	83.36	21	63.16	6.22	0.77

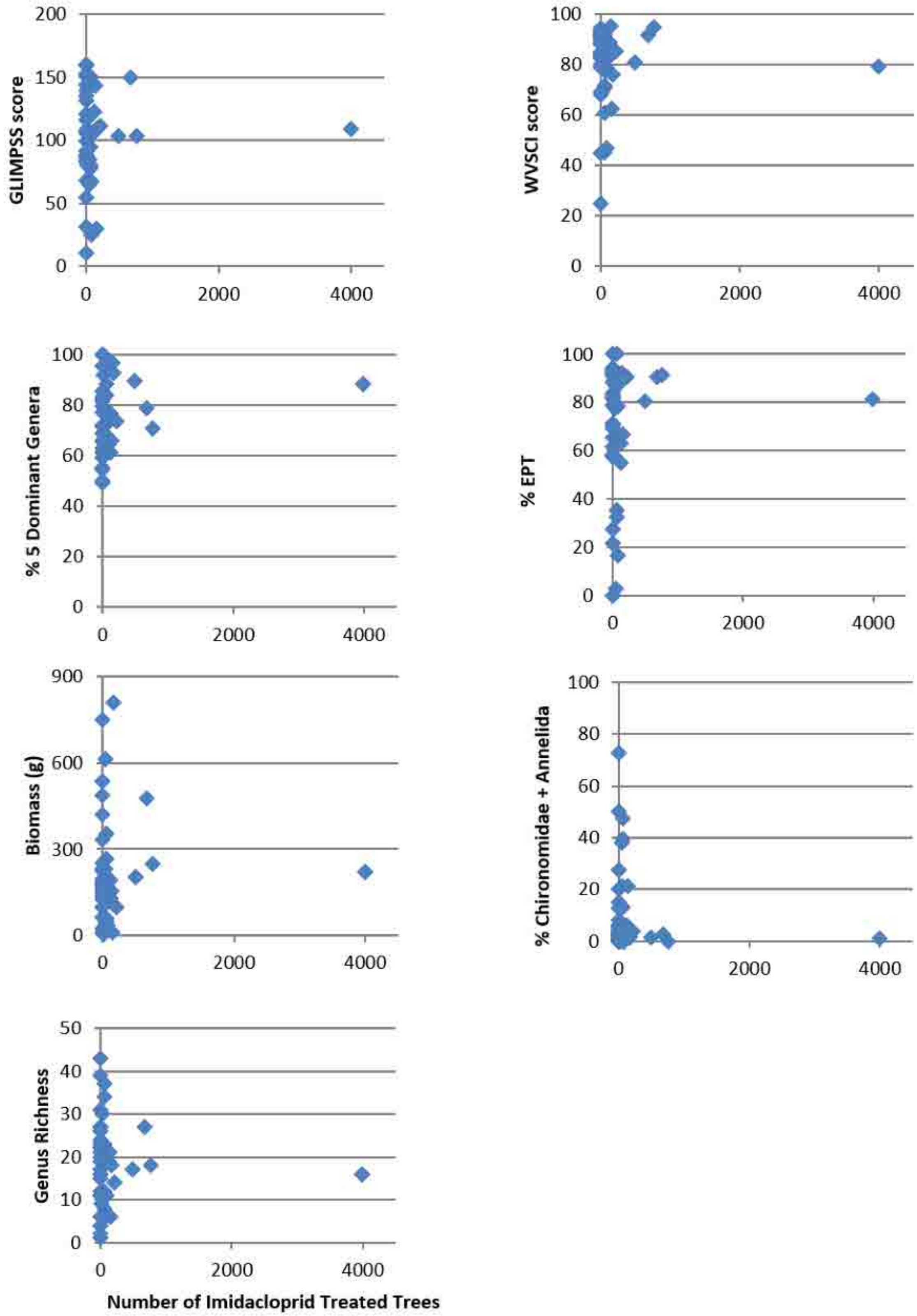
Appendix 4-4. Summary of means ± SE for seven indicators of benthic macroinvertebrate community integrity for sites without environmental imidacloprid (absent; n = 8) and with environmental imidacloprid (present; n=16) in the Monongahela National Forest (MNF) and for sites without environmental imidacloprid (absent; n = 6) and with environmental imidacloprid (present; n = 17) in National Park Service sites (NPS).

	MNF present	**MNF absent**	**NPS present**	**NPS absent**
Biomass (g)	138.65 ± 24.90	271.37 ± 46.32	271.77 ± 59.05	168.52 ± 78.17
WVSCI	78.65 ± 3.19	90.51 ± 1.17	78.94 ± 3.75	69.56 ± 9.61
GLIMPSS	100.35 ± 7.49	134.02 ± 9.98	96.10 ± 9.28	83.74 ± 16.57
Genus Richness	20.00 ± 2.73	25.13 ± 4.70	16.06 ± 1.58	14.67 ± 3.30
% EPT	69.14 ± 6.72	63.32 ± 9.64	78.80 ± 5.71	71.63 ± 10.61
% Chironomidae +Annelida	13.66 ± 3.97	8.86 ± 2.34	6.16 ± 2.99	13.88 ± 11.79
% 5 Dominant Genera	73.06 ± 3.13	62.29 ± 5.83	80.64 ± 2.69	85.7 ± 4.21

Appendix 4-5. Scatterplots comparing seven community indices to water imidacloprid concentration (ng/mL) for 47 sites sampled on MNF and NPS.



Appendix 4-6. Scatterplots comparing seven community indices to number of imidacloprid-treated trees for 47 sites sampled on MNF and NPS.



Description of Integrated Pest Management within the GHFR project

Integrated Pest Management methods would be used to minimize or prevent the development of pest problems, and could include the use of pesticides, for example, to preserve hemlock trees facing mortality from hemlock wooly adelgid. (VE26,27, 28, 29, 32,34,35,36,37)

The CE category used for the GHFR project (HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)): Insect and Disease Infestation) is applicable for this project because all project activities comply with the Healthy Forest Restoration Act section 603 requirements. Under this category, herbicides, insecticides, and pheromones may be used, but their use must be consistent with the Forest Plan.

Harvest treatments themselves are one component of the integrated pest management approach to be used in the project area. Diseased and infested trees will be removed in thinnings, leaving the most healthy trees available to form a fully stocked stand. In addition, regeneration harvests (commercial timber harvest that removes most or all of the trees in an area, with the intention of developing a new stand of young trees.) will remove most of the mature trees to develop a forest composed of smaller and younger trees that are more resilient when impacted by forest insects and disease organisms. Developing and maintaining tree species diversity in thinned and regenerated areas is another component of the project that can help to provide increased resilience to forest insects and diseases.

Use of insecticides that are registered and labeled for use on forest trees and shrubs, employing the methods and restrictions for such use, could potentially help maintain high value individual trees and species on the landscape. Labeling of such insecticides includes required measures to protect ground and surface waters, pollinating insect species and other flora and fauna. Most of these insecticides would be used on individual trees using hand labor.

(b)(5); Deliberative Process Privilege

[redacted]

Description of Integrated Pest Management within the GHFR project

Integrated Pest Management methods would be used to minimize or prevent the development of pest problems, and could include the use of pesticides, for example, to preserve hemlock trees facing mortality from hemlock wooly adelgid. (VE26,27, 28, 29, 32,34,35,36,37)

The CE category used for the GHFR project (HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)): Insect and Disease Infestation) is applicable for this project because all project activities comply with the Healthy Forest Restoration Act section 603 requirements. Under this category, herbicides, insecticides, and pheromones may be used, but their use must be consistent with the Forest Plan.

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Use of insecticides that are registered and labeled for use on forest trees and shrubs, employing the methods and restrictions for such use, could potentially help maintain high value individual trees and species on the landscape. Labeling of such insecticides includes required measures to protect ground and surface waters, pollinating insect species and other flora and fauna. Most of these insecticides would be used on individual trees using hand labor.

(b)(5); Deliberative Process Privilege

[redacted]

Stevens, Karen L -FS

From: Tarter, Kim - FS
Sent: Friday, January 10, 2020 12:51 PM
To: Brooks, Gregory - FS; Tanner, Cheryl L -FS; Coleman, Amy - FS; Tasker, Kyle - FS; Bard, Jane F -FS
Subject: Draft GHFR BA
Attachments: 2019Nov14GHFRBA.doc

I wanted to get this draft out to you today so you could review/revise as need in order to increase our ID team meeting success for next week. This draft addressed terrestrial TE species only. Aquatic and floral species section are highlighted in yellow and need revision, since it contains Big Rock info. Call me or send me an e-mail and let me know if I can help.

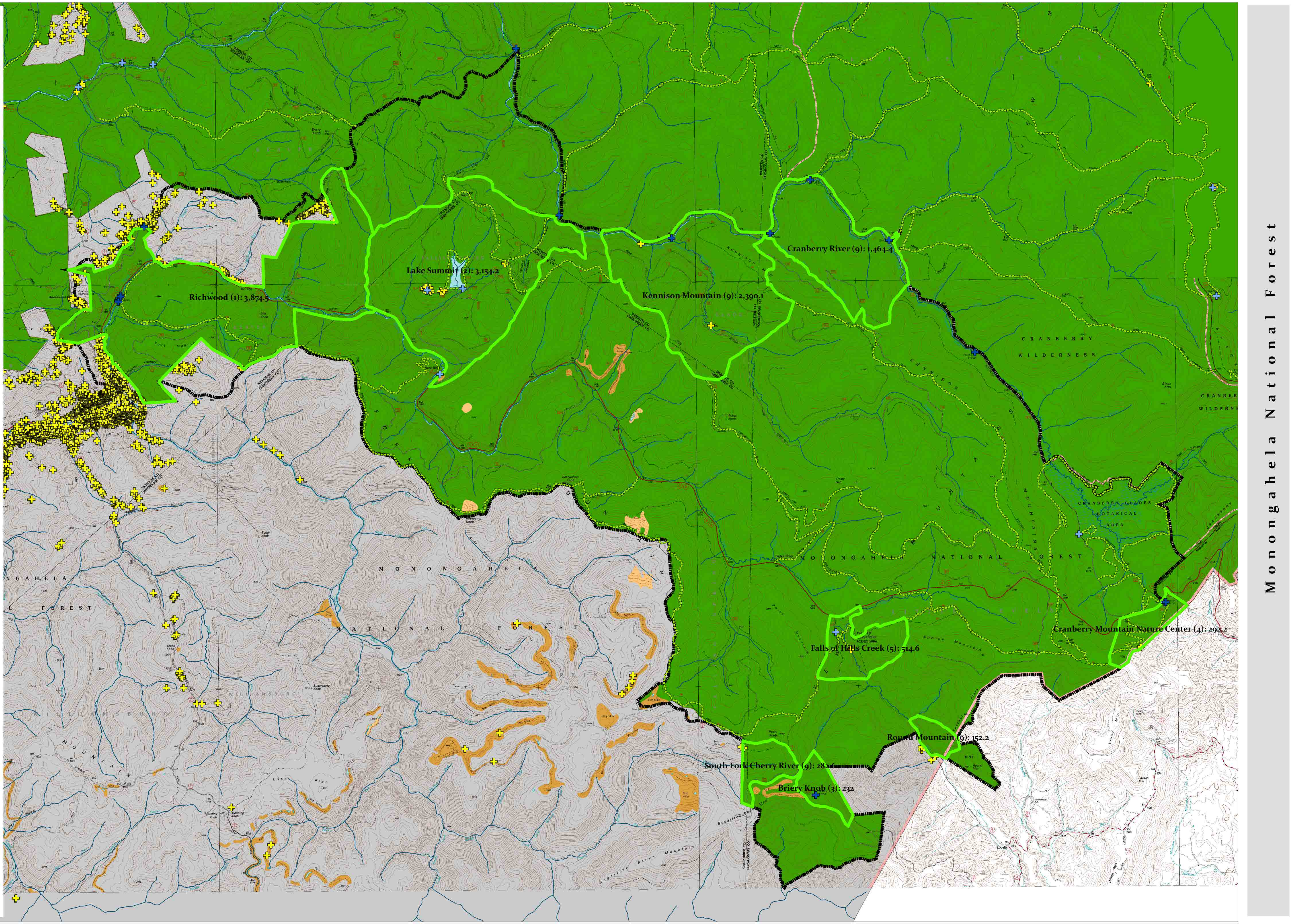
Thank you for working diligently and contributing to the success of our mission.....Kim

Gauley Healthy Forest Restoration

High Value Resource Assets

Total Acres - 12,356

Gauley Ranger District



- Real Property - Buildings
- Real Property - Rec Sites
- SAMB - MNF Structures
- High Value Resource Assets
- Project Boundary

Miles

0 0.375 0.75 1.5

Disclaimer:

This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

- DRAFT -
Internal Use Only

December 11, 2019

Stevens, Karen L -FS

From: Torres, Amy S -FS
Sent: Thursday, January 30, 2020 7:19 PM
To: Artale, Diane -FS; Ash, Jeremy - FS; Bard, Jane F -FS; Beer, Louis - FS; Brake, Timothy -FS; Brooks, Gregory - FS; Cober, William J -FS; Coleman, Amy - FS; Conner, Tami -FS; Edwards, Matthew J -FS; Fry, John - FS; Hale, Gavin -FS; Martin, Jay - FS; Mullins, Amelia -FS; Nottingham, Adrienne C -FS; Raione, Richard P -FS; Stevens, Karen L -FS; Tanner, Cheryl L -FS; Tarter, Kim - FS; Tasker, Kyle - FS; Tolley, Tim -FS; Torres, Amy S -FS; Tupis, Pete Jr. - FS; Walter, Terry J -FS; Wilson, Will -FS
Subject: Final Proposed Action Gauley Healthy Forest Restoration Project

Hi All,

Here is the link to the final proposed action for the Gauley Healthy Forest Restoration Project. You will notice that there is only one design criteria added to the document. It was decided by Richard that the other design criteria that was outlined was already covered in the Forest Plan or BMPs.

(b)(4) [redacted]

Please have your reports completed on February 2, 2020.

Thanks!

Amy Torres
Environmental Coordinator
Forest Service
WO Business Operations, Enterprise Program
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amy.torres@usda.gov
87155 Kellmore Street
Eugene, OR 97402
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Caring for the land and serving people

Stevens, Karen L -FS

From: Conner, Tami -FS
Sent: Wednesday, February 12, 2020 8:28 AM
To: Walter, Terry J -FS; Fry, John - FS
Subject: fire effects for GHFRA CE
Attachments: GSE EA fire effects.docx

(b)(5); Deliberative Process Privilege [redacted]

Tami Conner
Ecosystem Staff Officer

Forest Service
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tami.conner@usda.gov

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Caring for the land and serving people

Stevens, Karen L -FS

From: Martin, Jay - FS
Sent: Tuesday, January 14, 2020 11:23 AM
To: Bard, Jane F -FS; Tarter, Kim - FS; Raione, Richard P -FS; Nottingham, Adrienne C -FS; Coleman, Amy - FS; Tasker, Kyle - FS; Hale, Gavin -FS; Walter, Terry J -FS; Fry, John - FS; Tolley, Tim -FS; Brake, Timothy -FS; Tanner, Cheryl L -FS; Cober, William J -FS; Wilson, Will -FS; Stevens, Karen L -FS; Ash, Jeremy - FS; Artale, Diane -FS; Mullins, Amelia -FS; Conner, Tami -FS; Edwards, Matthew J -FS; Martin, Jay - FS
Subject: FW: GHFR Updated Proposed Actions

GHFR Team,
Please see Tim's message below regarding shapefiles for the project. Also feel free to contact me if you are having any issues accessing any of the project locations in BOX. There have been several cases where employees do not have access to different folders.

Thanks

Jay Martin
South Zone NEPA Planner
Forest Service
Monongahela National Forest, Marlinton / White Sulphur Ranger District
p: 304-799-4334 xx 7995513
f: 304-799-6820
jay.martin2@usda.gov
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From: Brake, Timothy -FS <timothy.brake@usda.gov>
Sent: Tuesday, January 14, 2020 9:50 AM
To: Martin, Jay - FS <Jay.Martin2@usda.gov>
Cc: Bard, Jane F -FS <jane.bard@usda.gov>; Stevens, Karen L -FS <karen.stevens@usda.gov>; Lammie, Samuel - FS <samuel.lammie@usda.gov>
Subject: GHFR Updated Proposed Actions

The T: Drive has been updated. There is a new Timber Units layer, and a new Skid Roads layer. They have a date stamp of 011320.

In the Aquatics folder there is a new Catchments layer also with the date stamp of 011320

Timothy Brake
Cartographic Technician
Monongahela National Forest
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(304) 635-4430

timothy.brake@usda.gov

Stevens, Karen L -FS

From: Martin, Jay - FS
Sent: Friday, January 24, 2020 1:02 PM
To: Bard, Jane F -FS
Cc: Tasker, Kyle - FS
Subject: FW: GHFRP FR946 crossing

Jane,
Just thought I'd resend Kyle's note on Spencer Run. I saw Tami's email and thought this may be helpful.

Thanks

Jay Martin
South Zone NEPA Planner
Forest Service
Monongahela National Forest, Marlinton / White Sulphur Ranger District
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From: Tasker, Kyle - FS <kyle.tasker@usda.gov>
Sent: Thursday, December 19, 2019 11:13 AM
To: Martin, Jay - FS <Jay.Martin2@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>
Cc: Bard, Jane F -FS <jane.bard@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>
Subject: GHFRP FR946 crossing

Jay and Richard,

I wanted to get you all the information for the stream crossing structure at Spencer Run on FR 946 that was discussed on our call Monday. (b)(5); Deliberative Process Privilege [redacted] The Trout Unlimited crews surveyed the crossing this summer and determined there was severe stream constriction at the site (meaning less than 50% of stream width through crossing). The culvert is "perched" on the outlet end creating a drop to a scour pool, and is currently acting as a barrier to upstream movement of aquatic biota. The bankfull width at the site is 14 feet and the width of the culvert is only half of that at 6.7 feet. The crossing has a North Atlantic Aquatic Connectivity Collaborative (NAACC) passability rating of 0.6 out of 1.0, pretty much again just indicating it is an aquatic organism passage barrier.

I believe Tim Brake has already created a point at the crossing for the T: drive, but I'll also include the GPS point as well:
Lat: 38.23350, Long: -80.51406

Thanks,

Kyle Tasker
Fisheries Biologist

Forest Service
Monongahela National Forest

p: 304-799-4334 x7995519
kyle.tasker@usda.gov

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Marlinton, WV 24954
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Caring for the land and serving people

Stevens, Karen L -FS

From: Martin, Jay - FS
Sent: Friday, December 20, 2019 10:27 AM
To: Tanner, Cheryl L -FS; Coleman, Amy - FS; Tasker, Kyle - FS
Subject: FW: phone call
Attachments: gauley .pdf

Here is the latest that John sent for RX proposal. Due to this proposal, we are adjusting the timer proposal so we can remain under the 3000 acre limit. Tim is working on finalizing as we speak. I will send out an email to the team when all proposals are in place.

Thanks – I hope you all can relax over the holidays!

Jay Martin
South Zone NEPA Planner
Forest Service
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From: Fry, John - FS <john.fry@usda.gov>
Sent: Wednesday, December 18, 2019 3:48 PM
To: Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: RE: phone call

Jay,

Take a look at this map. We can discuss tomorrow at 9.

Thanks,

John Fry
Forest Assistant Fire Management Officer
Forest Service
Monongahela National Forest

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c: 304-704-9196
f: 304-630-6300
john.fry@usda.gov

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From: Martin, Jay - FS
Sent: Wednesday, December 18, 2019 12:52 PM
To: Bard, Jane F -FS <jane.bard@usda.gov>; Fry, John - FS <john.fry@usda.gov>
Subject: RE: phone call

John,
In case it will help, I've attached a pdf of the proposed area with the features identified.

thanks

Jay Martin
South Zone NEPA Planner
Forest Service
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Caring for the land and serving people

From: Bard, Jane F -FS <jane.bard@usda.gov>
Sent: Wednesday, December 18, 2019 12:48 PM
To: Fry, John - FS <john.fry@usda.gov>
Cc: Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: phone call
Importance: High

It looks like tomorrow might be better for a call. Would 9 am work? Jay has something else this afternoon, and I would (b)(6) [redacted]. . Meanwhile, I hope the documents I sent may be helpful, and

Jay may send you a quick map with some of the features we talked about on the call, in hopes of saving some time for all of us.

Jane Bard
Silviculturist

Forest Service
Monongahela National Forest, Gauley Ranger District

p: 304-846-2695 x112
f: 304-846-4307
jane.bard@usda.gov

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Caring for the land and serving people

Stevens, Karen L -FS

From: Martin, Jay - FS
Sent: Wednesday, January 8, 2020 10:47 AM
To: Bard, Jane F -FS; Tarter, Kim - FS; Raione, Richard P -FS; Nottingham, Adrienne C -FS; Coleman, Amy - FS; Tasker, Kyle - FS; Hale, Gavin -FS; Walter, Terry J -FS; Fry, John - FS; Tolley, Tim -FS; Brake, Timothy -FS; Tanner, Cheryl L -FS; Cober, William J -FS; Wilson, Will -FS; Torres, Amy S -FS; Stevens, Karen L -FS; Ash, Jeremy - FS; Artale, Diane -FS; Mullins, Amelia -FS; Conner, Tami -FS; Edwards, Matthew J -FS; Whetsell, Carol L -FS
Subject: FW: Prescribed Fire / Mechanical Treatment

GHFR Team,
Please find the fire and fuels description of activities below from John – thanks John. As before you can find the stuff that jane provided under the Silviculture specialist folder in the project file.

Thanks

Jay Martin
South Zone NEPA Planner
Forest Service
Monongahela National Forest, Marlinton / White Sulphur Ranger District
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jay.martin2@usda.gov
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Caring for the land and serving people

From: Fry, John - FS <john.fry@usda.gov>
Sent: Tuesday, January 7, 2020 5:05 PM
To: Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: Prescribed Fire / Mechanical Treatment

Jay,

Here is the write up regarding prescribed fire and mechanical treatments. Please review and let me know if you have questions.

Prescribed Fire – Broadcast
Project will be implemented during either the Spring (prior to green-up) or Fall (dormant) seasons to promote oak regeneration and to reduce leaf litter the threat of catastrophic wildfire. A low to moderate fire intensity will be used to reduce leaf litter while maintaining fire adapted over story trees. The end result of this prescribed fire project will be to create a health forest by reducing some down and dead woody debris, increase sunlight by reducing competition from fire intolerant tree species, promote native greases and increase oak regeneration in turn increase wildlife populations. Prescribed fire will be implemented to emulate natural fire on the landscape. Fire will be established along the ridge and

allowed to back down the ridge. Natural features such as roads, rivers, and natural features will be used as much as possible to limit the impact on the land. In instances where hand line or dozer lines need to be constructed MIST techniques will be used. The concept of Minimum Impact Suppression Tactics (MIST) is to use the minimum amount of forces necessary to effectively achieve the fire management protection objectives consistent with land and resource management objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects when determining how to implement an appropriate suppression response. In some cases MIST may indicate cold trailing or wet line may be more appropriate than constructed hand line. In another example, the use of an excavator may be used rather than a dozer. Individual determinations will be dependent on the specific situation and circumstances of each fire.

Prescribed Fire – Piles
This will consist of creating hand piles along private property boundary and Forest Service infrastructure that will reduce logging slash. Piles will consist top wood and non-merchantable wood. Piles will be burned during low fire danger days preferably with snow on the ground or raining. No hand line will be constructed for hand piling.

Mechanical Treatment – Thinning
Mechanical thinning will occur along private property and Forest Service infrastructure. Top wood created from harvest operation will be hand piled and burned or pulled away from private property or Forest Service infrastructure by the contractor for approximately 33 feet. Hand piling will be recommend in areas that will have limited access. This will create defensible space in the event of a wildfire in vicinity.

John Fry
Forest Assistant Fire Management Officer
Forest Service
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Caring for the land and serving people

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Thursday, December 12, 2019 11:47 AM
To: Tasker, Kyle - FS
Subject: FW: Collab Doc
Attachments: SoilsGroup_Collaboration_FD_Dec2019.docx

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

Forest Service
Monongahela National Forest

p: 304-635-4466
c: 304-704-8134
adrienne.nottingham@usda.gov

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Caring for the land and serving people

From: Nottingham, Adrienne C -FS
Sent: Thursday, December 12, 2019 11:37 AM
To: Tolley, Tim -FS <tim.tolley@usda.gov>; Owen, Michael D -FS <michael.owen@usda.gov>
Cc: 'Connolly, Stephanie -FS (sconnolly@fs.fed.us)' <sconnolly@fs.fed.us>; Mellor, Steffany - FS <steffany.mellor@usda.gov>
Subject: FW: Collab Doc

Tim and Mike,

See attached collaboration document for soils. Thanks,

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

Forest Service
Monongahela National Forest

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c: 304-704-8134
adrienne.nottingham@usda.gov

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Caring for the land and serving people

From: Tolley, Tim -FS <tim.tolley@usda.gov>
Sent: Wednesday, December 11, 2019 7:28 AM
To: Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>
Subject: RE: Collab Doc

Good morning Adrienne,

Here is what I wrote (not sure if you already have it or not). It's just a brief summary. No in-depth details (I don't really know any details).

Tim

From: Nottingham, Adrienne C -FS
Sent: Tuesday, December 10, 2019 5:39 PM
To: Tolley, Tim -FS <tim.tolley@usda.gov>
Subject: Collab Doc

Hey Tim…. I am being ambitious but I just saw that email from Jay and if I have time I am going to try to write something up like what you did for the collab for GHFR.

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

Forest Service
Monongahela National Forest

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c: 304-704-8134
adrienne.nottingham@usda.gov

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www.fs.fed.us

Caring for the land and serving people

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Friday, February 7, 2020 7:12 AM
To: Connolly, Stephanie -FS
Subject: FW: GHFR insecticide background
Attachments: Description of Integrated Pest Management within the GHFR project.docx

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

Forest Service
Monongahela National Forest

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c: 304-704-8134
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Caring for the land and serving people

From: Raione, Richard P -FS <richard.raione@usda.gov>
Sent: Thursday, February 6, 2020 7:21 PM
To: Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>; Bard, Jane F -FS <jane.bard@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Brooks, Gregory - FS <Gregory.Brooks@usda.gov>; Morgan, Jonathan R -FS <jonathan.morgan@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>
Cc: Cochran, Shawn M -FS <shawn.cochran@usda.gov>
Subject: RE: GHFR insecticide background

Hi Adrienne – Thanks for your inquiry. Please submit your technical input as required on time on Friday, February 7. I'd like to start reviewing this and other important inputs over the weekend. As you suggested, please send an addendum related to these insecticides on Monday at the latest.

(b)(5); Deliberative Process Privilege
[redacted]

Richard Raione, COR, PG, CPG, CGWP
District Ranger
Forest Service
Gauley Ranger District, Monongahela National Forest
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f: 304-846-4307
richard.raione@usda.gov
932 North Fork Cherry Road
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Caring for the land and serving people

From: Nottingham, Adrienne C -FS
Sent: Thursday, February 6, 2020 5:07 PM
To: Bard, Jane F -FS <jane.bard@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>
Subject: RE: GHFR insecticide background

Richard,

Thank you for sending this information out. I quickly reviewed the attached document, but do not see where it specifically states what pesticides will be used for this project.

(b)(5); Deliberative Process Privilege
[redacted]

Thanks,

Adrienne Nottingham, MS
Assistant Forest Soil Scientist
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From: Bard, Jane F -FS <jane.bard@usda.gov>
Sent: Thursday, February 6, 2020 4:52 PM
To: Raione, Richard P -FS <richard.raione@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>
Subject: GHFR insecticide background

Jay asked me to write up a little more detail on the scope and scale of potential insecticide use in the GHFR project, to help with the context and intensity. Danielle Martin's email gives a potential list of insecticides currently in use elsewhere in the state for forestry.

Richard reviewed it today, and asked me to add a couple things, which I did prior to sending this out. Jay asked me to send it to the specialists who had asked for more details.

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Caring for the land and serving people

From: Martin, Danielle K -FS <danielle.k.martin@usda.gov>
Sent: Thursday, February 6, 2020 10:04 AM
To: Bard, Jane F -FS <jane.bard@usda.gov>
Subject: Fwd: insecticides in WV

Hi Jane,

Below is a list of pesticides that the WVDA uses. I will continue to ask other partners.

Danielle Martin
Forest Pathologist
USDA Forest Service
Morgantown, WV
Cell: 304.276.4171

From: Carrington, Kristen <kcarrington@wvda.us>

Sent: Thursday, February 6, 2020 10:02:23 AM

To: Martin, Danielle K -FS <danielle.k.martin@usda.gov>

Subject: RE: insecticides in WV

I don't really have a set list but the chemicals we use are:

EAB - emamectin benzoate brand name Tree-age

HWA- imidacloprid, we use Coretect for soil treatments and Ima-jet for tree IV

HWA- dinotefuran, Safari we don't use this chemical but I think the NPS does

We haven't done any treatments for BBD. I am going to use Neem oil on the beech orchard for BLD but that is made from a plant.

This is all I could think of. I hope it helps!

Kristen 😊

From: Martin, Danielle K -FS <danielle.k.martin@usda.gov>

Sent: Wednesday, February 5, 2020 3:18 PM

To: Carrington, Kristen <kcarrington@wvda.us>

Subject: insecticides in WV

[NOTICE: This email came from a sender outside of the WVDA organization. Please be careful when opening attachments and/or clicking links in this email.]

Hey Jane Bard called requesting a list of insecticides commonly used in WV for controlling insect pests such as EAB, HWA, BBD (in the case of BBD it would be a herbicide). Is there such a list you can think of?

Thanks for any info.

Danielle K. H. Martin
Forest Pathologist

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Morgantown Field Office

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Caring for the land and serving people

ADDRESS CHANGE: As part of the OneUSDA initiative, all Forest Service email addresses have been changed from **@fs.fed.us** to **@usda.gov**. Please update your address book to include my new email address: danielle.k.martin@usda.gov

Stevens, Karen L -FS

From: Bard, Jane F -FS
Sent: Thursday, January 16, 2020 4:08 PM
To: Martin, Jay - FS; Fry, John - FS; Brake, Timothy -FS
Cc: Mullins, Amelia -FS
Subject: FW: GHFR New Timber Units and Temporary Roads layer
Attachments: GHFR_ProposedTimberUnits_011620.CPG; GHFR_ProposedTimberUnits_011620.dbf; GHFR_ProposedTimberUnits_011620.prj; GHFR_ProposedTimberUnits_011620.sbn; GHFR_ProposedTimberUnits_011620.sbx; GHFR_ProposedTimberUnits_011620.shp; GHFR_ProposedTimberUnits_011620.shp.xml; GHFR_ProposedTimberUnits_011620.shx; GHFR_TemporaryRoads_011620.CPG; GHFR_TemporaryRoads_011620.dbf; GHFR_TemporaryRoads_011620.prj; GHFR_TemporaryRoads_011620.sbn; GHFR_TemporaryRoads_011620.sbx; GHFR_TemporaryRoads_011620.shp; GHFR_TemporaryRoads_011620.shp.xml; GHFR_TemporaryRoads_011620.shx

I looked over these shapefiles, and see that you captured the drop units that Amy and I had agreed on, and added a fuel break around the north side of Summit Lake (5 acres). That all looks correct, but thought I'd send it on to John and Jay, in case they wanted to check the fuel break, or discuss with you how it would be shown on the maps.

The total timber harvest acreage dropped down to 2811 acres, but the acres we dropped were portions of stands that would have had stream buffers, were parking lot inclusions and other factors that might have excluded them in implementation anyway.

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From: Brake, Timothy -FS <timothy.brake@usda.gov>
Sent: Thursday, January 16, 2020 2:36 PM
To: Bard, Jane F -FS <jane.bard@usda.gov>
Cc: Mullins, Amelia -FS <amelia.mullins@usda.gov>
Subject: GHFR New Timber Units and Temporary Roads layer

OK, Look these layers over and let me know what you think. They reflect the changes from the meeting yesterday. I'll be in till noon tomorrow so sooner rather than later!

Stevens, Karen L -FS

From: Raione, Richard P -FS
Sent: Wednesday, February 19, 2020 5:21 PM
To: Conner, Tami -FS; Cober, William J -FS; Edwards, Matthew J -FS; Morgan, Jonathan R -FS; Bard, Jane F -FS; Fry, John - FS
Subject: FW: WSR Study report

(b)(5); Deliberative Process Privilege

[redacted]

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From: Cober, William J -FS
Sent: Wednesday, February 19, 2020 3:01 PM
To: Raione, Richard P -FS <richard.raione@usda.gov>
Cc: Cober, William J -FS <william.cober@usda.gov>
Subject: FW: WSR Study report

Richard
Here is Matt and my email chain. See below.
b. Scenic and Recreational Rivers. A range of vegetation management and timber harvest practices are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character.

(b)(5); Deliberative Process Privilege

[redacted]

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From: Edwards, Matthew J -FS
Sent: Wednesday, February 19, 2020 11:38 AM
To: Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

(b)(5); Deliberative Process Privilege

[redacted]

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From: Cober, William J -FS
Sent: Wednesday, February 19, 2020 11:31 AM
To: Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>
Cc: Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

(b)(5); Deliberative Process Privilege
[redacted]

b. Scenic and Recreational Rivers. A range of vegetation management and timber harvest practices are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character.

(b)(5); Deliberative Process Privilege
[redacted]

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From: Edwards, Matthew J -FS
Sent: Wednesday, February 19, 2020 11:20 AM
To: Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

(b)(5); Deliberative Process Privilege
[redacted]

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From: Cober, William J -FS
Sent: Wednesday, February 19, 2020 8:23 AM
To: Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Piehler, Kirk G -FS <kirk.piehler@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>; Cober, William J -FS <william.cober@usda.gov>
Subject: RE: WSR Study report

I found some additional information that I feel ties to our Forest Plan. Forest-wide Management Direction: Chapter II page 37, ***Standard WS03 – When management actions are proposed that may compromise the outstandingly remarkable value, classification, or free-flowing character of an eligible Wild and Scenic River segment, a suitability study shall be completed for that eligible river segment prior to initiating the action.***

(b)(5); Deliberative Process Privilege [redacted]

https://www.nps.gov/subjects/rivers/consultation-instructions.htm

Instructions for consulting with the National Park Service regarding NRI compliance issues:

The **Council on Environmental Quality (CEQ)**, under 5(d)(1) Wild and Scenic River Act authority, provides guidance to federal agencies with permitting and/or granting authority for projects on or near rivers listed on the NRI. In accordance with **executive memorandum**, all agencies must "take care to avoid or mitigate adverse effects" to rivers identified in the Nationwide Rivers Inventory. For projects on federal lands, check with the local land manager to verify that the segment is still considered 'eligible and/or suitable' in their most recent land or resource management plan.

The National Park Service (NPS) is available to assist other federal agencies in carrying out this process; however, it is the role of the federal permitting agency (not the National Park Service) to ensure that effects to NRI rivers are avoided or mitigated. **Assessment/Environmental Impact Statement process, entities proposing projects that could affect NRI, should research river value information to find up to date information.** **Here is a sampling of research resources.** Do not limit your research to these national sources; supplement this with other national as well as state and local sources.

If you do not hear from NPS within 30 days, CEQ states that you may proceed with the following in mind:

1. Determine whether the proposed action could affect an NRI river.

- Check the current regional/state NRI list to determine whether the proposed action could affect an NRI river (i.e., is the proposed action location in the vicinity of the NRI segment).
- If an NRI river segment could be affected by the proposed action, an environmental assessment or and environmental impact statement may be required depending on the significance of the effects.

- If the action would not affect an NRI river, no further action is necessary regarding the NRI.

2. Determine whether the proposed action could have an adverse effect on the natural, cultural, and recreational values of the NRI segment. These values are listed as "outstandingly remarkable values" (ORVs) on the state NRI list. Adverse effects on NRI rivers may occur under conditions which include, but are not limited to:

- Destruction or alteration of all or part of the free flowing nature of the river;
- Introduction of visual, audible, or other sensory intrusions which are out of character with the river or alter its setting;
- Deterioration of water quality; or
- Transfer or sale of property adjacent to an NRI river without adequate conditions or restriction for protecting the river and its surrounding environment.

3. Determine whether the proposed action could foreclose options to classify any portion of the NRI segment as wild, scenic, or recreational river areas.

- In some cases, impacts of a proposed action could be severe enough to preclude inclusion in the Wild and Scenic River System, or lower quality of the classification (e.g., from wild to recreational). If the proposed undertaking could effectively downgrade any portion of the NRI segment, you should consult with NPS.
- Proposed actions (whether uses or physical changes), which are theoretically reversible, but which are not likely to be reversed in the short term, should be considered to have the effect of foreclosing for all practical purposes Wild and Scenic River status. This is because a river segment, when studied for possible inclusion in the Wild and Scenic River System, must be judged as it is found to exist at the time of the study, rather than as it may exist at some future time.
- If a proposal, including one or more alternatives, could have an adverse effect on an NRI river, an EA, or if the effects are significant, an EIS must be prepared.

4. Incorporate mitigation/avoidance measures in the proposed action to the maximum extent feasible within the agency's authority.

If NPS does not respond to your request for assistance within 30 days, you may proceed with completing preparation and circulation of the environmental assessment or EIS as planned. Even where NPS has been unable to comment on the environmental assessment or DRAFT EIS, you are still obligated to "…take care to avoid or mitigate adverse effects on the rivers identified in the Nationwide Inventory…"

Last updated: February 27, 2019

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From: Piehler, Kirk G -FS
Sent: Thursday, February 13, 2020 3:54 PM
To: Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>
Cc: Conner, Tami -FS <tami.conner@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Cober, William J -FS <william.cober@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: RE: WSR Study report

Matt,
W.J. is out, so I took a look at Forest Plan and handbook references for WSR.

In the FP, Chapter III, page III-6, is following information:

Portions of four eligible Wild and Scenic River segments occur within this prescription area, totaling 25.3 miles. River miles, classification, and values are described in the table below. Rivers are currently managed according to Wild and Scenic River Act guidance for their classification, and to maintain their outstandingly remarkable values and free-flowing status.

Eligible Wild and Scenic River Segments in MP 3.0			
River Name	**Classification**	**Outstandingly Remarkable Values**	**Miles**
North Fork Cherry River	Recreational	Scenery, Recreation	10.8
Glady Fork	Recreational	Recreation	2.8
Laurel Fork	Scenic	Recreation	4.4
Williams River	Recreational	Scenery, Recreation	7.3

Your reference to WS03, Chapter II, identifies suitability study requirement for actions that may compromise ORV. I could not find specifics in handbook for that type of study or reference to ¼ threshold, but do not doubt presence in document. I did find the following for veg. management; there is specific reference to Recreational Classification applicable to North Fork Cherry River.

WO AMENDMENT EFFECTIVE DATE: 01/30/2015 DURATION: This amendment is effective until superseded or removed. 1909.12_80 Page 32 of 41 **FSH 1909.12 – LAND MANAGEMENT PLANNING HANDBOOK CHAPTER 80 – WILD AND SCENIC RIVERS**

9. Vegetation Management.

a. Wild Rivers. Cutting of trees and other vegetation is not permitted except when needed in association with a primitive recreation experience, to protect users, or to protect identified outstandingly remarkable values. Examples of such exceptions include activities to maintain trails or suppress wildfires. Prescribed fire and wildfires managed to meet resource objectives may be used to restore or maintain habitat for threatened, endangered, or sensitive species or restore the natural range of variability.

b. Scenic and Recreational Rivers. A range of vegetation management and timber harvest practices are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character.

Kirk Piehler
Natural Resources and Engineering Group Leader

Forest Service
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From: Conner, Tami -FS
Sent: Thursday, February 13, 2020 1:26 PM
To: Piehler, Kirk G -FS <kirk.piehler@usda.gov>
Subject: FW: WSR Study report

Can we discuss when you get a minute?

Tami Conner
Ecosystem Staff Officer
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From: Raione, Richard P -FS
Sent: Thursday, February 13, 2020 1:24 PM
To: Conner, Tami -FS <tami.conner@usda.gov>
Subject: FW: WSR Study report

fyi

Richard Raione, COR, PG, CPG, CGWP
District Ranger
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From: Edwards, Matthew J -FS
Sent: Thursday, February 13, 2020 10:26 AM

To: Cober, William J -FS <william.cober@usda.gov>
Cc: Raione, Richard P -FS <richard.raione@usda.gov>; Martin, Jay - FS <Jay.Martin2@usda.gov>
Subject: WSR Study report

WJ, do you have access to the Wild and Scenic Rivers study report that was conducted sometime in the 1980s or 1990s?

There is language in the LRMP (page II-37) that states that river corridors include the shorelines that generally extend ¼ mile on either side of the eligible river segments. Standard WS03 states*: When management actions are proposed that may compromise the outstandingly remarkable value, classification, or free-flowing character of an eligible WSR segment, a suitability study shall be completed for that eligible river segment prior to initiating actions.* We are (b)(5); Deliberative Process Privilege [redacted]

(b)(5); Deliberative Process Privilege [redacted]

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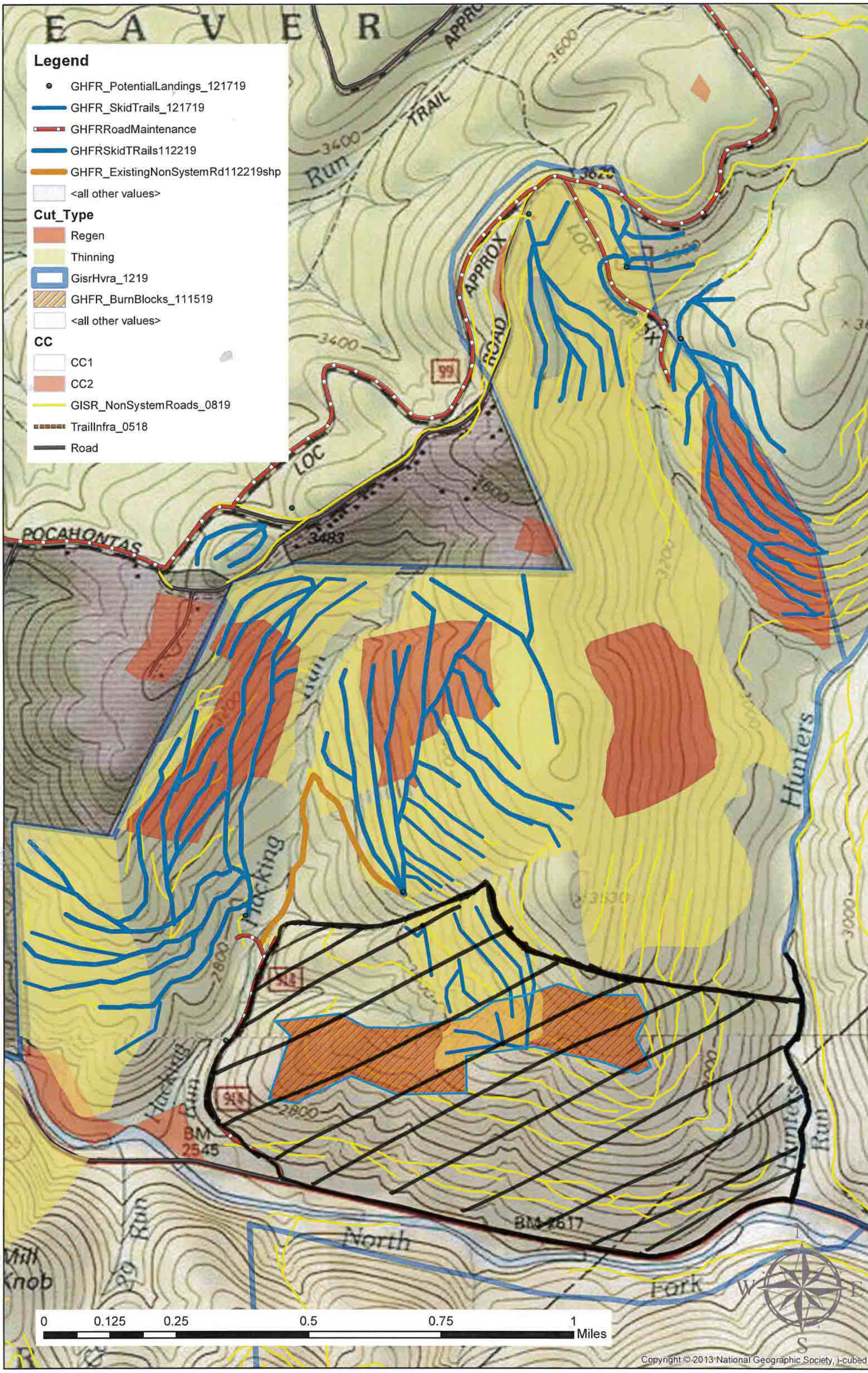
Legend
GHFR_PotentialLandings_121719
GHFR_SkidTrails_121719
GHFRRoadMaintenance
GHFRSkidTRails112219
GHFR_ExistingNonSystemRd112219shp
<all other values>
Cut_Type
Regen
Thinning
GisrHvra_1219
GHFR_BurnBlocks_111519
<all other values>
CC
CC1
CC2
GISR_NonSystemRoads_0819
TrailInfra_0518
Road
0 0.125 0.25 0.5 0.75 1 Miles
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Gauley Healthy Forest Restoration Act – CE

Description of management activities:

Thinning – Forest Plan, p. A2 "The thinning method is an intermediate cut that . . . removes high reisk (trees that most likely will not survive until the regeneration harvest is initiated), low quality, diseased, and over mature trees to increase the health, development, and growth of the residual trees in a stand. . . . Thinning is applicable to all of the forest types found on the Forest."

Clearcutting – Forest Plan, p. A2 " The clearcutting method harvests most or all of the trees within a stand in one removal. Typically, some reserve trees are left to meet wildlife habitat or other resource needs."

Associated with the clearcutting treatment is **Site Preparation with Hand Tools for Natural Regeneration** – Forest Plan p. A15. "The objective of site preparation is to enhance germination, sprouting, and survival of natural regeneration. Site preparation includes cutting down residual trees between 1 and 5 inches in diameter during or immediately after a regeneration harvest. Normally red spruce, hemlock, dogwood, serviceberry and shrub species that produce mast for wildlife are not cut. This treatment opens up the forest floor to increased sunlight to improve seed germination potential, promotes sprouting of cut trees, and reduces shading that could inhibit the growth of shade intolerant and moderately tolerant species."

Associated with all timber harvest, where vines occur is **Vine Control** – Forest Plan p. A16. "Vines interfere with the growth of trees, causing decreased growth, deformity and broken tops. Broken tops allow entrance for insect and diseases, decreasing the vigor of a stand. Vines are severed with cutting tools near the ground. (This treatment is normally done three growing seasons prior to harvest.)

Herbicide --Forest Plan p. A16. This treatment will be used to control competition with diseased beech sprouts, only in stands where beech bark disease occurs and has resulted in dense competition that excludes tree and understory species. In most cases, it will be possible to control competition with diseased beech sprouts by cutting alone, as described above in **Site Preparation with Hand Tools for Natural Regeneration**. For herbicide treatment of diseased beech, herbicides would be applied to individual stems by stem injection (cut surface treatment) or basal spray.

This table outlines how MNF Forest Plan standards should be applied with respect to the soil and watershed resources for the Gauley RD CE project. The purpose of this document is to provide context and direction for design criteria and mitigation that may be used for line officer review. This information may also be used in implementation guides.

MNF Forest Plan Reference	Applicable Proposed Actions & Context	Design Criteria & Mitigations
Standard SW03	(b)(5); Deliberative Process Privilege [redacted]	[redacted]
Standard SW04	[redacted]	[redacted]
Standard SW06	[redacted]	[redacted]
Standard SW07	[redacted]	[redacted]

(b)(5); Deliberative Process Privilege

	[redacted]	
Standard SW08		
Guideline SW11		
Guideline SW13		
Guideline SW15	spodosols.	
Aquatics & Hydrology		

Standard SW23	(b)(5); Deliberative Process Privilege [redacted]
Guideline SW26	[redacted]
Guideline SW27	[redacted]
Standard SW34	[redacted]
Standard SW35	[redacted]
Standard SW36	[redacted]
Standard SW37	[redacted]

(b)(5); Deliberative Process Privilege

	[redacted]	
Standard SW40		
Standard SW44		
Standard SW45		
Standard SW46		
Standard SW51		
SW53		

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(b)(5); Deliberative Process Privilege

Standard VE32	[redacted]	[redacted]
Standard WF14	[redacted]	[redacted]
Guideline WF19 / WF21	[redacted]	[redacted]
Standard RF06	[redacted]	[redacted]
Guideline RF13	[redacted]	[redacted]
Standard RF14	[redacted]	[redacted]
Standard RF15	[redacted]	[redacted]

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This table outlines how MNF Forest Plan standards should be applied with respect to the soil and watershed resources for the Gauley RD CE project. The purpose of this document is to provide context and direction for design criteria and mitigation that may be used for line officer review. This information may also be used in implementation guides.

MNF Forest Plan Reference	Applicable Proposed Actions & Context	Design Criteria & Mitigations
Aquatics & Hydrology		
Standard RF06	(b)(5); Deliberative Process Privilege [redacted]	[redacted]
Guideline RF13	[redacted]	[redacted]

Stevens, Karen L -FS

From: Tolley, Tim -FS
Sent: Thursday, February 6, 2020 3:23 PM
To: Tasker, Kyle - FS
Cc: Tolley, Tim -FS
Subject: GHFR - Hydro report
Attachments: GHFRP_Effects_Hydro.docx

It is essentially done. I'm just cleaning it up a bit. Hopefully it is sufficiently thorough.

Hopefully your writing is going well. Let me know if you need anything else from me.

Tim

Timothy Tolley
Hydrologist
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Stevens, Karen L -FS

From:	Coleman, Amy - FS
Sent:	Friday, February 7, 2020 2:20 PM
To:	Brooks, Gregory - FS
Cc:	Tarter, Kim - FS; Tasker, Kyle - FS; Tanner, Cheryl L -FS; Conner, Tami -FS; Martin, Jay - FS; Raione, Richard P -FS; Torres, Amy S -FS
Subject:	GHFR BA - TES Plants
Attachments:	GHFR_Biological Assessment_TEPlants_020720.doc; GHFR_Biological Evaluation_TESPlants_ 020720.doc

Hi Greg,

Please find the Biological Assessment for the Gauley Healthy Forest Restoration Project with the completed TE Plants section and my edits attached. I have also saved it in the "Botany" folder in the GHFR project file on Pinyon. I have also attached the Biological Evaluation for TES Plants. Please let me know if you have any questions.

Best,

Amy Coleman
South Zone Ecologist
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Caring for the land and serving people

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Tuesday, December 17, 2019 10:27 AM
To: Torres, Amy S -FS
Cc: Bard, Jane F -FS; Tarter, Kim - FS; Raione, Richard P -FS; Coleman, Amy - FS; Tasker, Kyle - FS; Hale, Gavin -FS; Walter, Terry J -FS; Fry, John - FS; Tolley, Tim -FS; Brake, Timothy -FS; Tanner, Cheryl L -FS; Cober, William J -FS; Wilson, Will -FS; Stevens, Karen L -FS; Ash, Jeremy - FS; Artale, Diane -FS; Mullins, Amelia -FS; Conner, Tami -FS; Edwards, Matthew J -FS; Whetsell, Carol L -FS
Subject: GHFR Landing Question

Hi Amy,

I started to review some of our proposed action shapefiles this morning and realized I don't have a good understanding of how landings play into the CE category we are using for GHFR. About half (17) of the landings proposed for use are new.

Can you provide some information on this? Also, more specifically, do landings count towards the treatable acres and how will they be treated after the project is implemented.

Adrienne Nottingham, MS
Assistant Forest Soil Scientist

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Caring for the land and serving people

Stevens, Karen L -FS

From: Bard, Jane F -FS
Sent: Thursday, January 30, 2020 2:43 PM
To: Martin, Jay - FS; Torres, Amy S -FS
Cc: Raione, Richard P -FS; Tarter, Kim - FS; Fry, John - FS
Subject: GHFR meeting notes
Attachments: GHFRmeetingsWithPublicGroupsDECtoJan.docx

Here are my notes on 5 recent meetings where the GHFR project was discussed, for the collaboration folder. I have a couple other documents to scan and send in: the news article referring to the city council meeting, and the attendee list from the fire department.

John, I thought you might want to look over the one with the fire department and see if you have anything to add or change in these notes. Thanks.

Jane Bard
Silviculturist
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Caring for the land and serving people

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Friday, February 7, 2020 5:32 PM
To: Raione, Richard P -FS; Torres, Amy S -FS; Martin, Jay - FS
Cc: Bard, Jane F -FS; Tolley, Tim -FS; Tasker, Kyle - FS; Coleman, Amy - FS; Hale, Gavin -FS; Tarter, Kim - FS; Tanner, Cheryl L -FS; Morgan, Jonathan R -FS; Connolly, Stephanie -FS; Brooks, Gregory - FS; Conner, Tami -FS
Subject: GHFR Soils Information

GHFR Team,

I have completed the CE checklist and soils report. I believe they are filed in the appropriate locations in box. Briefing papers, supplemental documentation and references cited have all been filed in the Soils folder.

(b)(5); Deliberative Process Privilege

[redacted]

I will be back in the office M-W next week if you have any questions. Thank you,

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Caring for the land and serving people

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Thursday, January 23, 2020 10:32 AM
To: Mullins, Amelia -FS; Fry, John - FS
Subject: GHFR- Thinning above Summit Lake

Amy and/or John:

(b)(5); Deliberative Process Privilege [redacted]

Looking at the soils layer in that area there are wet soils and given the topography I'd say that is accurate. If you all get back in today give me a shout.

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Assistant Forest Soil Scientist

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Caring for the land and serving people

Stevens, Karen L -FS

From: Nottingham, Adrienne C -FS
Sent: Monday, July 27, 2020 1:24 PM
To: Owen, Michael D -FS; Tasker, Kyle - FS
Cc: Landress, Chad M -FS; Tolley, Tim -FS
Subject: RE: GHFR

Awesome job Kyle! Mike- thank you for sharing and keeping me in the loop.

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Assistant Forest Soil Scientist

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Caring for the land and serving people

From: Owen, Michael D -FS <michael.owen@usda.gov>
Sent: Monday, July 27, 2020 1:07 PM
To: Tasker, Kyle - FS <kyle.tasker@usda.gov>
Cc: Landress, Chad M -FS <chad.m.landress@usda.gov>; Tolley, Tim -FS <tim.tolley@usda.gov>; Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>
Subject: RE: GHFR

Thanks for replying Kyle.

(b)(5); Deliberative Process Privilege

[redacted]

Thanks Kyle.

Michael D. Owen
Aquatic Ecologist

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Monongahela National Forest, Supervisor's Office

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Caring for the land and serving people

From: Tasker, Kyle - FS
Sent: Monday, July 27, 2020 12:00 PM
To: Brooks, Gregory - FS <Gregory.Brooks@usda.gov>
Cc: Owen, Michael D -FS <michael.owen@usda.gov>
Subject: RE: GHFR

Hey Greg,

(b)(5); Deliberative Process Privilege [redacted] It does state that "Excessive sedimentation was likely a primary cause of the historical decline of the candy darter" (pg.39).

Here is the citation:
U.S. Fish and Wildlife Service. 2018. Species Status Assessment (SSA) Report for the Candy Darter (*Etheostoma osburni*) Version 1.5. U.S. Fish and Wildlife Service. Northeast Region. Hadley, MA. 94 pgs.

Best,

Kyle Tasker
Fisheries Biologist

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Caring for the land and serving people

From: Brooks, Gregory - FS
Sent: Friday, July 24, 2020 4:22 PM
To: Tasker, Kyle - FS <kyle.tasker@usda.gov>
Cc: Owen, Michael D -FS <michael.owen@usda.gov>
Subject: GHFR

Mr. Kyle,

I have been currently, trying to write a wildlife BE for terrestrial RFSS, MIS, BCC. However, I was using information from the BA to assisted with some of the T & E information that needs to go into the document and stumbled across this statement in the BA package and need your assistance.

"Hybridization is expected to be the greatest threat to this species, although approximately half of the historic range of the species was lost before the threat of hybridization because of sedimentation."

Is there a peer review citation that supports this statement. Please provide. Thanks and have a wonderful weekend.

Respectfully,

Gregory Brooks (Certified Wildlife Biologist ®)
Forest Wildlife & Ecology Program Manager

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Caring for the land and serving people

Acidic Deposition Briefing Paper

Introduction

Soils within the Gauley Healthy Forest Restoration (GHFR) project area are mapped as having high acidic deposition risk (USDA Forest Service, 2006). Acid deposition negatively impacts the soil resource (Cronan and Grigal, 1995; Grigal, 2000; O'Dea, 2016). The Monongahela National Forest (MNF) Forest Plan speaks directly to land management actions that have the potential to disturb these soils (SW08 and TR05) (USDA Forest Service, 2006). Standard SW08 states that management activities that have the potential to contribute to soil nutrient depletion shall be evaluated for the potential effects of depletion in relation to on-site acid deposition conditions (USDA Forest Service, 2006). Typically, this standard is met through site-specific soil sampling for soil chemistry analysis (USDA Forest Service, 2006: SW10). Although soil samples were not taken specifically for this project, 11 soil pedons and corresponding soil chemistry data are available from within the project area from the same geology and were used to determine the base line condition for the project area and the potential effects for the proposed activities.

Acidic Deposition and the Soil Resource

Soil acidification is the net result of acid inputs and mineral weathering (breakdown of bedrock) (Brady and Weil, 2002). Soil acidification is a natural process, especially in forest ecosystems (Brady and Weil, 2002). Soils can be naturally acidified through processes such as leaching (downward movement of precipitation through the soil) and vegetative uptake (Brady and Weil, 2002; Gbondo-Tugbawa and Driscoll, 2003). When acidifying soil processes exceed the rate of base cation weathering, the soil becomes more acidic. On the MNF, soil acidifying processes often exceed mineral weathering for three reasons: 1) weathering rates of bedrock are much slower than acidification (USGS, 1999), 2) many geologies (types of bedrock) do not naturally have high amounts of base cations or alkalinity (Schnably, 2003), and 3) the region receives elevated amounts of nitrogen and sulfur compounds (acid deposition) from emission sources such as coal-fired power plants and automobiles (USDA Forest Service, 2006; https://www.srs.fs.fed.us/airqualityportal/critical_loads/map_terr.php ; https://webcam.srs.fs.fed.us/impacts/acid/index.shtml#).

Acidic deposition is a complex process that can be attributed to the Industrial Age and subsequent increase in atmospheric pollutants (Cowling and Nilsson, 1995; Gorham, 1998; Robarge and Johnson, 1992; Reuss, 1983). Acid deposition occurs when acidic atmospheric pollutants (primarily sulfur and nitrogen compounds) are deposited in ecosystems through either dry (aerosols) or wet (precipitation and fog) deposition in the form of low ionic strength sulfuric and nitric acid (Cowling and Nilsson, 1995; Gorham, 1998; Robarge and Johnson, 1992; Reuss, 1983; Sparks, 2003). The most commonly recognized type of acidic deposition is acid rain. During the past century in particular, the Central Appalachians (and the MNF) have received some of the highest acidic deposition rates in the nation, primarily due to its location downwind of coal-fired power plants that historically had little to no pollution control (Elias et al., 2009). This, coupled with slow mineral weathering rates and inherently nutrient-poor and acidic geologies, has resulted in the majority of soils on the MNF having moderate to high acidic deposition risk.

These high rates of acidic deposition and accelerated soil acidification result in both decreased soil fertility and productivity (Cronan and Grigal, 1995; Grigal, 2000; O'Dea, 2016). Consequently, acid deposition negatively impacts both terrestrial and aquatic systems (Cronan and Grigal, 1995; Grigal, 2000; O'Dea, 2016). Acid deposition causes direct effects to plant foliage as well as indirect effects on vegetation associated with changes in soil chemistry (O'Dea, 2016).

On the MNF, soils that have been impacted by acidic deposition have distinctive soil chemical and nutrient cycling properties. These soils have limited stores of plant available base cations, including calcium which is essential to healthy tree growth (Huntington 2000; Jenkins 2002; Johnson and Todd 1990). The majority of nutrient capitol and alkalinity in these soils are contained in the organic horizon (comprised of decomposing plant material), the A horizon (commonly referred to as the topsoil) and transition horizons – AB or BA. Leaf litter and plant material, as well as the nutrients and base cations they contain, are deposited on the soil surface and nutrient cycling is limited to the uppermost soil horizons. Management actions that have the potential to disrupt or alter this process, such as timber removal, which permanently removes nutrients offsite and logging system construction and use (temporary road, landings) which disturbs the uppermost soil horizons, will result in adverse effects to the soil resource. Disturbance of organic and topsoil horizons results in nutrient loss through erosion and accelerated leaching due to the disruption of the soil microbial community. The subsoil typically has high levels of plant available aluminum which is known to be toxic to vegetation (Cronan and Grigal, 1995). To summarize, acidic deposition and heavy soil disturbance, soil loss, and soil mixing could result in soil chemistry that is unfavorable for plant growth and survival due to nutrient loss (Cronan and Grigal, 1995).

The ratio of calcium to aluminum in soils has been used to assess the effects of acidic deposition on forest productivity (Joslin and Wolfe, 1989; Cronan and Grigal, 1995). Soil samples were not taken specifically for the GHFR project, but past soil pedons (11) and corresponding soil chemistry analyses are available from this project area and assessed for calcium to aluminum ratios (https://agsci.psu.edu/aasl/soil-testing/aluminum-stress-test). See the table below which displays the risk of adverse impacts per range of calcium to aluminum ratios (Cronan and Grigal, 1995).

Table 1. Calcium to aluminum ratios and respective risk of adverse impacts (Adapted from Cronan and Grigal, 1995).

Lab Result Ranges for Ca:Al Molar Ratio	Risk of Adverse Impacts to Forest Health
1.0	50% risk of adverse impacts
0.5	75% risk of adverse impacts
</= 0.2	Nearly 100% risk of adverse impacts

Results and Interpretation

Full Soil Pedon Sampling

Table 2 displays the calcium to aluminum (Ca:Al) molar ratios per horizon. Ca:Al ratios of 1.0 indicate a 50% risk of adverse impacts, Ca:Al ratios of 0.5 indicate a 75% risk of adverse impacts and Ca:Al ratios of less than or equal to 0.2 indicate nearly a 100% risk of adverse impacts. Soil chemistry results show soils throughout the project area have high acid deposition risk. The highest Ca:Al ratios can be seen in the uppermost part of the soil profile (organic and A horizons). This supports the aforementioned statement that the majority of calcium and alkalinity in these soils is contained in the uppermost horizons and provides justification for why disturbance of these horizons is detrimental as defined by FSH 2550. The results for the most part show that the Ca:Al ratio decreases with increasing soil depth. The slight increase in Ca:Al values observed in the deepest soil horizons indicate that the parent material (geology) does contain some base cations. However, it is unlikely that weathering of base cations would exceed the amount of soil nutrients and alkalinity lost during construction of temporary roads and landings given current leaching rates and accelerated leaching due to acid deposition.

Table 2. Calcium to aluminum molar ratios per horizon

Soil Pedon ID	Horizon	Depth (cm)	Ca:Al Molar Ratio
FS14WV075001	Oe	2-5	70.67
	A	5-15	0.33
	BA	15-32	0.16
	Bw	32-71	0.19
	Bs	71-101	0.3
	C	101-120	1.21
FS14WV075002	Oe	5-13	36.57
	Oa	13-20	2.66
	A	20-32	0.13
	BE	32-38	0.12
	Bs	38-67	0.12
	Bhs	67-101	0.2
FS04WV025005	A	0-3	0.6
	AB	3-13	0.1
	Bt1	13-25	0.1
	Bt2	25-48	0.1
	Btx1	48-78	0.1
	Btx2	78-104	0.1
	Btx3	104-127	0.1
	BC	127-152	0.1
FS04WV025004	O/A	0-2	1.8
	BA	2-13	0.3
	Bw	13-30	1.1

	Bt1	30-51	0.2
	Bt2	51-78	0.1
	Bt3	78-109	0.1
	Btx	109-130	0.2
	BC	130-145	0.2
FS04WV025003	A	5-10	0.8
	BA	10-20	0.2
	Bt	20-53	0.1
	Btx1	53-74	0.1
	Btx2	74-91	0.1
FS04WV025001	A	0-8	5.1
	AE	8-13	1.9
	BA	13-20	0.4
	Bt1	20-41	0.3
	Bt2	41-58	0.3
	Bw1	58-89	0.3
	Bw2	89-109	0.1
	BC	109-152	0.4
FS04WV101001	A	0-5	3.7
	E	5-10	0.5
	Bt2	10-25	0.1
	Bt1	25-48	0.1
	Bt3	48-61	0.1
FS05WV075001	Oa	2.5-7.5	0.23
	A	7.5-11	0.2
	E	11-19	0.1
	Bh	19-26	0.08
	Bs1	26-44	0.04
	Bs2	44-64	0.16
	C	64-93	0.1
FS05WV075002	Oa	2.-6.5	6.75
	A	6.5-11	0.42
	E	11-21	0.18
	Bt1	21-46	0.08
	Bt2	46-74	0.12
	BC	74-99+	0.15
FS05WV075004	A	2-14	1.15
	BA	14-27	1.54
	Bt1	27-50	2
	Bt2	50-100	1.24

	Bt3	100-126	1.05
	BC	126-153	1
FS05WV075006	Oa	2-4	1.09
	A	4-9	0.62
	E1	9-20	0.19
	E2	20-28	0.08
	Bw1	28-47	0.13
	Bw2	47-64	0.07
	Bw3	64-82	0.12
	Bw4	82-112	0.06
	Bw5	112-132	0.05
	BC	132-158+	0.17

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GAULEY HEALTHY FOREST RESTORATION CE

FIRE AND FUELS EFECTS

/S/ John Fry 02/24/2020

Assistant Fire Management Officer

For most of the 20th century, any form of wildland fire, was quickly suppressed for fear of uncontrollable and destructive wildfires. In the 1960's, policies governing wildfire suppression changed due to ecological studies that recognized fire as a natural process. Today, polices advocating complete fire suppression have been replaced by policy that allows fire to act as a tool to meet resource objectives. Fire played an important role in the development and maintenance of oak forest in the eastern United States (Van Lear, Brose, and Keyser 2000). Declines of oak forests have been noted throughout much of the East and are often attributed to reduced frequency. Prescribed fire can be an important tool for regenerating oak stands by reducing competition and oak sprout vigorously after fire.

The identified proposed prescribed and fuels treatments are in conjunction with the Monongahela National Forest Plan. The Forest-wide desired condition is to use fire as a tool to achieve and maintain desired vegetative conditions and fuel levels. The Forest-wide goals and objectives of implementing fuels reduction and fuels break projects are to be located in areas that would reduce the wildfire risk to communities, municipal water supplies, and at risk federal land and prescribed fire would be used to mimic natural process to accomplish resource objectives.

Proposed Action

The proposed fire and fuels treatments include the creation and maintenance of fuel breaks adjacent to private property, municipal water sheds and valued recreation sites. Biomass would be removed or treated, thus allowing fuel loading and fire hazards to decrease. Prescribed fire would be reintroduced into fire-adapted ecosystems thus fulfilling the Forest Plan objectives and goals.

The purposed treatments would move the project area towards a more resilient landscape and reducing overall surface fuel loading in the stands being treated. Crown-to-crown contact would be eliminate where thinning activities occur. Without crown-to-crown contact the potential for crown fire development and the subsequent destruction of the trees on site would be greatly reduced. Overall, the probability of intense surface fires in mixed hardwood stands would be reduced.

Prescribed Burning:

The cumulative effects of periodic prescribed burning would be the reduction of hazardous fuels conditions and the reintroduction of fire into fire-adapted ecosystems thus fulfilling the Forest Plan.

The direct effects of implementing using prescribed fire would be a decrease in fuel loading. The proposed action would have a positive effect on restoring the natural fire regime by maintaining disturbances in ecosystems that have adapted over time to periodic short-return interval disturbances. Studies show that areas that have prescribed fire introduced prior to a wildfire exhibit lower rates of spread, less intensity, less severity, and a smaller final wildfire size. When combined with past, present and future activities this project would provide short term and long term positive contributions within the analysis boundary by reducing fuels and reintroducing fire into the ecosystem.

The effects would be a gradual decrease in fuel loadings. After a couple of burns, the effectiveness of prescribed burning would start to decline, at which time maintenance burns would be implemented every 5-10 years. Periodic prescribed burning would reduce hazardous fuel conditions and the reintroduction of fire into the fire adapted ecosystems thus fulfilling Forest Plan objectives and goals. There would also be a reduction in the probability of damage to private and public improvements should a wildfire occur, a reduction of fuel loading to provide for public and firefighter safety, and protection of public and private property adjacent to the burn units in the event of a wildfire. There would be a very low risk of any effects to private property during or following prescribed burn implementation.

Prescribed fire would generate primarily short term smoke emissions. Smoke would disperse quickly and have no effect on air quality parameters. The majority of emissions from smoke produced by prescribed fires should typically occur within the first 8 to 24 hours of the prescribed burn being initiated. Residual smoldering, with small amounts of smoke production would continue for several days afterward in 100 and 1000 hour fuels sizes, but should disperse quickly. It is expected that smoke from the prescribed burns could impact roads and commercial and residential areas downwind, causing reduced visibility and very short term local air quality reduction. Signage maybe be used to warn motorists to slow down along sections of roadways if visibility is greatly reduced. Based on limited to no direct or indirect effects to the air resource, there is limited potential for a cumulative effect to the air resource from the Proposed Action.

This activity would have no long-term negative effects on visitor safety and should increase public safety due to the decreased chance of wildfire from the controlled reduction of fuels. The proposed action would have a positive effect on restoring the natural fire regime by maintaining disturbances in ecosystems that have adapted over time to periodic short-return interval disturbances. Studies show that areas that have prescribed fire introduced prior to a wildfire exhibit lower rates of spread, less intensity, less severity, and a smaller final wildfire size. When combined with past, present and future activities this project would provide short term and long term positive contributions with the analysis boundary by reducing fuels and reintroducing fire into the ecosystem.

Mechanical Treatment:

Fuel breaks would be created by removing both understory and over story trees. Trees would be removed to allow for open canopy (no tree to tree contact). Hardwood species would be selected to remain because of their fire resistant properties. Tree density will vary with more open conditions closest to private property to encourage grasses and fade into a heavier density as distance from private property increase. The desired condition is a more natural appearance of forest transitioning to open conditions near private property. Any residual fuels left after treatment implementation will wither be burned (piles or broadcast burn) or mechanically treated (chipped). Subsequent maintenance at three to seven year intervals by mechanical treatments or by prescribed burning to remove encroaching vegetation and ladder fuels would be done to maintain their effectiveness.

The direct effects of would be a decrease in fuel loading. The effectiveness of the activities would decease as biomass increased. The indirect effects would result in fuel loadings slowly increasing within the project area without maintenance treatments. The treatments would decline in effectiveness over time, with mechanical treatment declining over a ten-year period. The three-to-ten year maintenance schedule of the fuel breaks provide a constant benefit to the analysis area by maintaining lighter fuel loadings and thus low fire intensity. The cumulative effects of the planned periodic maintenance treatments would assure that fuel loading would not increase to pre-treatment levels.

The desired condition from a Fire and Fuels perspective is the protection of life and property, the reduction of hazardous fuels accumulations and the restoration of a fire adapted and resilient ecosystem. The project's proposed vegetation management activities and use of prescribed fire are needed to help restore the project area's natural fire regime, reduce the intensity of a wildfire and subsequent damage to the public and/or private property.

References

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****Include in portion of document explaining spatial and temporal area of proposed actions***

Nearly all associated actions with the Gauley Healthy Forest Restoration (GHFR) project will only occur on portions of the North Fork of Cherry River, including the Little Lick Run catchment and all areas downstream to the confluence with the South Fork of Cherry to form the Cherry River. Approximately 5 acres of proposed actions would occur in the Cranberry watershed. The effects of the action within the Cranberry watershed are expected to be insignificant to populations of candy darter within this watershed. Thus, the aquatic spatial analysis area of this project is focused on those areas of the North Fork of Cherry and tributaries, as described above. The temporal boundary used to evaluate most direct, indirect effects to aquatics is approximately 10 years. This period was used because it best reflects the expected timeframe for most anticipated direct and indirect effects to occur in association with this project and allows analysis results to contain much greater certainty and less speculation than using a different time period.

Candy Darter (*Etheostoma osburni*) and Proposed Critical Habitat

Critical Habitat Description

The proposed critical habitat for the candy darter is approximately 370 linear stream miles (596 kilometers), subdivided into 5 units, 3 of which occur in West Virginia, while 2 occur in Virginia. Current proposed critical habitat units for the candy darter only includes areas where candy darter is known to persist and contain one or more the physical and biological factors (PBF) to support life-history processes critical to the conservation of the species. The area applicable to this project is Unit 5 – Upper Gauley unit, specifically Unit 5f – Cherry River, as all project actions are comprised fully within the lower half of the North Fork Cherry River (NFCR) watershed (HUC: 050500050401), approximately 7.5 miles of proposed critical habitat is located within the project area.

<u>Primary Constituent Elements</u>

The primary constituent elements are those specific elements of the PBF that provide for a species' life history processes and are essential to the conservation of the species. The following are the primary constituent elements identified for the candy darter as listed and how these elements are currently represented in the GHFR project area:

(1) Ratios or densities of nonnative species that allow for maintaining populations of candy darters
   - Specific ratios and/or densities of nonnative species are not known within the North Fork Cherry River, although historically the West Virginia Division of Natural Resources (WVDNR) has conducted trout stocking with rainbow, golden, brown, and hatchery brook trout during the spring and fall seasons. The WVDNR are proposing a change to current stocking practices, no longer stocking brown trout within candy darter range, which are known to prey upon darter species.

(2) A blend of unembedded gravel and cobble that allows for normal breeding, feeding, and sheltering behavior
   - The North Fork Cherry River does support the substrate necessary for normal habitat and feeding and sheltering behavior of candy darter. However, once tributaries begin having higher gradient, these desirable conditions begin to drop out and stream conditions are not suited for the candy darter. Embeddedness and fine sediment rates are slightly impaired for a forested system of this size compared to other sites across

the Forest. Table 1 below shows fine sediment occurrence at sites monitored in the project area exceed levels above what is considered to have an effect on aquatic biota (Edwards et al. 2007).

(3) Adequate water quality characterized by seasonally moderated temperatures and physical and chemical parameters (e.g., pH, dissolved oxygen levels, turbidity) that support normal behavior, growth, and viability of all life stages of the candy darter.

- ➢ The water quality of the North Fork Cherry and surrounding tributaries is generally lower pH and more acidic because the underlying geology is not able to buffer for the heavy atmospheric acidic deposition that occurs in this watershed. This is currently being mitigated by WVDNR efforts of ongoing limestone sands added higher in the watershed to neutralize acidity of the Cherry River and bring pH closer to a circumneutral value (between 6.5 to 7.5). Several tributaries still supply pulses of lower pH influx, though generally gets diluted enough to not heavily influence downstream pH. This watershed is considered to be a high quality fishery of the state, with important mixing qualities, such as stream gradient, that lend well to having high levels of dissolved oxygen (DO). The North Fork Cherry River is listed as "impaired" for Aluminum (Al) concentrations on the West Virginia 303(d) list of impaired streams. Aqueous concentrations of Al have more relevance to brook trout (Decker and Menendez1974), effects to candy darter or similar Percidae are currently not well studied. Hunters Run and Desert Branch are also listed as impaired for pH.

(4) An abundant, diverse benthic macroinvertebrate community (e.g., mayfly nymphs, midge larvae, caddisfly larvae) that allows for normal feeding behavior.

- ➢ The average West Virginia Stream Condition Index (WVSCI) score for two sites on the main stem Cherry River indicate an index score of 84 out of 100, indicating good macroinvertebrate composition and abundance. The average EPT score of mayfly, stonefly, and caddisfly was 88.5 out of 100 indicating diverse community of macroinvertebrates that signify good water quality (U.S. Environmental Protection Agency 2000).

(5) Sufficient water quantity and velocities that support normal behavior, growth, and viability of all life stages of the candy darter.

- ➢ The North Fork Cherry River and associated tributaries are all associated with natural variation in stream flows. These flows are generally highest during spring snowmelt run-off, and lowest in late summer. All determined growth and viability of the species would not be expected to vary from the projected actions. Regeneration timber harvest could marginally increase the base flow during the growing season, however, high flow changes will be negligible from harvest actions.

<u>Ecology</u> – The candy darter is an endemic fish species to 2nd order streams and larger rivers within the Gauley and greater New River watersheds in West Virginia and Virginia. They prefer swift flowing riffle and run habitats with rocky substrate in small to moderate size streams that are characterized as cool to cold water systems. The candy darter has been described as a habitat specialist (Chipps et al. 1994) because they occupy stream bottom niches typically characterized by gravel-cobble substrates that are free of excessive sedimentation and embeddedness which allow candy darter to utilize interstitial spaces for shelter/cover, feed on benthic aquatic insects, and successfully reproduce (U.S. Forest Service 2018). Research suggest candy darter spawning occurs around mid-April, while eggs incubate until June (Schoolcraft et al. 2002). Recent research suggests that ontogenetic shifts and seasonal habitat plasticity may introduce complexity when

identifying suitable habitat for some populations (Dunn and Angermeier 2016). Young-of-the-year and juveniles tend to utilize stream margin habitats and smaller substrate more than adults. Candy darter reach sexual maturity at age 2 and have a life expectancy of 3 years. Migration tendencies and capabilities are not well understood at this time.

Distribution - The historical distribution of candy darter was more expansive than the current distribution (Jenkins and Burkhead 1994). Extant populations of candy darter represent only 17 of 35 historically known populations distributed among five of seven historically known meta-populations - Bluestone, Lower New River, Upper Gauley, Lower Gauley, and Middle New watersheds in the Appalachian Plateaus physiographic province and the Upper New River and Greenbrier watersheds in the Valley and Ridge physiographic province (Federal Register/Vol. 83, No. 225 2018). Chipps et al. 1994 reported on the status of candy darter on the Monongahela National Forest and found them to be well-distributed in the Cherry, Upper Greenbrier and Upper Gauley river systems. However, he expressed concerns for populations in the Williams River, Deer Creek and Anthony Creek and identified siltation as the major threat to candy darter populations.

Table 1: Water Chemistry and Stream Condition Summary of Monitoring within the GHFR project area

Stream	***Sample Date***	***pH***	***Conductivity – uS/cm***	***ANC – ueq/L***	***% Fines < 4mm***	***% Fines < 1mm***
Coats Run	3/25/2019	6.86	18.6	71.23	-	-
Coats Run	9/24/2019	7.12	29.7	221.84	-	-
Hunters Run	4/2/2018	6.39	16.3	42.41	33.28 (AEUI 2019)	14.33 (AEUI 2019)
Hunters Run	9/24/2018	7.08	31.3	193.3	-	-
Desert Branch	3/28/2017	5.45	16.1	21.56	15.82 (AEUI 2016)	9.86 (AEUI 2016)
Desert Branch	9/12/2017	5.64	16.5	23.16	-	-
North Fork Cherry River, lower	4/2/2018	6.60	29.1	67.82	-	-
North Fork Cherry River, lower	9/24/2018	6.75	22.6	93.28	-	-

The Forest conducts annual Aquatic Ecological Unit Inventory (AEUI) monitoring of streams across the forest, typically aiming to survey a stream reach every 5 years. Monitoring includes collecting stream morphology parameters including; pebble count, channel cross-section, fine sediment samples, valley and stream gradient, and stream sinuosity. Habitat data is also collected including; habitat unit classification (pool, glide, riffle and run) and the residual pool depth of pools, also any large wood that can be found in a unit. The Forest also conducts surveys of fish populations within a 100 meter reach. The fish sampling is conducted with a backpack electroshocker, and typically a three person crew. A triple-pass depletion sample of the reach is performed. Fish sampling does not specifically target candy darter or their habitat, meaning, monitoring data would not be considered an intensive survey for candy darter, although, the information above contains any information that has been collected in the project area. Surveys in the project area have only occurred in the larger tributaries of the NFCR, no survey sites occur within the portion of the main stem NFCR within the project.

Locality records indicate candy darter presence in the NFCR as recently as 2014 (Gibson et al. 2018). This information suggests candy darter is distributed throughout the entire NFCR where suitable habitat exists. The Upper Gauley meta-population that contains the GHFR project area was evaluated as having moderate resiliency as part of the recent species status assessment for candy darter (U.S. Forest Service 2018). The condition of candy darter metapopulations was determined by using eight metrics of physical habitat, non-native competition, and population demographics Status and Threats - The U.S. Fish and Wildlife Service (hereafter referred to as "Service") announced a final ruling to list candy darter as a federally endangered species with an effective date of December 21, 2018. Hybridization with the introduced but closely related variegate darter (*E. variatum*) was identified as a primary threat to the viability of candy darter populations. Other contributing threats to candy darter populations that are noted include water temperature, excessive sedimentation, habitat fragmentation, water chemistry, water flow, and competition with non-native species.

Like candy darter, variegate darter is native to the Kanawha River basin but its distribution was historically confined to areas downstream of Kanawha Falls. Kanawha Falls functions as a natural migration barrier preventing the upstream dispersal of variegate darter into the upper Kanawha River basin where the candy darter is an endemic species. However, variegate darter now exist upstream of the falls, presumably transported and released by way of one or more "bait bucket transfers". Variegate darter alleles were first reported in the Upper Gauley watershed in 2014. Variegate darter has progressively invaded candy darter habitats allowing these two species to inter-breed and produce fertile hybrid offspring. Hybridization of these species is poised to genetically swamp out candy darter throughout nearly all of its remaining distribution in West Virginia.

Recent evaluation of candy darter range and speciation has helped to identify streams where extant candy darter populations still occur, where variegate darter are hybridizing with candy darter, and where there is relative robustness of remaining intact populations of candy darter (Switzer et al. 2008 and Gibson 2017). The meta-population in the Upper Gauley watershed (which includes the GHFR project area) is suspected to be genetically pure, although genetic analysis of a few sampled individuals revealed the presence of variegate darter alleles (Gibson 2017). Summersville Lake dam functions as an effective physical barrier to upstream migration of fish that occur in the lower Gauley River, including variegate darter. It is possible that variegate darter could occupy areas upstream of the dam at some time in the future by means other than natural migrations. However, proactive management (e.g. signage, public awareness, fishing regulations, etc.) of various state and federal agencies are attempting to reduce the potential for variegate darter introductions into the upper Gauley River system.

Prior to federally listing as an endangered species under the Endangered Species Act (ESA), candy darter was identified as a Regional Forester's Sensitive Species (RFSS) for the Monongahela National Forest. The Forest Plan for the Monongahela National Forest provides direction (Guideline WF18) to use conservation strategies in managing RFSS habitat to help prevent management actions on the Forest from contributing to a trend toward federal listing. No formal conservation strategy has been developed for candy darter although various Forest Plan standards and guidelines that address general aquatic resources management issues and priorities serve as favorable direction for the conservation of candy darter habitat on the Forest.

Potential Direct and Indirect Impacts to Critical Habitat in the Project Area:

Timber harvesting is expected to produce approximately 28.6 additional miles of new temporary road used to mechanically remove trees and transport to landings, 30.4 miles of reconstructed road on existing features, and one mile added as a temporary haul road.

West Virginia standard Best Management Practices (BMPs), National Core BMP Technical Guide FS-990a (U.S. Forest Service 2012), Forest Plan guidance (U.S. Forest Service 2006), and other project design features will help reduce short-term negative effects of project activities relating to conventional vegetation management's 59 miles of associated temporary road (skid) system throughout harvest units. Direct and indirect effects to aquatic resources from temporary road creation for vegetation management actions (thinning and regeneration harvests) include a low to moderate risk for limited adverse impacts associated with stream sedimentation and altered watershed hydrology; this risk would only occur during active project implementation and perhaps for a brief period there-after.

Timber harvesting, roads, skid roads, and log landings are ground disturbing activities that may alter surface and subsurface hydrology and potentially result in accelerated runoff, new channel cutting, channel head-cutting, and increased soil erosion and sediment delivery to streams if not properly addressed. Changes such as these can affect soil and water quality and degrade physical characteristics of aquatic habitats including those associated with occupied and proposed critical habitat for candy darter within the GHFR project area. The extent of effects is largely influenced by the amount and type of the ground disturbance, soil characteristics, topography and landform, proximity to stream channels, pre-existing conditions of the receiving channels, and effectiveness of design features and mitigation measures associated with project activities.

Streams associated with the GHFR project area are already impaired by high levels of fine sediment predominantly as a result of past land use practices (Table 1). Adverse effects to aquatic biota are documented in MNF streams when the percentage of fine sediment <1mm is greater than approximately 5 percent (Edwards et al. 2007). These impaired conditions are present at all monitoring locations in the project area. Additional accumulations of stream sedimentation could further compromise habitat qualities and therefore, affect aquatic biota associated with this aquatic ecosystem.

The Monongahela Land and Resource Management Plan (LRMP) has established standards and guidelines to reduce the potential for effects to water quality and aquatic biota during Forest actions. For example, Forest Plan standard SW37 defines buffer widths for perennial, intermittent and ephemeral stream channels that are incorporated by referenced in other Forest Plan standards to help protect stream resources from potential project impacts (including soil disturbance and erosion). Forest Plan standard SW34 prohibits programmed timber harvest or any tree removal from stream channel buffers (with few exceptions). Forest Plan standard SW40 requires skid trails/roads and landings to maintain a filter strip of at least 100 feet from all stream channels. In addition, project actions will effectively decommission new skid roads using Forest Plan standard RF13, and address maintenance needs on existing Forest System roads within the project area.

Conventional Timber Harvesting:

Timber harvesting for this project includes clear-cut prescriptions that essentially cut all trees to regenerate target stands and thinning prescriptions that remove approximately 1/3 of the standing basal area of timber in target stands. Roads, landings, and skid roads are necessary to implement these prescriptions using conventional harvesting methods. Each of these activities require ground disturbance that can impact hydrology, riparian and aquatic resources to various degrees depending on a number of variables. Roads and landings will be evaluated after their near term use to identify locations that require further action, consistent with the Forests' ongoing restoration, to get the area to a watershed stable condition. Disturbance of the forest floor and ground cover in the general treatment unit area (i.e. excluding haul roads, skid roads, or landings) is generally dispersed and not concentrated, and consequently has a much lower probability for impacts to hydrologic and aquatic resources. This is because soil disturbance typically only occurs at landing sites and where skid roads are created. Also, compaction is typically not an issue because the harvesting is not concentrated and heavy machinery is not repeatedly tramming the same area (the exception being skid roads and landings).

Water Yield - Annual water yield conveyed by streams is influenced by numerous environmental factors including rates of evapotranspiration associated with contributing watershed areas. Removing trees can reduce rates of evapotranspiration and consequently increase water yield transported by streams. Watershed studies in eastern deciduous forests in Appalachian regions found measurable increases in water yield when approximately 20 to25 percent of the basal area of standing timber is removed from contributing watershed areas (Hornbeck et. al. 1993; Stuart, Edwards, 2006). Increases were most apparent in the first few years after harvesting and were virtually nonexistent after approximately 5 to 10 years post-harvest in these studies. Increases were found to be measurable only during base flow or low flow conditions, potentially having a slight benefit.

Negative effects to aquatic resources from water yield variations are unlikely to occur.

Additionally, the relatively small catchments that could experience increased water yields as a result of timber harvesting are located higher in the watershed, upstream from or otherwise outside of suitable candy darter habitat. Potential effects associated with increases in water yield from these small headwater streams are expected to dissipate as the smaller streams flow into increasingly larger receiving channels downstream where suitable candy darter habitat exists.

Water Chemistry - Most streams in the GHFR project area are currently impacted by relatively high rates of atmospheric acid deposition. This area of the forest faces high soil and water acidity because of the acid rain produced by coal burning power plants to the West; Cherry River watershed has some of the highest rates of acid deposition in the country (Farr et al. 2009. Stream acidification within this project area is a function of the watersheds being predominantly composed of soils and underlying geology that are highly vulnerable to the effects of the high rates of atmospheric acid deposition. Streams with an acid neutralizing capacity (ANC) of values nearing 0 (zero) are not able to buffer acid deposition and stream acidity as well as streams with an ANC value of 100 or more. Table 1 shows that most streams in the project action area have high values because of limestone treatments higher in the headwater. Applications of limestone sand are routinely applied by WVDNR to various streams in the project area to help mitigate some effects associated with acid deposition. Desert Branch displays lower ANC values and currenly has no limestone treatment in this catchment.

Forest System Roads Maintenance – For this project there will be no new Forest system roads constructed. System road maintenance of 19.1 miles is proposed for this project area. Existing system roads have been identified to receive upgraded maintenance as needed and would consider elements such as; the purpose of the road, types of vehicles expected, duration and frequency of use, and environmental conditions currently causing resource concern. The type of maintenance that could occur includes mowing, grading, cleaning or replacing cross drain culverts, and applying gravel to the surface. Table 2 identifies the distribution of these roads in individual watersheds or catchments in the NFCR watershed. One crossing will be a temporary bridge placed on Hacking Run and the other will be a culvert replacement on Spencer Run. Both crossing locations will be greater than one half mile from suitable candy darter habitat in North Fork Cherry River. The Hacking Run crossing will be going in at a location where a temporary bridge has already been installed and removed previously. The Spencer Run crossing will be a replacement with a larger structure that would involve slightly more ground disturbance, however the footprint of the work would still be less than one-half acre. Sediment and Erosion control measures will be implemented at stream crossings to reduce the potential for effects. Following conservation measures outlined below and National Core BMP guidance (Road-7) (USDA Forest Service, 2012), these actions are not expected to affect suitable candy darter habitat. Road stream crossing structures that warrant replacement will be designed in accordance with stream simulation design methodology to restore free movement of aquatic biota and provide continuity for other stream processes and functions including the conveyance of bedload material, LWM, and flood flows through the stream crossing structure.

Table 2. Drainage Catchments with Proposed Road Maintenance

Stream Catchment	Catchment Size (square miles)	Road Construction (miles)	Road Maintenance (miles)	Stream Crossings

Spencer Run	0.85	0	0.58	1
Desert Branch	1.51	0	3.8	1
Hacking Run	0.84	0	0.4	1
Hunters Run	3.38	0	4.3	1
Coats Run	1.55	0	4.1	2
Little Lick Run	1.34	0	1.2	0

Roads potentially have negative effects on aquatic ecosystems as previously described (alter natural hydrologic conditions, increasing erosion and stream sedimentation, fragmenting aquatic habitat, etc.). However, maintenance of Forest System roads associated with this project are unlikely to adversely affect the existing condition of the aquatic ecosystem in the project area. This conclusion is dependent upon the compilation of road management actions that help form the strategy for maintaining or enhancing watershed conditions in this project area. Road management actions that are key to facilitating the expected results for aquatic resources include: compliance with Forest Plan standards (SW35, RF04, and RF07) and National core BMPs to control the potential for adverse effects during road construction, reconstruction and maintenance activities.

Landings - Log landings are necessary for timber harvesting activities. The project plans to use a total of 40 landings. 33 landings will be used for conventional logging, of which 13 will be newly created. There will also be 7 helicopter landings, of these, 4 will be newly created. Conventional landings typically account for 0.5 acres and helicopter landings are slightly larger at around 2 acres. Short-term effects related to the construction and use of landings will expose soil and may produce sediment. Proper application of West Virginia BMPs, National Core BMP direction (Veg. 6) and design features will be used to help limit potential effects associated with stream sedimentation coming from these sites. For example, the Forest Plan direction (Standard SW 40) requires that all landings be located at least 100 feet from any stream channel (perennial, intermittent and ephemeral) and to stabilize them upon completion of their intended use following the project. Treatments necessary to stabilize landings include vegetative ground cover and possibly other measures including regrading, soil de-compaction, and soil amendments (such as fertilizer and lime). The creation and use of these landings will follow direction as identified in the National Core BMP Technical Guide. Landings that satisfy these conditions are expected to have inconsequential effects to the aquatic ecosystem.

Temporary roads - temporary roads are a necessary component for conventional ground-based timber harvesting within the project area.

The GHFR project is expected to use 59 miles of temporary road for the removal of trees from harvest units. Of these, 28.6 miles will be newly constructed temporary roads. The remaining 27.1 miles are currently existing features on the landscape that will be reused for this projects activities. Decommissioning will occur within three years of final project actions. The method of decommissioning temporary roads and skid roads will consist of treatment with BMPs such as removing temporary crossings and culverts, establishing protective ground cover, and installing water-bars of appropriate spacing and design to reduce potential adverse watershed impacts. Decommissioning actions are outlined in Forest Plan guideline RF13, parts a-e. The greatest potential for erosion and sedimentation occurs the first year post-harvest and generally decreases each year after that. Edwards and Williard (2010) found that the application of appropriate BMPs have been shown to be 53 to 94 percent effective at reducing sediment in the first year after harvesting. \

<u>Non-Native Invasive and Undesirable Species Control</u> - Management of non-native invasive species (NNIS) and undesirable beech brush will occur throughout the project area where appropriate. Methods of treatment can including manual pulling (hand crews) or the use of herbicide. The Forest conducted a Forest-wide NNIS EA (U.S. Forest Service 2010) which has reviewed the effects of herbicides on aquatic systems and has determined that some herbicides do pose a risk of toxicity to aquatic life. The Forest-wide NNIS EA recommends that only an aquatic formulation herbicide be used for treatment within stream channel buffers indicated in the Forest Plan or within 100 feet of other water bodies, otherwise, non-herbicide control methods may be used. Direct and indirect effects of herbicide use are expected to be inconsequential for aquatic and riparian resources if application of aquatic formulations of herbicide are applied following manufacturers direction.

Control of beech sprouts will incorporate preparation of the area with hand tools, and can use a combination of actions including; herbicide treatment by direct stem injection, or with a basal spray.

Pesticide use may occur in regeneration units to address hemlock woolly adelgid (HWA) infestations. Chemical treatment of HWA would adhere to manufacturer's application direction.. Crayton (2019) concluded that areas with adjacent HWA treatment using the pesticide imidacloprid had direct correlation to concentrations being found in benthic macroinvertebrates. Bioaccumulation of the substance has the potential to occur in species that comprise the higher trophic levels that consume macroinvertabrates, however, candy darter would not be considered to inhabit adjacent headwater streams where treatment would occur, thus effects of this treatment would considered a low potential of risk.

<u>Helicopter Logging-</u> This project will include helicopter harvest of 17 units, totaling 850 acres, that will incorporate the use of a helicopter to remove felled trees by hand crews in areas where slope or soil conditions exclude the use of conventional logging techniques as determined by the Forest Plan (U.S. Forest Service 2006). Helicopter logging represents the least amount of ground disturbance, because temporary roads are not needed to extract the timber, therefore, the issues that typically persist from temporary road creation on conventional logging operations are not present. Helicopter logging represents little to no soil disturbance for this type of action, thus, this action is expected to have inconsequential effects on candy darter or its habitat. Helicopter landings are necessary to facilitate transport out of the area, however these do not occur within the units and are analyzed as a combined action to the conventional landings, above.

<u>Stream Crossings</u> Road stream crossings will be evaluated as needed for maintenance to determine where crossing structures may need replaced to adequate size for passage of increased storm flows and potential aquatic organism barrier. The crossing identified, occurs on a stream

with a higher stream gradient than what is typically considered suitable for candy darter. The identified stream crossing does not fall within proposed critical habitat, however, with a proximity of approximately half mile to three quarter mile away from suitable habitat. Conservation measures will be used to reduce potential for sedimentation in critical habitat.

Potential adverse effects of stream crossing projects would primarily be limited to localized clearing of streamside vegetation as well as short-term sedimentation effects on water quality for a relatively short time after project construction. Applying West Virginia BMPs for erosion and sediment control, Forest Plan standards, and other requirements associated with project permitting under the Clean Water Act (sections 401 and 404) would substantially reduce the amount of soil loss and sediment delivery to the stream channels. Any crossing replacement site will incorporate the use of pumps to direct most water around the crossing replacement site so that work can be completed in dry conditions to reduce movement of sediment from the area. Crossing replacement would also be limited to the drier portion of the year, from the end of July to the end of September. There is no threat of variegate dater expansion to previously inaccessible habitat with the replacement of the Spencer Run crossing. When site conditions are not suitable for replacement (i.e. wet conditions, high water, etc.) then soil disturbing actions will not commence until stream and soil conditions are within a manageable condition.

Expected long-term benefits associated with stream crossing replacement projects include reducing longer-term erosion and stream sedimentation at these sites by removing the effect of flow obstruction, improving flow hydraulics, improving in-stream sediment transport processes, and reducing occurrences of erosion associated with stream banks, riparian areas, and road prisms at road stream crossings. In addition, stream crossing improvement projects will eliminate human-caused aquatic habitat fragmentation that can have pronounced impacts on the productivity and sustainability of populations of native aquatic communities.

Recognizing the priority to guard against potential risks to the genetic integrity of candy darter when contemplating stream crossing projects in the GHFR project area, long-term benefits associated with the restoration of aquatic habitat connectivity in the project area would be expected to more than compensate for potential short-term adverse effects of localized vegetation clearing and sediment production associated with construction activities at the project site.

Prescribed Fire Duration and temperature are relevant concerns of prescribed fire risk to the aquatic resources. If prescribed fire increased from low intensity to high intensity fire, it could reduce or eliminate protective vegetative ground cover which can lead to either increased soil hydrophobicity, (such as, the soil could become more water repellent), or increased erosion depending on fire temperature and soil characteristics (Gresswell 1999). Much hotter fires tend to burn more of the vegetation and leaf litter and also have the potential to kill trees. This in turn provides less of a vegetative cover and roughness over the area, which can increase erosion potential. Management of prescribed fires avoid these situations and is designed to create low temperature, efficient burns that accomplish the objective without sacrificing the integrity of the forest floor composition to capture and dissipate rain and snowfall. McNabb and Swanson (1990) concluded that generally, sediment production from fire-related activities is not a serious contributor when compared to other forest management practices, such as certain timber harvest methods and associated roads.

The prescribed burn area in the GHFR project totals 357 acres. This burn will incorporate minimum impact suppression tactics (MIST) to reduce the potential for impacts from fire line creation that may affect aquatic resources. This includes the use of hand blowers to clear fire line, or the use of existing features on the landscape, which limit the need for dozer line creation which typically involves ground disturbance. Using MIST control tactics, and implementing burns that slowly back down to riparian areas and create a mosaic burn pattern extinguishing within the riparian buffer, well before reaching the stream, it is expected that the isolated effects of prescribed fire generally pose a low risk to candy darter and proposed critical habitat. Fuel breaks and pile burns will pull slash material that is created from timber harvest activities and burn in piles away from riparian areas, which should have discountable effects to aquatic resources.

<u>Potential Cumulative Impacts</u>:

<u>Atmospheric Deposition</u> - Acid deposition associated with the GHFR project areas is an environmental condition which is likely to continue for the foreseeable future. Atmospheric acid deposition in this area is largely a by-product of coal burning power plants located to the west (upwind), which account for some of the highest rates of acid deposition in the country (Farr et al. 2009. Streams in the project area that are part of the Forest's water chemistry monitoring plan such as Windy Run, Carpenter Run, and North Fork Cherry River exhibit water chemistry that is more acidic than most other streams monitored across the Forest. This is partly due to the high rates of acid deposition and partly due to nutrient poor geologic composition which are naturally more vulnerable to effects from acid inputs. Stream acidification is not expected to improve in the foreseeable future which presents risks for native aquatic species that are less tolerant of acidic stream conditions. Aquatic biota may continue to experience population declines in the project area even where physical qualities of aquatic habitat are not lacking.

Various streams within the project area receive regular treatments of limestone from the WVDNR to help mitigate some symptoms associated with stream acidification. Limestone treatments have enabled aquatic communities in treated streams to be sustained at levels that otherwise would not exist. Limestone treatments will be continued for the foreseeable future to maintain existing aquatic populations at their current levels in these streams. Candy darter normally occur in streams with water chemistry that is circum-neutral on the pH scale. The effects of atmospheric deposition can have a pronounced effect in the future on the suitability of habitat in the project area for candy darter if current supported conditions differ.

<u>Climate Change</u> - Scientific models and long-term monitoring and research continue to forecast risks to the environment associated with the effects of climate change. Effects to the watershed and aquatic biota in the analysis area are likely to be associated with more erratic weather patterns that show a general warming trend for air and water temperatures, modifications to soil and water chemistry, changes to hydrology, increased frequency of disturbance, and increased stressors including invasive species and disease (Williams et al. 2015). Changes in the regional climate and conditions within the NFCR watershed would be expected to cause some level of cumulative effect to aquatic biota in this project area. This effect has not been quantified to any specific range, although effects could be assessed through long term monitoring of stream

conditions within the project area and throughout the Forest.

As regional air temperatures increase, there are concurrent changes in forest productivity and soil nutrient cycling which represent an elevated risk for cumulative effects to watershed health. Soil nitrate mobilization is a consequence of microbial activity positively related to soil temperature (Brookshire et al. 2011). Increased nitrate movement represents an increased threat to watershed acidity and stream health. Increasing air temperature along with increasing atmospheric CO_2, may result in parallel increases in tree growth and nitrogen demand, which could off-set the increased nitrogen availability (Ollinger et al. 2008).

Generally, the streams in this sub-watershed have relatively good canopy cover, which helps deflect solar radiation and keep microclimates in healthy riparian areas around streams cool during even warmer days. There is less of the microclimate influence on the larger streams that receive more direct sunlight such as the main stem of the North Fork Cherry River. Temperature fluctuations may not generally be as great a concern for candy darter as it is for other native species in the project area such as brook trout (*Salvelinus fontinalis*), a management indicator species. Candy darter can be described as eurythermal (wide range of temperatures) and they tend to be more accepting of cooler and even sometimes warm temperatures. However, if water quality conditions are managed to favor brook trout and other cold water species, candy darter will likely also benefit, as there are indications in developing habitat suitability indices that candy darter are more productive and condition factor is higher in colder water environments (P. Angermeier, personal communication 02/21/2019).

Effects Determination: The determination for direct, indirect, and cumulative effects to candy darter and proposed critical habitat is **"**May Affect, Not Likely to Adversely Affect**"**. This determination is primarily a result of short-term adverse effects that are expected immediately during and shortly after the implementation of various actions associated with the GHFR project. Although certain actions have the potential to harm candy darter and impact their proposed critical habitat, the intensity of project actions will be low and lasting a short duration of time, leaving the majority of effects lasting 10 years and not constant during that period.

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Gauley Healthy Forest Restoration Project CE – Aquatics Effects Analysis

Methodology

This analysis of the Gauley Healthy Forest Restoration (GHFRP) project actions to aquatic resources will review the following proposed actions and their associated effects:

- Commercial thinning and regeneration harvest using conventional ground based logging with temporary road use
- Commercial thinning and regeneration harvest using helicopter logging
- Herbicide and pesticide use for undesirable species
- Prescribed Fire piling of logging slash created fuel breaks around high interest areas and a broadcast burn unit
- Road maintenance of existing Forest system roads
- Temporary road construction

Activity	Units	Proposed Action Total
Vegetation Management - Commercial		
Commercial Timber Harvest – Conventional Clear cut with reserve trees	8 units	242 acres
Commercial Timber Harvest – Conventional select tree thinning (without Rx burn)	57 units	1,519 acres
Commercial Helicopter Timber Harvest – clear cut with reserve trees	3 units	109 acres
Commercial Helicopter Timber Harvest – select tree thinning (without Rx burn)	14 units	741 acres
Prescribed Fire Activities		
Prescribed Fire and conventional select tree thinning		200
Prescribed Fire - Burn block (without thinning)	1 unit	157 acres
Prescribed Fire – Fuel Breaks	3 locations	16 acres
Herbicide		
Nonnative invasive treatment		
Beech brush treatment		
Pesticide		
Treatment in Regeneration units	11 units	351 acres
Roads		
Temporary road construction (haul)	25 feet	1.0
Temporary road reconstruction (haul)	25 feet	1.9
Temporary road construction (skid)	12 feet	28.6
Temporary road reconstruction (skid)	12 feet	30.4

The baseline for this analysis will be the current condition of the project area. This analysis will only analyze the new proposed actions and their potential for effects to the resource. The timeframe of effects will be a period of 10 years following project activities, which includes the implementation of project actions and expected period following which could have short term effects. Because actions of the project can have an effect to aquatic biota and habitat outside of the project area, the spatial boundary of analysis includes any 6th level Hydrologic Unit Code (HUC) watershed that falls within the project action areas. These watersheds include; North Fork Cherry River and Outlet Cranberry River (HUC: 050500050401, 050500050202 respectively). Less than 5 acres of the project fall within the Outlet Cranberry River watershed. Any ground disturbance in these 5 acres would be occurring near the ridgeline, and effects are negligible to the watershed and aquatics at that scale. The majority of this analysis will focus on potential impacts to the North Fork Cherry River watershed and its aquatic biota.

Summary

- The Proposed Action, would be compliant with the West Virginia Division of Forestry BMPs (WV Division of Forestry 2018), National Core BMP technical guide (U.S. Forest Service 2012) and Forest Plan (U.S. Forest Service 2006). Consistency with the Plan, especially relative to SW01, SW03, SW04 and RF15, relies on implementation of road and trail treatments necessary to hydrologically neutralize the effects of existing and new linear features.

Resource Impacts or Issues Addressed

Effects to watershed processes and aquatic biota are analyzed, and aquatic Regional Forester Sensitive Species and Management Indicator Species.

Aquatic Resources Analysis DRAFT – Gauley Healthy Forest Restoration CE 12/05/19			
Resource/ Issue	**Existing Condition**	**Proposed Action – Effects Determination**	**Rationale**
Threatened and Endangered Species			
Candy darter (*Etheostoma osburni*)	Proposed critical habitat within Project boundary. The candy darter is known to occur in the North Fork Cherry, South Fork Cherry and Cranberry River with species specific surveys conducted as recent as 2016 (Gibson 2017). Hybridization is expected to be the greatest threat to this species, although approximately half of the historic range of the species was lost before the threat of hybridization due to the effects of sedimentation.	May Affect, Not Likely to Adversely Affect	Project actions will adhere to Forest Plan standards and guidelines which provide mitigations to limit the effects actions have on aquatic biota. For further explanation of effects toward the species and critical habitat, please see the candy darter portion of the Biological Assessment for this project.
Aquatic Regional Foresters Sensitive Species (RFSS)			
Eastern Hellbender (*Chryptobranchus alleganiensis*)	The Eastern Hellbender is a species of fully aquatic salamander that occupies large boulders in medium to large rivers, including the North Fork Cherry and larger tributaries. Eastern Hellbender occurrence in the project area were	May impact individuals, but will not lead to a loss of viability.	The species is very dependent on exceptional water quality with high dissolved oxygen and low levels of sedimentation. The actions proposed would follow all applicable standards and guidelines and will also incorporate applicable state and national core BMP's to reduce the potential for the amount of sediment that could be introduced. This is not to say there would be no impact to the species, as

	verified by eDNA collection (Wineland 2019). Hellbender occur in larger streams where adequate large boulder habitat exists including North Fork Cherry, Dogway Fork, and main Stem Cranberry River. Population estimates have not quantified hellbender, though range-wide the population of this species is declining due to habitat loss and alteration. State-wide populations are only found in roughly 20 percent of their historic range (Keitzer et al. 2013)		short term effects during implementation could have an effect on hellbender habitat. Once ground cover is established, typically within two weeks following seeding and mulching treatment, the potential for sedimentation is greatly reduced. The actions of this project are not expected cause excessive levels of sedimentation when implementing applicable Forest plan guidance and BMPs. The use of pesticides for preserving hemlock trees from the HWA could have adverse effects on hellbenders. Crayton et al. (2019) found evidence that HWA treatment using imidacloprid occurring adjacent to stream channels had a negative effect on benthic macroinvertebrates and stream salamanders. Hellbenders could be affected by imidacloprid through dermal respiration or consumption of invertebrates. Crayfish are frequently consumed by hellbender. Although crayfish were not examined in the study, they accumulate environmental contaminants similar to macroinvertebrates. Use of imidacloprid would be limited to 20 acres of treatment totalingacres. These areas generally occur away from suitable hellbender habitat and effects of its use would be expected to be low, however, the particular effects on hellbender is uncertain. Imidacloprid use should avoid application within stream channel buffers to avoid potential negative impact to the hellbender and its forage species.

New River Shiner (*Notropis scabriceps*)	Endemic to the New River drainage of Virginia and West Virginia. This species is documented historically occurring in the Appalachian Plateau of West Virginia and is described as cool water adapted (Shingleton et al. 1981). New River shiner typically dwelling near bottom and mid-column of 2nd order and larger streams. Habitat is sandy and course gravel substrate in pools/runs of small and medium rivers. Evidence of New River Shiner occurrence in the lower Cherry river drainage apprise us of possible occurrence in the North Fork watershed (Welsh and Cincotta, 2007). New River shiner could be expected to occur in the North Fork Cherry River.	May affect individuals or habitat, but not lead towards federal listing or a loss of viability.	New River shiner are intolerant of siltation and generally avoid areas where silt accumulates (Jenkins and Burkhead 1993). Effects of actions proposed likely would not have long term persistence, however, sediment may temporarily disrupt the species habitat. Likelihood of this species occurrence in the project area is low to moderate. Ground disturbing actions including skid road, haul road creation and use and road maintenance will have the greatest potential for effects to this species, however, appropriate use of state and National Core BMPs should greatly reduce sediment.

Tonguetied minnow (*Exoglossum laurae*)	Tonguetied minnow have a historical account of occurrence in the Cherry river watershed. No species specific sampling has been conducted for this project and no tonguetied minnow have been captured in any of the annual inventory sampling conducted within the analysis area (MNF Aquatic Ecological Unit Inventory Data). This species prefers clear, cool water and avoids areas of heavy silt deposit (Jenkins and Burkhead 1994)	May affect individuals or habitat, but not lead towards federal listing or a loss of viability.	Likelihood of occurrence within the project area is low to moderate. The effect of the proposed actions, in particular ground disturbance, will be mostly short in duration and with appropriate BMP mitigations, will avoid lasting effects. The 7 miles of habitat within the North Fork Cherry River is a low proportion of the overall habitat across the Forest and the state.
Appalachia darter (*Percina gymnocephala*)	Little is known of the habitat requirements of the Appalachia darter. In a study of four darter species in streams on the Monongahela N.F., Chipps (1994) observed that Appalachia darters tended to use deeper habitats (runs and pools) than the other species. He also classified them as benthic-insectivores. Fishbase (2004) characterizes Appalachia	No effect	This species does have presence within the project boundary, however, documented occurrence only exists for the headwaters of the Cranberry River and no actions associated with this project are proposed for this watershed. There are fewer than 5 acres of identified potential actions that slightly overlap the Cranberry River watershed. These units are identified as thinning units which remove a much smaller basal area and there are only 36 feet of skid road feature, which will be an inconsequential amount of disturbance to effect water quality or the species.

	darter habitat as gravel and rubble runs and riffles of small to medium size rivers. There is no information available on temperature preferences, but the collection sites within the proclamation boundary can generally be characterized as cool to cold water systems.		
Green-faced Clubtail (*Gomphus viridifrons*)	This species has been observed in the project area, locally around the cranberry glades area, with the last observation occurring in 2002 (Forest Database). Green-faced clubtail are typically found in river systems with medium to large substrate, also near impoundments and wetland areas. Suitable river and lake habitat occur throughout the project area and species could be expected to be present.	May affect individuals or habitat, but not lead towards federal listing or a loss of viability.	Odonates are effected by actions within a watershed and within streams that disrupt the quality of the aquatic environment. Short-term effects of stream sedimentation could degrade habitat for the species. The main effect of sedimentation to odonate habitat is not considered to rise to the level of impacting populations that may occur in the project area. Green-faced Clubtail habitat in impoundments such as Summit Lake would not be considered to be affected from proposed actions, with the buffer around the water body and use of sediment and erosion control measures in place in areas upstream from the impoundment.
Rapids Clubtail (*Gomphus quadricolor*)	Rapids clubtail have been found in the higher elevation areas of the state, including Greenbrier	May affect individuals or habitat, but not lead towards federal listing or a loss of viability.	Odonates are effected by actions within a watershed and within streams that disrupt the quality of the aquatic environment. The actions of this project are not expected to create

	and Pocahontas streams with good water quality. This species has records of occurrence on larger streams and rivers. There have been no record of rapids Clubtail within the analysis area, although suitable habitat occurs and it is within the species range found in the state.		conditions that would rise to the level of measureable effects toward this species. The closest recorded occurrence for Forest heritage data of this species was in the Glady Fork watershed, however the state odentate atlas lists the mountainous areas within and surrounding the project area as suitable habitat.
Management Indicator Species (MIS)			
Brook Trout (*Salvelinus fontinalis*)	Brook trout are documented throughout this project area where water temperature and chemistry are favorable. This species is considered a cold water indicator species because of its requirement of exemplary water quality. The North Fork Cherry River has several tributaries with low pH that are not currently being augmented with limestone sand additions. Forest long term monitoring data indicate that sites monitored within the project area (Desert Branch and Hunters Run) largely show brook trout	May affect individuals or habitat, but would not lead to federal listing or loss of viability.	The effects that are typically of concern for this species are actions that alter stream or riparian conditions or when ground disturbing activity is expected. The only proposed action with potential to alter riparian or stream conditions, are forest road maintenance of a culvert crossing Spencer Run and temporary road construction that include stream crossings. Forest Plan standard and guidelines, also West Virginia BMPs will be adhered to. The main effects will come from the creation and use of temporary roads and skid roads associated with vegetation management. During use temporary roads will have sediment and erosion control measures installed, such as temporary water bars, to prevent excessive sedimentation of these areas. The greatest potential for effect would occur from the time of initial implementation of timber harvest activities, to the time the

	populations improving over time (MNF Aquatic Ecological Unit Inventory).		temporary roads are decommissioned and vegetation has reestablished
Other Habitat Components/ Watershed Processes			
Sediment production & mobility	Sediment is a product of any fluvial systems natural composition as a stream move through soil and rock, carrying material throughout the system. Anthropogenic factors from past land use create features on the landscape that often help facilitate and speed up the rate of sediment production and movement through a system. Forest monitoring locations within the project area currently show levels of sediment that are above what is considered normal and reach levels that can begin to affect brook trout reproduction.	Of the proposed project actions for the GHFR project, only the temporary road use for conventional timber harvest, road maintenance, and prescribed burn area would have the potential to disturb sediment and have the potential to increase sediment mobility.	The effects to aquatic systems vary widely from areas of ground disturbance. Areas of increased slope or high soil sensitivity to disturbance will cause greater issue to aquatics during the period of implementation and a time shortly after until vegetation is established on the road surface. The exact amount of sediment that is produced would be highly dependent on the position of the temporary road on the landscape, and its effects on the aquatic system are largely variable. Prescribed fire and fuel break treatments have little potential for effect to the aquatic system. Generally burns back down slopes into drainages and the fires expire once reaching the wet soils surrounding riparian buffers.
Hillslope Hydrology	Legacy features installed in poorly located areas or have damaged or failing erosion and sediment controls tend to have greater effect on the	New temporary road construction would occur on 29.6 miles throughout this project.	features that have been identified as reconstruction are those that currently occur on the landscape, thus effects on hillslope hydrology would not be changed with this project action. Only newly constructed temporary road features will change the

	hillslope hydrology and associated implications on aquatic systems.		existing condition on the ground and have an effect on hillslope hydrology in the project action area.
Water quantity	The analyzed watersheds are all considered headwater systems of the Gauley River watershed and streams in the analysis area have exceptional water yield in times of normal rainfall rates. Streams very rarely get to the point of being completely dry. There is a small Forest owned impoundment within the project area, Summit lake, which is a back-up reservoir for the town of Richwood in times of low flow in the North Fork of the Cherry.	A measurable change in water quantity is not expected to occur from actions of this project.	(86 percent) of timber operations would be thinning practices, which remove a small amount of the overall trees in a unit and exhibit nonsignificant changes in annual discharge (Edwards and Troendle 2012) A change in flow would be most evident at drier times of the year and may actually be slightly beneficial to maintaining residual flows.
Stream temperature	Pre-existing long-term monitoring sites within this project area help better understand the temperature regime of streams within the project area also how conditions such as riparian cover, thermal exposure, and land use throughout the		Temporary road creation uses equipment to create a cut and fill on the landscape creating the road prism. Temporary roads will be decommissioned following final use, however most of the road prism will still occur on the landscape. Storm flows that typically would infiltrate un-compacted soils will be transported over the surface to stream channels. West Virginia BMP's will be

	watershed influence water temperature, thus affecting cold water dependent aquatic communities. The riparian areas throughout the project area are generally well forested and provide excellent stream shading. The headwater streams provide cold water year round for aquatic biota dependent on it.		established water bars at proper spacing to control surficial runoff.
Riparian condition	Riparian areas within this project are generally well forested, with the exception of areas along State Route 39/55 and the North Fork Cherry river are in close proximity to one another. The riparian areas mostly consist of the same age class of trees. Natural recruitment of downed wood is still in an increasing trend toward desired conditions. Areas of lower riparian function occur upstream of project actions on the North Fork Cherry, though still in the project area, totaling approximately 18 acres.	Existing riparian conditions in the project area are not expected to improve from actions of the GHFR project. The effects of this project on riparian conditions will be minor because of the proposed actions to measurably alter riparian characteristics do not occur, except for areas where new temporary road crossings will be established. This change is not expected to have measurable effects on stream temperature or microclimate disruption.	Riparian areas have Forest Plan standards and guidelines that reduce effects of forest management activities on riparian condition and conversely the water quality conditions. Such actions that may cross riparian areas are limited to as small of a disturbance as possible. The effects of these small gaps in the overall riparian area across individual catchments are discountable because of the relative area of riparian opening across the scale of the project action area. Water conditions in the analysis area generally would see little to no change in temperature from these openings created in the Riparian. No timber harvest is allowed within the riparian buffers, so the only expected alteration would be from temporary road crossings. Two crossings on perennial streams in the Hacking Run catchment have been identified

	These large gaps in tree coverage can have impacts to thermal loading of coldwater systems.		and will total approximately 2 acres of change. The total area of perennial riparian is 50 acres, meaning there would only be 4 percent of the riparian of this drainage affected.
Stream channel conditions	Monitoring sites within the project area indicate stream channels surrounding proposed activities have been relatively stable throughout the time monitored (approximately10 years). This is because of the relatively high gradient and the large dominant substrate that is not as conducive to large changes in stream condition. This area experienced a 1,000-year flood event in 2016 which may still be affecting changes in stream channel and bankfull widths. Data collected from the long-term monitoring indicate stream sedimentation is changing through time. Sites located at Bear Run and Hunters Run indicate levels of fine	Habitat diversity within the streams across the action area is not expected to change considerably from project actions. The condition of the stream channel would only be modified at temporary stream crossings, and these crossings would be removed within 3 years of final use.	Across the entire project action area, there are only two crossings proposed on perennial streams, approximately half an acre of disturbance each. This is approximately one acre across the 3,051 acres of perennial riparian stream buffer, resulting in a minor potential for effects materialize into substantial alterations.

	sediment that is collected in suitable spawning gravel has increased. A site located on Desert Branch indicates that fine sediment has decreased in suitable spawning gravel samples. However, all samples are still above an amount of sediment that is known to impact egg survival rates of brook trout and other aquatic organisms (Edwards et al. 2007).		

Table 1: Key resource concerns, existing condition, direct/indirect effects, and rationale.

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United States
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Forest
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Monongahela
National
Forest

Gauley
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District

Gauley Healthy Forest Restoration – Biological Evaluation

Threatened, Endangered, and Sensitive Plants

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Resource Impacts or Issues Addressed

This biological evaluation discloses expected direct, indirect, and cumulative effects of the Gauley Healthy Forest Restoration project on threatened and endangered plants, as well as Regional Forester's Sensitive Species plants. Regional Forester's Sensitive Species plants are hereafter referred to as sensitive plants; threatened, endangered, and sensitive plants are collectively referred to as TES plants.

The Proposed Action would involve various types of vegetation management activities that have the potential to affect TES plants (see the Categorical Exclusion (CE) Review for a detailed description of the Proposed Action).

Scope of the Analysis

For direct and indirect effects, the spatial boundary of the analysis is the Richwood Wildland Urban Interface (WUI) boundary (see Gauley Healthy Forest Restoration Project Helicopter & Ground Based Logging Plan map in CE Review). The Richwood WUI boundary includes all parcels of land that would be affected by project activities, therefore it is an appropriate boundary for the analysis of direct and indirect effects on TES plants. The Richwood WUI boundary encompasses approximately 7029 acres, which includes 7028 acres of National Forest land and one acre of private land. For cumulative effects, the spatial boundary of the analysis is the Proclamation and Purchase Unit boundary for the Monongahela National Forest. This is the boundary to which the National Forest Management Act's species diversity and viability requirements apply.

The temporal boundary for direct and indirect effects on TES plants is 120 years from the beginning of project implementation. This is the time frame within which effects to forested habitat will persist. While effects to each individual species may not persist that long, successional changes set in motion by regeneration harvesting will continue for at least that long, potentially affecting some species that occur in forested habitats. This temporal boundary is also used for the cumulative effects analysis because the contribution to cumulative effects ends when the direct and indirect effects no longer exist.

Methodology

Surveys for TES plants were conducted in many of the proposed activity areas that would involve soil disturbance and/or removal of 20 percent or more of the overstory in mature stands. Field surveys covered representative habitats in areas proposed for commercial timber harvest, temporary road and landing construction, prescribed fire, and fuel break establishment. Areas proposed for road maintenance were generally not surveyed because these activities have little potential to affect TES plants (see discussions of direct and indirect effects below). Surveys for TES plants will be conducted in proposed activity areas that have not been previously surveyed, where optimal habitat conditions exist, prior to implementation.

Surveys were conducted by experienced botanists and consisted of meandering walks through the proposed activity areas. Surveys covered representative habitats in all parts of the activity areas, with the goal of traversing 100 linear feet per acre of activity area on average. Surveys were intended to locate substantial populations of TES plants that could be important for maintaining Forest-wide population viability. Locations of TES plants were noted and documented using global positioning system technology. As a precaution in case additional species are listed prior to project implementation, botanists generally listed all plant species that were encountered.

Field surveys were conducted from 2001-2006. All surveys were conducted between June 1 and September 30, inclusive, which constitutes the active growing season for TES plants that are known to occur on the Monongahela National Forest. Field surveys were supplemented by existing records of TES plants from files at the Monongahela National Forest Supervisor's Office and the West Virginia Division of Natural Resource's Natural Heritage program.

Discussions of the effects of proposed activities were based on reviews of scientific literature and other information, as well as the general observation and experience of the Ecologist. The likelihood of occurrence in the project area for each TES plant was assessed in the Likelihood of Occurrence document, which is filed in the project record. The likelihood of occurrence was based on field surveys, historic records, and the presence of potential habitat in the project area.

Affected Environment – Threatened and Endangered Plants

Four federally-listed threatened and endangered plant species are known to occur on the Monongahela National Forest: running buffalo clover (*Trifolium stoloniferum*), shale barren rockcress (*Arabis serotina*), Virginia spiraea (*Spiraea virginiana*), and small whorled pogonia (*Isotria medeoloides*). Based on field surveys and existing records, none of these species are known to occur in the analysis area. Following is a brief description of the typical habitat and likelihood of occurrence in the analysis area.

Virginia Spiraea - Virginia spiraea is a clonal shrub found on damp, rocky banks of large, high-gradient streams (USFWS 1992a). Within the analysis area, potential habitat for Virginia spiraea is limited to the channels and banks of larger streams such as the North Fork Cherry River and some of its larger tributaries.

Existing records show that the nearest known occurrence of Virginia spiraea is along the Greenbrier River approximately 25 air miles southeast of the analysis area. Virginia spiraea is not known to occur along any streams in the analysis area, so the likelihood of occurrence is considered to be low. However, streams were not included in the field surveys, so the potential for occurrence in the analysis area cannot be ruled out completely.

Running Buffalo Clover – Running buffalo clover is typically found in mesic habitats with partial to filtered sunlight and a prolonged pattern of moderate and periodic disturbance, such as grazing, mowing, trampling, selective logging, or flood-scouring. Running buffalo clover is often found in areas underlain with limestone or other calcareous bedrock, but not exclusively. In West Virginia, sites have also been identified on the Mauch Chunk formation, which is primarily shale (Harman 2016). Running buffalo clover is found in a variety of habitat types, including mesic woodlands, streambanks, grazed woodlots, mowed paths, old logging roads, trails, mowed wildlife openings within mature forests, savannahs, sandbars, steep ravines and infrequently used

ATV trails and gravel drives (USFWS 2007, 2008a). Sites that were recently discovered occur in hawthorn thickets and locust savannah communities. The Monongahela National Forest is a stronghold for running buffalo clover, with the largest and highest quality populations range-wide occurring on the Forest (USFWS 2007).

Existing records show that the nearest known occurrence of running buffalo clover is located along a Forest Service road, approximately 9 air miles northeast of the analysis area. The likelihood of occurrence for running buffalo clover is considered low because it is not known to occur in the analysis area, and field surveys have not located it.

Small Whorled Pogonia – Small whorled pogonia habitat preferences are poorly known, but could include a variety of forested habitats. The available literature indicates occurrence in mixed deciduous and pine-hardwood habitats of a variety of ages, often near partial canopy openings (USFWS 1992b) or in open understories. Small whorled pogonia appears to be associated with acidic soils having a pan layer, and slopes of 11 to 17 percent near small streams (USFWS 2008b).

The likelihood of occurrence for small whorled pogonia is considered low because it is not known to occur in the analysis area, and field surveys have not located it. However, the potential occurrence cannot be completely ruled out based on habitat preferences and due to the difficulty of locating this species using conventional survey techniques.

Shale Barren Rockcress – Shale barren rockcress occurs in specialized habitats known as shale barrens in eastern West Virginia and western Virginia (USFWS 1991). Shale barrens are limited to the drier areas of the Monongahela National Forest. Therefore, shale barren rockcress is not likely to occur in the analysis area due to a lack of habitat.

Affected Environment – Regional Forester's Sensitive Species Plants

Seventy plant species are listed as Regional Forester's Sensitive Species on the Monongahela National Forest. Based on field surveys and existing records, one sensitive plant species is known to occur in the analysis area: longstalk holly (*Ilex collina*). Based on the Likelihood of Occurrence table, potential habitat exists for an additional 32 species, for a total of 33 sensitive species that could occur in the analysis area. However, for the 33 species with potential habitat but no known occurrences, field surveys did not locate them in the activity areas. Therefore, the probability of occurrence of these 33 species in areas that would be affected by project activities is low.

To facilitate analysis, sensitive plant species have been grouped according to their primary habitat. The three habitat groupings are mesic forests, wetland/riparian habitat, and rocky habitat. Mesic forest is a broad grouping that includes mixed hardwood and northern hardwood forests, as well as hemlock-hardwood mixed forests. Mesic forests cover the majority of the analysis area. Forests dominated by oaks are scattered throughout the analysis area, but they do not cover large areas and generally fall toward the mesic end of the oak forest moisture spectrum. Therefore, the oak forests are included with the mesic forests for this analysis. Riparian habitat and small areas of wetland habitat occur along streams throughout the analysis area. Small seep wetlands also occur on slopes in areas that are not near streams. Dry rocky habitat includes dry rock outcrops and ledges that occur at various elevations along ridge tops and side slopes, whereas moist rocky habitat includes the wet outcrops and moist colluvial rubble that occur along streams and in cove bottoms. The analysis area has the potential to contain patches of both types of habitat. Some overlap among the habitat types occurs. For example, mesic forests, wetland/riparian habitat, and moist rocky habitat co-occur in the deep, narrow coves. The following table lists sensitive species that could occur in the analysis area.

Table 1. Sensitive species that could occur in the Gauley Healthy Forest Restoration analysis area.

Scientific Name	Common Name	Habitat Comments	Known Occurrence(s)	Potential Habitat
Mesic Forests				
Botrychium lanceolatum var. *angustisegmentum*	Lanceleaf Grapefern	Moist, shady woods and swamp margins		X
Carex lucorum var. austrolucorum	Blue Ridge Sedge	Well-drained, acidic soils on mesic to dry slopes		X
Carex roanensis	Roan Mountain Sedge	Mid- to high-elevation mesic forests		X
Corallorhiza bentleyi	Bentley's Coralroot	Habitat preferences poorly understood		X
Cypripedium reginae	Showy Lady's Slipper	Swamps and woods		X
Juglans cinerea	Butternut	Variety of wooded situations; does not require rich soil, but generally does not occur on the poorest sites		X
Platanthera shriveri	Shriver's Purple Fringed Orchid	Deciduous forests; wooded roadsides		X
Rosa blanda var. blanda	Smooth Rose	Thickets, grassy verges, edges of woods, ditches, stream banks, gravelly and sandy flats		X
Triphora trianthophora	Threebirds Orchid	Deep leaf litter or humus		X
Viola appalachiensis	Appalachian Violet	Often in riparian areas, but can occur in other mesic situations		X
Wetland and Riparian Habitat				
Amelanchier bartramiana	Oblongfruit Serviceberry	High elevations in wet and moist sites		X
Baptisia australis var. *australis*	Blue Wild Indigo	Primarily early successional wetlands		X

Scientific Name	Common Name	Habitat Comments	Known Occurrence(s)	Potential Habitat
Hasteola suaveolens	False Indian Plantain	Riverbanks and disturbed wetlands		X
Hypericum mitchellianum	Blue Ridge St. John's Wort	Riverbanks and disturbed wetlands		X
Ilex collina	Longstalk Holly	Open or closed canopy wetland/riparian	X	
Listera cordata	Heartleaf Twayblade	Mossy hummocks in forested wet areas; moist, mossy sites in conifer and conifer-hardwood forests		X
Marshallia grandiflora	Monongahela Barbara's Buttons	Banks of large streams		X
Potamogeton tennesseensis	Tennessee Pondweed	Slow-flowing rivers		X
Ranunculus pensylvanicus	Pennsylvania Buttercup	Wetlands in full sun and filtered sunlight		X
Ribes lacustre	Bristly Currant	Wetlands in partial shade or full sun		X
Vitis rupestris	Sand Grape	River banks		X
Woodwardia areolata	Netted Chainfern	Swamps and wet woods		X
Rocky Habitat				
Clematis occidentalis var. occidentalis	Western Blue Virginsbower	Rocky habitats in at least partial shade		X
Cornus rugosa	Roundleaf Dogwood	Rocky areas within forests		X
Gymnocarpium appalachianum	Appalachian Oak Fern	Rocky woods along streams		X
Heuchera alba	White Alumroot	Rocky areas within forests		X
Piptatherum canadense	Canadian Ricegrass	Sandstone barrens		X
Pycnanthemum beadlei	Beadle's Mountainmint	Open canopy over rocks		X
Saxifraga michauxii	Michaux's Saxifrage	Wet ledges, boulder fields, and rocky slopes, usually in thin soil over rock		X
Scutellaria saxatilis	Smooth Rock Skullcap	Variety of rocky situations, but most common in moist, partially shaded talus.		X

Scientific Name	Common Name	Habitat Comments	Known Occurrence(s)	Potential Habitat
Taxus canadensis	Canada Yew	Moist, rocky habitats along streams; wetlands and spruce forests		X
Tortula ammonsiana	Ammon's Tortula Moss	Wet, cool outcrops		X
Trichomanes boschianum	Bristle-fern	Dripping rocks		X

Effects – Threatened and Endangered Plants

Direct and Indirect Environmental Effects

Virginia spiraea– Proposed activities would not occur in or near potential habitat for Virginia spiraea. Therefore, these activities would not affect Virginia spiraea.

Running buffalo clover is not known to exist in any of the proposed activity areas. Therefore, direct effects on running buffalo clover are not likely to occur. If any undiscovered occurrences of running buffalo clover exist in proposed activity areas effects could occur. Potential habitat could be impacted but such effects on habitat would not translate into actual impacts on running buffalo clover unless undiscovered populations exist.

The open canopy created in regeneration units likely would lead to running buffalo clover being out-competed by sun-loving herbs, shrubs, and saplings. Beneficial effects could occur in thinning units due to the partial opening of the canopy. If any undiscovered occurrences of running buffalo clover exist within temporary road and landing sites, they could be damaged or eliminated. In conventionally-yarded thinning units, the soil disturbance due to skidding could benefit running buffalo clover by providing a suitable habitat for it to colonize. Temporary road construction and reconstruction could also create additional habitat.

The possible effects outlined are considered unlikely due to the low probability that any undiscovered occurrences of running buffalo clover exist. Therefore, the potential for adverse effects is considered discountable

Small whorled pogonia is not known to exist in any of the proposed activity areas. Therefore, direct effects on small whorled pogonia are not likely to occur. If any undiscovered occurrence of small whorled pogonia exists in the proposed activity areas, effects could occur. Potential habitat could be impacted but such effects on habitat would not translate into actual impacts on small whorled pogonia unless undiscovered populations exist.

Commercial regeneration harvest, temporary road and landing construction, and prescribed fire have the potential to damage or eliminate small whorled pogonia. The effects of thinning harvest on small whorled pogonia are difficult to predict but may have a beneficial effect due to the partial opening of the canopy. Small whorled pogonia is not likely to be affected by road maintenance which would be limited to the existing footprint of heavily traveled roads that are not likely to support small whorled pogonia.

The possible effects outlined are considered unlikely due to the low probability that any undiscovered occurrences of small whorled pogonia exist. Therefore, the potential for adverse effects is considered discountable

Shale barren rockcress – Habitat for shale barren rockcress does not occur in the analysis area. Therefore, none of the activities proposed would affect shale barren rockcress.

Cumulative Effects of Proposed Action

Under the Proposed Action, the potential for direct and indirect effects to threatened and endangered plants is so small it is considered discountable. Therefore, the Proposed Action would be unlikely to make any measurable contribution to the effects of other past, present, and reasonably foreseeable actions.

Effect Determinations for Threatened and Endangered Plants

Virginia spiraea - None of the proposed actions would have any potential to affect Virginia spiraea. Therefore, the proposed action would have **no effect** on Virginia spiraea.

Running buffalo clover - Under the Proposed Action, the potential for direct and indirect effects on running buffalo clover would be so low as to be discountable. Therefore, the Proposed Action **may affect but is not likely to adversely affect**, running buffalo clover.

Small whorled pogonia - Under the Proposed Action, the potential for direct and indirect effects on small whorled pogonia would be so low as to be discountable. Therefore, the Proposed Action **may affect but is not likely to adversely affect**, small whorled pogonia.

Shale barren rockcress - Shale barren rockcress has no potential to occur in the analysis area. Therefore, the Proposed Action would have **no effect** on shale barren rockcress.

Consistency with the Forest Plan

The Proposed Action would be unlikely to affect threatened and endangered plants adversely. Therefore, the Proposed Action would be consistent with Forest Plan direction to avoid and minimize adverse impacts to threatened and endangered plants.

Consistency with Laws, Regulations, Handbooks and Executive Orders

The Proposed Action would be unlikely to affect threatened and endangered plants adversely. Therefore, all alternatives would be consistent with Endangered Species Act protections and consultation requirements, as well as all regulations, directives, and policies that implement that act with respect to threatened and endangered plants.

Effects – Sensitive Plants

Direct and Indirect Environmental Effects

Activities that are unlikely to affect sensitive plants – Several activities that are proposed by the Proposed Action would have little or no potential to affect sensitive plants:

- **Site preparation and vine control using hand tools, crop tree release, and targeted herbicide applications.** Hardwood stands that would be commercially harvested also would be subject to various associated treatments. Cutting non-merchantable stems and vines would be accomplished using hand tools, so it would not involve any ground disturbance that might impact sensitive plants. If any butternuts are encountered, they would be protected by a project design feature. Tree planting, fencing or caging could be used to reduce deer browse but would involve no appreciable ground disturbance. Crop tree release would be conducted in young stands that are not likely to support sensitive plants due to intense competition from the low, dense saplings canopy. Applying herbicides using cut surface and basal spray methods would cause little or no overspray and would be unlikely to affect non-target plants, including sensitive species.

- **Nonnative invasive plant control** was analyzed in the Forest-wide Nonnative Invasive Plant Management Project Environment Assessment, which is filed in the project record.

Because the activities listed above have little or no potential to affect sensitive plant species, they will not be analyzed further in this report.

Activities that may affect sensitive plants – All other proposed activities involve ground and vegetation disturbance and could have at least a small chance of affecting sensitive plant species. These activities are analyzed according to their potential to affect sensitive plant species.

- **Commercial timber harvesting and associated temporary road and landing construction.** Proposed commercial timber harvesting includes regeneration of hardwood stands (351 acres), commercial thinning of hardwood stands (2464 acres), fuel break establishment (75 acres including 72 acres within commercial harvest units) and associated temporary road construction/reconstruction (62 miles) and landing construction (40 sites). These activities cover large portions of the analysis area, and while survey coverage of representative habitats will be obtained in the proposed units, the large total area proposed for harvest precludes 100 percent survey coverage within each unit. Therefore, some potential exists for undiscovered sensitive plants to be impacted.

- **Prescribed fire and fuels reduction**. Proposed prescribed fire includes broadcast burning of one unit (357 acres) and associated fire line construction, prescribed fire to maintain fuel breaks (75 acres), and pile burning within fuel breaks to reduce logging slash and woody debris created from commercial timber harvest. Survey coverage of representative habitats was obtained in the proposed units but the large total area proposed precluded 100 percent survey coverage. Therefore, some potential exists for undiscovered sensitive plants to be impacted.

- **Maintenance of existing roads.** In general, the roads that are proposed for maintenance (19 miles) are heavily used, maintained, and compacted. Many of the roads were used as travel routes by botanists during their surveys of the other activity areas. However, despite the low probability of sensitive plants occurring on these routes, the possibility cannot be completely discounted, and survey coverage is not complete. While the probability is considered low, some potential exists for undiscovered sensitive plants to be impacted.

Longstalk holly is a deciduous shrub or tree with stalked red berries found at higher elevations in moist soil, especially riparian areas of high energy streams, but also present, though less common, in wet meadows, bogs, and seeps (NatureServe 2019). Longstalk holly is known to occur at 8 locations in the analysis area. The known occurrences are not within proposed activity areas and therefore would be directly affected by proposed activities. However, because longstalk holly is known to occur in scattered locations across the analysis area, additional undiscovered occurrences probably exist. Whether any undiscovered occurrences exist within proposed activity areas is not known.

Forest Plan direction that protects stream channels and wetlands would limit the potential effects of commercial harvest and associated activities on longstalk holly. Forest Plan direction prohibits programmed timber harvest in channel buffers (SW34) and limits roads, skid trails and landing to essential crossings (SW44, SW40). Similar protection is required for wetlands (SW51). Because of the allowance for essential crossings of streams and wetlands, temporary roads, skid trails, and landings would have some potential to impact longstalk holly. Impacts on undiscovered occurrences could include directly damaging or eliminating plants through grading, applying gravel, and installing culverts.

Prescribed fire is unlikely to carry through wetland/riparian habitat with much intensity. Recent experience on other prescribed fire projects on the Forest suggests that fire in mesic oak-hickory ecosystems will burn into the riparian area, but typically at low intensity. Such low intensity fire usually consumes the undecomposed leaf litter without substantial effects on the organic and mineral horizons of the soil. The effects of fire on longstalk are not known. Presumably, longstalk holly would be top-killed unless a lack of fuel limits the intensity of the fire. The extent to which roots and seeds would be damaged and plants potentially subjected to total mortality is not known, but likely would be related to fire intensity.

Other sensitive species - An additional 32 sensitive species have the potential to occur in the analysis area (Table 1). No occurrences of these sensitive species are known in the analysis area, so the potential for effects on these species is low. However, due to the representative nature of the surveys, the potential for impacts to undiscovered occurrences cannot be ruled out completely.

Mesic forest species –If any undiscovered occurrences of these species exist in areas proposed for commercial regeneration harvesting or temporary road and landing construction, they likely would be damaged or eliminated. One possible exception would be butternut, which is shade-intolerant and requires an open canopy to regenerate (Burns and Honkala 1990). If any undiscovered butternut seedlings or saplings survive the harvest, or if any seedlings become established following site preparation, they would benefit from the open canopy in even-aged regeneration units. For most species in this group, the effects of thinning harvests would be uncertain because preferred light levels are not precisely known. However, any undiscovered butternuts likely would benefit from thinning.

The effects of prescribed fire on species in this group are unknown. Presumably, butternut would be top-killed or damaged by fire. The extent to which roots and seeds would be damaged and plants potentially subjected to total morality is not known, but would likely be related to fire intensity.

Wetland and riparian habitat species – Forest Plan direction that protects stream channel corridors and wetlands would limit the potential effects of commercial timber harvest and associated activities on wetland/riparian habitat sensitive plants (see longstalk holly direct and indirect effects discussion above). In contrast to the potential for negative impacts from road and skid trail crossings, habitat adjacent to the crossings could be improved for species that prefer an open or partially open canopy. Actual benefits to these species would not occur if no individuals are present nearby to colonize the habitat.

Prescribed fire is unlikely to carry through these habitats with much intensity, although the potential for effects cannot be ruled out completely (see longstalk holly direct and indirect effects discussion above).

Rocky habitat species – If any undiscovered occurrences of these species exist in areas proposed for commercial regeneration harvesting or temporary road and landing construction, they likely would be damaged or eliminated. Construction of temporary roads and landings typically avoids major outcrops due to excavation difficulties, but smaller outcrops could be damaged. In addition, project activities are designed to avoid rocky habitats along streams and seeps.

The effects of prescribed fire on species in this group are unknown. Presumably, the woody species and semi-evergreen species (purple clematis and white alumroot) would be top-killed unless a lack of fuel in rocky areas limits the intensity of the fire. The extent to which roots and seeds would be damaged and plants potentially subjected to total mortality is not known, but likely would be related to fire intensity.

Cumulative Effects of the Proposed Action

The Proposed Action would have no direct or indirect effects on known occurrences of sensitive plants but has the potential to affect undiscovered occurrences. This potential is considered highest for longstalk holly because of the known distribution across the analysis area. For other sensitive plants, the potential for affecting undiscovered occurrences is considered low enough that a meaningful analysis of the contribution to the cumulative effects of other past, present, and reasonably foreseeable future actions is not practical. Therefore, the remainder of this cumulative effects analysis will focus on longstalk holly.

Within the Forest boundary, numerous past activities likely have affected longstalk holly. The most important past impact probably was the large-scale clearcut logging that took place around the turn of the 20th Century. No data on this species are available from that time period, but it is likely that at least some occurrences of this species were reduced in size or eliminated. Other development activities likely contributed to past impacts, including railroad and road construction, mining, urban development, and coversion of land to agriculture. In more recent decades, natural gas extraction and Forest Service management activities such as road building probably impacted this species. Comprehensive botany surveys have only been conducted for Forest Service projects since 1995, so even these more recent impacts cannot be reliably quantified.

No ongoing or reasonably foreseeable future Forest Service actions would impact known occurences of longstalk holly. Therefore, the effects of the Gauley Healthy Forest Restoration project, added to the unquatifiable impacts of past actions, would consitute the entirety of all known cumulative impacts on this species.

Although the Proposed Action could cause the decline or loss of an undetermined number of undiscovered occurrences of longstalk holly, such impacts would not be expected to have an appreciable impact on overall population viabiliy within the Forest boundary. Because all known occurences would be protected, the species would be expected to persist in the anaylsis area. In addition, known occurences outside the analysis area are not expected to be impacted by reasonably foreseeable future actions. In addition to the 8 known locations of longstalk holly in the analysis area, 406 other occurrences are known within the Proclamation and Purchase Unit boundary for the Monongahela National Forest, 235 of those are on federal land. None of the occurrences on federal land are expected to be impacted in the foreseeable future.

Effect Determinations for Sensitive Plant Species

The Proposed Action could affect any undiscovered occurrences of longstalk holly. However, as discussed above, such losses would not be expected to impact population viability within the analysis area or on a Forest-wide basis. Also, the Proposed Action would pose a very small risk of damaging or extirpating undiscovered occurrences of other sensitive plant species with potential habitat in the analysis area. Therefore, for all sensitive plant species listed in Table 1 above, the Proposed Action **may impact individuals but are not likely to lead to loss of viability or a trend toward federal listing.**

Sensitive plant species that are not listed in Tables 1 above are not expected to occur in the analysis area. Therefore, for all sensitive plant species not list in Tables 1, the action alternatives would have **no impacts.**

Consistency with the Forest Plan

The Proposed Action could affect undiscovered occurrences of sensitive plants, particularly longstalk holly. However, damage to known occurrences would be avoided or minimized through design criteria, so the Proposed Action would be consistent with Forest Plan direction to avoid and minimize negative impacts on sensitive plants to the extent practical (see Forest Plan standard VE13, p. II-19).

Consistency with Laws, Regulations, Handbooks, and Executive Orders

Under the Proposed Action, effects on sensitive species would be avoided and minimized to the extent practical, and would not result in loss of viability or a trend toward federal listing. Because of this maintenance of viability, the Proposed Action would be consistent with requirements in the National Forest Management Act and its implementing regulations related to maintenance of biological diversity and population viability.

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Effects Analysis for Threatened and Endangered:

Streamlined Biological Evaluation/Assessment and Concurrence/Tiered Biological Opinion for Monongahela National Forest (MNF) Projects Tiered to the 2006 Forest Plan Programmatic Biological Assessment and FWS Programmatic Biological Opinion.

TYPE OF CONSULTATION: ☒ **Informal**
☒ **Formal (tiered process)**
☒ **Streamlined NLEB Process (Part B)**

PROJECT NAME: Gauley Healthy Forest Restoration

PROJECT LOCATION: near Richwood, West Virginia

DISTRICT: Monongahela National Forest, Gauley Ranger District

COUNTY (IES): Greenbrier, Nicholas, Pocahontas, and Webster Counties

WATERSHED(S): Cherry River and portions of Cranberry River and Spring Creek

MAP(S) ATTACHED: ☒VICINITY ☒DETAILED PROJECT MAP

☒ ACTION AREA MAP

Table 1. Overall Determination of Effects for Federally Listed Species.

Species	**Determination**
Cheat Mountain salamander (*Plethodon nettingi nettingi*)	NE
Virginia big-eared bat (*Corynorhinus townsendii virginianus*)	NE
Indiana bat (*Myotis sodalis*)	LAA
Northern long-eared bat (*Myotis septentrionalis*)	LAA
Rusty Patched Bumble Bee (*Bombus affinis*)	NE
Candy Darter (*Etheostoma osburni*)	NLAA
Shale barren rock cress (*Arabis serotina*)	NE
Virginia spiraea (*Spiraea virginiana*)	NE
Running buffalo clover (*Trifolium stoloniferum*)	NLAA
Small whorled pogonia (*Isotria medeoloides*)	NLAA

NE (No Effect); NLAA (May affect, not likely to adversely affect); LAA (May affect, likely to adversely affect).

PROJECT DESCRIPTION (proposed action):

Silvicultural Treatments

Hardwood Commercial Regeneration Harvest: (11 stands, 350 acres)

Regeneration harvest will occur in 350 acres. Eight units (242 acres) will be harvested through conventional means and three units (108 acres) will be helicopter units. Helicopter units should have limited ground disturbance when compared to conventional logging as it limits the need for temporary roads and skid trails. Regeneration harvest would remove almost of all trees of commercial size, except in areas designated as wildlife and riparian buffer zone.

Clearcutting (Regeneration). Forest Plan, page A2 "The clearcutting method harvests most or all of the trees within a stand in one removal. Typically, some reserve trees are left to meet wildlife habitat or other resource needs." Commercial timber harvest involves the use of hand or mechanical felling and removal from the forest by helicopter or skidder. Firewood gathering opportunities may be provided with these treatments also, as described under thinning.

Hardwood Commercial Thinning: (71 stands, 2462 acres)

Commercial thinning will occur in 2460 acres. Fifty-seven units (1719 acres) will be harvested through conventional means and 14 units (741 acres) will be helicopter units. Helicopter units should have limited ground disturbance when compared to conventional logging as it limits the need for temporary roads and skid trails. Thinning would remove 1/3 of the basal area from overstory and midstory trees. The proposed timber harvest and associated tasks could take from 3-5 years to complete and would not take place all at once.

Thinning. Forest Plan, page A2 "The thinning method is an intermediate cut that . . . removes high risk . . . low quality, diseased, and over mature trees to increase the health, development, and growth of the residual trees in a stand. . .. Thinning is applicable to all of the forest types found on the Forest."

Commercial timber harvest involves the use of hand or mechanical felling and removal from the forest by helicopter or skidder.

Connected Actions:

- ***Site Preparation***. Forest Plan page A15. Site preparation includes cutting down residual trees between 1 and 5 inches in diameter during or immediately after a regeneration harvest. Normally red spruce, hemlock, dogwood, serviceberry and shrub species that produce mast for wildlife are not cut.
- ***Planting.*** Forest Plan page A16. Hardwood forests normally regenerate naturally after a timber harvest occurs, planting is sometimes used in stands to improve species diversity. Competition for sunlight, moisture, and soil nutrients is intense when a stand is regenerated. To improve the potential for planted seedlings to grow into be retained as a viable component within a stand, protective tree shelters may be used to improve

survival. A tree shelter acts like a mini green house, providing increased temperatures over longer time periods than in open conditions, resulting in increased survival rates and overall growth of the planted seedling. Tree shelters are also put in place to protect the seedlings from deer browsing. These potential treatments would occur during the regeneration period (normally 1 to 5 years after the harvest and site preparation).

- ***Vine Control***. Forest Plan page A16. Pre-harvest vine treatment would be used to prevent vines from damaging regeneration. The pre-harvest vine treatment would include hand cutting of most vines, usually grape or camphor, attached in the crowns of trees, prior to harvest.
- ***Insecticide Use*** - Emamectin benzoate, Imidacloprid, Dinotefuran and neem oil may be used on a maximum of 20 acres to treat emerald ash borer, hemlock wooly adelgid and beech bark disease. Application will follow manufacturer specifications as well as MNF Forest plan standards, guidelines and direction.
- ***Landings.*** Cut logs would be temporarily stored in landing areas, before loading onto trucks for transport. Landings are generally cleared of standing trees, stumps, and leveled with a heavy equipment to form a place to store logs until they can be loaded and removed from the site. There will be 40 landings proposed for this action. Conventional lands are 0.5 acres. Helicopter landings are 1.5 acres. Activities put in place to reclaim the landings include back blading and leveling to ensure positive drainage and seeding (approved seed mixture) and mulching to establish ground cover. View table 2 for details.

Table 2. Landing Zones.

Disturbance	Type	Number	Acres
New	Helicopter	4	6
New	Conventional	13	6.5
Existing	Helicopter	3	4.5
Existing	Conventional	20	10
Total	Landings	40	26

*13 acres of new disturbance

- ***Temporary Roads.*** Cut trees would be moved to the log landing along temporary roads that are constructed between the cut trees and the log landing within each harvest unit. Temporary roads are generally constructed with a dozer or a blade on a skidder and 12 feet wide. Temporary roads are generally closed with dips, water bars, and seeded with a Forest Service approved seed mixture following the completion of harvesting activities. Approximately 29.5 miles of temporary road construction and 32.3 miles of temporary road reconstruction is proposed which would result in approximately 45 and 50 acres of disturbance (respectively).
- ***Crop tree release.*** Forest Plan page A16. This treatment may be used to achieve a variety of objectives including: to restore diversity of species within a stand; to develop mast producing trees for wildlife; increase commercial value; and/ or to improve scenic quality. Criteria should be developed to meet specific objectives in selecting 30 to 50 trees per acre of good health and form to retain the stand. These selected crop trees are released from competing vegetation by cutting or girdling nearby trees that touch the

crowns of the selected trees. Cut or girdle trees that are of little commercial value or provided valuable wildlife habitat may be left on site.

Prescribed Burning

Prescribed Fire: Broadcast (357 acres)

The project will be implemented during either the Spring (prior to green-up) or Fall (dormant) seasons to promote fire adapted species and to reduce leaf litter and the threat of uncharacteristic wildfire. A low to moderate fire intensity will be used to reduce leaf litter while maintaining fire adapted overstory trees. The result of this prescribed fire project will be to create a healthy forest by reducing dead woody debris, increasing sunlight by reducing competition from fire intolerant tree species, promoting native grasses, increasing oak regeneration, and increasing wildlife populations. Natural features such as roads, streams, and rivers will be used as much as possible to limit the impact on the land. In instances where handlines need to be constructed Minimum Impact Suppression Tactics (MIST) techniques will be used. The concept of MIST is to use the minimum amount of forces necessary to effectively achieve the fire management protection objectives consistent with land and resource management objectives. It implies a greater sensitivity to the impacts of suppression tactics and their long-term effects when determining how to implement an appropriate suppression response. In some cases, MIST may indicate where cold trailing or wet line may be more appropriate than constructed handline. Individual determinations will be dependent on the specific situation and circumstances of each fire. Prescribed fire would be implemented in this area periodically until resource objectives are meet.

Connected Actions:

- ***Fire lines.*** These are natural or constructed barriers used to stop a fire from spreading. Construction of fire lines may be accomplished with leaf blowers, hand tools, and/or rakes. Natural features (drainages, creeks, cliffs) and manmade features (roads, trails) could also be used as fire lines.
- ***Prescribed Fire – Piles.*** An associated treatment that consists of creating hand piles along private property boundary and Forest Service infrastructure will reduce logging slash and woody debris created from the thinning project within the fuel break areas. Piles will consist of top wood and non-merchantable wood. Piles will be burned during low or moderate fire danger days when either snow is on the ground or when there is enough moisture in the soil to prevent the spread of fire. No handline will be constructed for hand piling. Piles may be constructed whenever there is a change in fuel loadings that may influence the effectiveness of the fuel break. An example of this would be a weather event that blows down trees within the fuel break.
- ***Fuel Breaks.*** **(16 acres not covered in other harvest, 75.5 acres total)** Mechanical fuel breaks will be constructed along portions of private property and Forest Service infrastructure (around Summit Lake and Richwood) and would be treated with thinning for the purpose of fuel reduction. This mechanical fuel break will consist of removing

dead and down trees, pruning limbs of larger trees, and removing brush/vines and some small diameter trees within 100 feet of private property or Forest Service infrastructure. Slash created from harvest operation will be mechanically or hand piled and burned or pulled away from private property or Forest Service infrastructure by the contractor approximately 100 feet from property boundary. Fuel breaks will be created and maintained by using chainsaws, prescribed fire, and/or mowing. Prescribed burning may be used within fuel breaks to reduce fuel loading of brush, shrubs, and trees while encouraging the growth of fire adapted species. These fuel breaks will create defensible space in the event of a wildfire in the vicinity. The fuel breaks will be evaluated periodically for effectiveness of the defensible space and to determine if future treatments are needed.

Non-Native Invasive Species

Existing and new infestations of high-priority nonnative invasive plants in proposed activity areas will be treated before, during, and after project implementation to prevent the spread of nonnative species into new areas. Treatment methods will include hand-pulling, mowing, grubbing, biological control, and herbicide application. Herbicide use to treat existing and new infestations of high-priority nonnative invasive species (NNIS) is proposed throughout the project area. Species that may be controlled as well as herbicides that may be used can be found in the 2010 Forest-wide Nonnative Invasive Plant Management Project Environmental Analysis (page 2-7). Any treatment of NNIS within the Gauley Healthy Forest Restoration (GHFR) project area will tier to the Forest-wide Nonnative Invasive Plant Management Project. All design criteria, mitigation measures, and monitoring requirements listed in Chapter 2 of this analysis (page 2 to 15 through 2 to 20) will be followed.

Transportation

Maintenance: (19.1 acres)

Road maintenance will occur as needed on system roads within the project area to provide for egress and ingress in case of fire and for firefighting as well as timber haul. It includes mowing, grading, cleaning or replacing culverts, and applying surface material. Some of the culverts to be replaced are at stream crossings, such as the one on FR 946 where it crosses Spencer Run. Road maintenance also includes removing hazard trees (using commercial sale methods where practical) that may fall and block the road access and to thin the canopy across and along roads so they can act as fuel breaks (Forest Plan RF11).

Construction: (44.63 acres)

Temporary road construction will allow for access to timber harvest and prescribed fire related actions for this project.

Temporary roads used for removal of timber products involve blading a route with cut and fill slopes, providing for water crossings during use, and decommissioning after use. Temporary roads used for hauling products may also involve gravel surfacing. Temporary roads for hauling or skidding are not anticipated to be needed on very steep slopes (more than 50 percent). Building or using temporary roads on steep slopes (40 to 50 percent) would be avoided where possible. If during implementation, operation on steep slopes (40 to 50 percent) is found to be needed, then operation on these slopes shall be analyzed on a case-by-case basis to determine the best method of operation while maintaining soil stability and productivity according to standard SW07.

Temporary roads will be needed for removal of timber products. Temporary roads will be decommissioned and restored within 3 years of the end of project activities as required by the Section 603 of HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)). Decommissioning methods used for temporary roads should allow for fuel reduction by brushing to retain defensible space, where appropriate. Decommissioning methods for temporary roads built on existing linear wildlife openings should consider the need to retain defensible space as well as maintenance of wildlife and pollinator plantings after use.

Decommissioning of temporary roads used for both hauling and skidding would follow guideline RF13. The road profile should not normally be returned to contour during decommissioning. Decommissioning should also allow for treatment of non-native plant species, as appropriate.

Reconstruction: (49.98 acres)

Road reconstruction consists of improvements to the original surface material and constructing drainage features. In some cases, realignment of the road may be necessary. Temporary roads will be decommissioned and restored within 3 years of the end of project activities as required by the Section 603 of HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)). Decommissioning methods used for temporary roads should allow for fuel reduction by brushing to retain defensible space, where appropriate. Decommissioning methods for temporary roads built on existing linear wildlife openings should consider the need to retain defensible space as well as maintenance of wildlife and pollinator plantings after use.

Table 3. Proposed Temporary Roads.

Type of Road	Mileage	Width in feet	Approx. Acreage
Temporary road construction	1.0	25	3.03
Temporary road reconstruction	1.9	25	5.76
Temporary road construction	28.6	12	41.6
Temporary road reconstruction	30.4	12	44.22
Maintenance of forest system roads	19.1		Existing condition

*3.03 acres of temporary roads will be accessed outside of disturbance areas and will go toward ITS.

Table 4. Activity and Treatment Acreage Summary for Proposed Action

Treatment	Acreage
Thinning, using ground-based logging, without prescribed burning	1521
Thinning, using helicopter logging, without prescribed burning	741
Prescribed burning and thinning using ground-based logging	200
Prescribed burning (without thinning)	157
Regeneration harvest, using ground-based logging	242
Regeneration harvest, using helicopter logging	108
Fuel break, not included in other timber harvest in 3 locations	16
New Landings	13
Temporary road construction and reconstruction	61.9
Herbicide	350
Insecticide	20

PROJECT STATEMENTS (Check all that apply and provide additional information as necessary.)

☒ All applicable standards and guidelines will be followed during implementation of this project.

☐ The following standards and guidelines cannot be followed (include a reason in a bullet list below):

Click here to enter text.

☒ The following mitigation/minimization measures will be applied during implementation of this project and are part of the proposed action under consultation:

Table 5. Species List (generated in Information for Planning and Consultation tool (IPaC) (https://ecos.fws.gov/ipac/)/Other FS data). Surveys for bats are done in accordance with the Reasonable and Prudent Measures of the 2006 Programmatic Biological Opinion and in consultation with the USFWS, Elkins, WV Field Office. List *ONLY* the species/critical habitat within the action area (or high potential to be in the area):

Species/Critical Habitat/High Potential for Bats	Data Source(s): (IPaC, MNHD, Surveys, Other)	Status in Action Area (2.5 Mile Buffer)

Indiana bat (*Myotis sodalis*)	BatRoostDataDraft2003_2019_01312020 MNFMistnetTemp1997_2019_01302020 Ibat_cave_5mi_circle_n83_072606 Ibat_vbeb_caves_n83_072606	Present in action area, with 9 confirmed captures, based on 2000-2019 mist-net data. 13 confirmed roosts within project area. No known maternity roosts within action area, with the closest known maternity roost being 68 miles from the proposed disturbance area. No known hibernacula, closest known hibernacula is 10.8 miles from disturbance area. The action area is outside any 5-mile primary range or key area.
Northern long-eared bat (*Myotis septentrionalis*)	BatRoostDataDraft2003_2019_01312020 MNFMistnetTemp1997_2019_01302020 NLEBhib_WvDnrCaves_0605 MonongahelaNF_NLEB_known_hib_090715	Present in action area, with 200 confirmed captures based on 2000-2019 mist-net data. No known roosts or maternity roosts within the action area, with the closest maternity roost being 24.4 miles from the proposed disturbance area. The closest known hibernacula are 10.8 miles from the proposed action.
Candy Darter (*Etheostoma osburni*)	WVDNR, Surveys, etc.	Recent evaluation of candy darter range and speciation has helped to identify streams where extant candy darter populations still occur, where variegate darter are hybridizing with candy darter, and where there is relative robustness of remaining intact populations of candy darter (Switzer et al. 2008; Gibson 2017). The meta-population in the Upper Gauley watershed (which includes the GHFR project area) is suspected to be genetically pure, although genetic analysis of a few sampled individuals revealed the presence of variegate darter alleles (Gibson 2017). Summersville Lake dam functions as an effective physical barrier to upstream migration of fish that occur in the lower Gauley River, including variegate darter. Critical habitat within Project boundary. The candy darter is known to occur in the North Fork Cherry, South Fork Cherry and Cranberry River with species specific surveys conducted as recent as 2016(Gibson 2017). Hybridization is expected to be the greatest threat to this species,

		although approximately half of the historic range of the species was lost before the threat of hybridization because of sedimentation.
Running buffalo clover (*Trifolium stoloniferum)*	Past Surveys, West Virginia Division of Natural Resources' Natural Heritage program, and additional surveys will be conducted prior to implementation.	Existing records show that the nearest known occurrence of running buffalo clover is located along a Forest Service road, approximately 9 air miles northeast of the project area. The likelihood of occurrence for running buffalo clover is considered low because it is not known to occur in the project area, and field surveys have not located it.
Small whorled pogonia (*Isotria medeoloides*)	Past Surveys, West Virginia Division of Natural Resources' Natural Heritage program, and future surveys prior to implementation activities.	The likelihood of occurrence for small whorled pogonia in the project area is considered low because it is not known to occur near the project area, and site-specific surveys have not located it. However, the potential occurrence cannot be completely ruled out based on habitat preferences and due to the difficulty of locating this species using conventional survey techniques. There are 6 known occurrences in West Virginia.

Analysis of Effects:

☒All effects are consistent with the effect's analysis in the 2006 Forest Plan/PBO and subsequent analyses. (See Appendix A and the literature cited for list of documents and page numbers for references used in this tiered analysis). These effects are summarized in Table 6.

☐The may affect, but is not likely to adversely affect the NLEB. No additional forms are necessary. See Table 7 for summary of effects and Table 1 for the determination of effects rationale.

☒The project is likely to adversely affect the Northern Long-eared bat (NLEB) Consultation for this species will use the optional streamlined consultation framework under the under the 2016 Programmatic Biological Opinion for the Final 4(d) rule. Any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule. The streamlined consultation form for NLEB is attached in Appendix A.

☐ The NLEB will be affected by this project and some activities are not exempt under the 2016 Programmatic Biological Opinion. An analysis of effects is described below in detail:

Table 6. Site Specific Analysis of Effects Summary for T & E

Species	Proposed Action (List all activities)	Season/Life Stage Impacted	Concise Effects Analysis
Indiana bat, Northern long-eared bat	Regeneration Harvest Temporary roads Site preparation Vine control Log landings	Active Season	Foraging and roosting habitat will be disturbed. The cutting of live trees will alter current habitat conditions converting mid to late successional forest to early successional. Removal of trees may result in direct mortality or harm if in occupied habitat. Indirect effects associated with habitat modifications may also disrupt breeding, feeding or sheltering behaviors. However, no breeding habitat is known to occur within the action area. Harvesting dead and dying trees during the active season could result in the loss of occupied roosts potentially injuring, killing, or disturbing individuals. Foraging opportunity will be improved by enhancing the herbaceous understory which will likely increase the insect population upon which these species prey. Both species are present in action area, however no NLEB roosts have been discovered and no known Ibat maternity roosts have been discovered in the action area. Ibat bachelor and unknown roosts will be flagged. Retention of snags (TE 24) will help retain potential or suitable roost trees for both species. There are no known hibernacula, primary range or key area within the action area. Effects of harvest activities are analyzed in depth on pages 51 to 56 of the 2006 MNF PBO.
	Thinning Temporary roads	Active Season	Similar effects as programmed regeneration harvest; however, most of the over-story will remain intact, limiting potential effects to roosting and foraging habitat. Effects of harvest activities are analyzed in depth on pages 51 to 56 of the 2006 MNF PBO.
	Prescribed fire Broadcast Fire lines Burn Piles	Active Season, Hibernation or migration	There are no known Ibat or NLEB hibernacula within the project action area. Prescribed fire typically occurs between spring or fall for timber related burning, minimizing the potential for direct effects to roosting bats as most will be hibernating or will be migrating and non-volant bats will be less likely to be present on the landscape. *Broadcast burning* will be restricted from June 1st to July 31st as an additive mitigation measure to reduce potential impacts during the pup season and to non-volant bats. Smoke effects will be managed and will no pose a threat to bats. Nearest hibernacula is 12.4 miles to the east. Fire lines are constructed during the hibernation season. Prescribed fire can benefit bat habitat by creating additional snags on the landscape and by creating conditions that stimulate growth in the understory. Some snags could also be burned or removed during operations

			(line construction or implementation) if they become a safety hazard. Most snags will remain on the landscape post-burn. Effects of burning activities are analyzed in depth on pages 57 to 59 of the 2006 MNF PBO.
	Fuel Breaks	Active Season	Additional acres of potential roosting and foraging habitat disturbed. Same impacts as analyzed in the harvest section. Effects of harvest activities are analyzed in depth on pages 51 to 56 of the 2006 MNF PBO.
	Temporary roads	Active Season, Hibernation or migration	Trees may be removed during the process and some may be suitable as roosts for Indiana or northern long-eared bats. This will have similar effects as programmed regeneration harvest. Effects of road related activities are analyzed in depth on page 56 of the 2006 MNF PBO.
	Herbicide	Active Season, Hibernation or migration	Herbicides have known impacts on Lepidoptera larvae and other insects, the primary food source for Ibat and NLEB. However, based on the scope and scale of these activities these impacts are minimal within the action area.
Running buffalo clover	Thinning Regeneration Harvest Temporary roads Site Preparation Log Landings Prescribed Fire Fuel Breaks Burn Piles	Growing Season	Running buffalo clover is not known to exist in any of the proposed activity areas. Therefore, direct effects on running buffalo clover are not likely to occur. If any undiscovered occurrences of running buffalo clover exist in proposed activity areas, effects could occur. Potential habitat could be impacted but such effects on habitat would not translate into actual impacts on running buffalo clover unless undiscovered populations exist. The open canopy created in regeneration units likely would lead to running buffalo clover being out-competed by sun-loving herbs, shrubs, and saplings. Beneficial effects could occur in thinning units due to the partial opening of the canopy. If any undiscovered occurrences of running buffalo clover exist within temporary road and landing sites, they could be damaged or eliminated. In conventionally yarded thinning units, the soil disturbance due to skidding could benefit running buffalo clover by providing a suitable habitat for it to colonize. Temporary road construction and reconstruction could also create additional habitat. The possible effects outlined are considered unlikely due to the low probability that any undiscovered occurrences of running buffalo clover exist. Therefore, the potential for adverse effects is considered discountable.
Small whorled pogonia	Programed Thinning, Regeneration Harvest, Temporary roads, Site Preparations, Prescribe Fire, Fuel Breaks Burn Piles	Growing Season	Surveys for small whorled pogonia were conducted in many of the proposed activity areas that would involve soil disturbance and/or removal of 20 percent or more of the overstory in mature stands. Field surveys covered representative habitats in areas proposed for commercial timber harvest, temporary road and landing construction, prescribed fire and fuel break establishment. Surveys for small whorled pogonia will be conducted in proposed activity areas that have not been previously surveyed, where optimal habitat conditions exist, prior to implementation.

			Surveys were conducted by experienced botanists. Surveys covered representative habitats in all parts of the activity areas, with the goal of traversing 100 linear feet per acre of activity area on average. Field surveys were conducted from 2001-2006. All surveys were conducted between June 1 and September 30, inclusive, which constitutes the active growing season for threatened and endangered plants that are known to occur on the Monongahela National Forest. Small whorled pogonia is not known to exist in any of the proposed activity areas. Therefore, direct effects on small whorled pogonia are not likely to occur. If any undiscovered occurrence of small whorled pogonia exists in the proposed activity areas, effects could occur. Potential habitat could be impacted but such effects on habitat would not translate into actual impacts on small whorled pogonia unless undiscovered populations exist. Commercial regeneration harvest, temporary road and landing construction, and prescribed fire have the potential to damage or eliminate small whorled pogonia. The effects of thinning harvest on small whorled pogonia are difficult to predict but may have a beneficial effect due to the partial opening of the canopy. Small whorled pogonia is not likely to be affected by road maintenance which would be limited to the existing footprint of heavily traveled roads that are not likely to support small whorled pogonia. The possible effects outlined are considered unlikely due to the low probability that any undiscovered occurrences of small whorled pogonia exist. Therefore, the potential for adverse effects is considered discountable.

Effects Analysis not covered in the 2006 Forest Plan/PBO:

Candy Darter:

Potential Direct and Indirect Impacts to Critical Habitat in the Project Area:

The proposed action is expected to utilize 61.9 acres of temporary roads. Temporary roads will be used for access, timber actions, and prescribed fire activities. View Table 3 for details. Some temporary road reconstruction and use is within one quarter mile of Candy Darter critical habitat.

West Virginia standard Best Management Practices (BMPs), National Core BMP Technical Guide FS-990a (U.S. Forest Service, 2012), Forest Plan guidance (U.S. Forest Service, 2006), and other project design features will reduce short-term negative effects of project activities relating to conventional vegetation management's 59 miles of associated temporary road (skid) system throughout harvest units. Direct and indirect effects to aquatic resources from temporary road creation for vegetation management actions (thinning and regeneration harvests) include a low to moderate risk for limited adverse impacts associated with stream sedimentation and altered watershed hydrology; this risk would only occur during active project implementation and a brief period there-after.

Timber harvesting, roads, temporary roads, and log landings are ground disturbing activities that may alter surface and subsurface hydrology and potentially result in accelerated runoff, new channel cutting, channel head-cutting, and increased soil erosion and sediment delivery to streams if properly BMPs are not implemented. Changes such as these can affect soil and water quality and degrade physical characteristics of aquatic habitats including those associated with occupied and proposed critical habitat for candy darter within the GHFR project area. The extent of effects is largely influenced by the amount and type of the ground disturbance, soil characteristics, topography and landform, proximity to stream channels, pre-existing conditions of the receiving channels, and effectiveness of design features and mitigation measures associated with project activities.

Some streams associated with the GHFR project document higher percentages of fine sediment. (Table 1). Adverse effects to aquatic biota are documented in MNF streams when the percentage of fine sediment <1mm is greater than approximately 5% (Edwards et al. 2007). In 2019, Hunters Run documented (% Fines<1mm) are greater than 5%. Additional accumulations of stream sedimentation could further compromise habitat qualities and therefore, affect aquatic biota associated with this aquatic ecosystem. The proposed action is at low risk to causing adverse impacts from sediment. Temporary roads pose the highest risk for sediment entering adjacent streams. Temporary roads will make up 3.6% of land disturbance activities and is not anticipated to cause adverse impacts to the candy darter.

The Monongahela Land and Resource Management Plan has established standards and guidelines to reduce the potential for effects to water quality and aquatic biota during Forest actions. For example, Forest Plan standard SW37 defines buffer widths for perennial, intermittent and ephemeral stream channels that are incorporated by reference in other Forest Plan standards to help protect stream resources from potential project impacts (including soil disturbance and erosion). Forest Plan standard SW34 prohibits programmed timber harvest or any tree removal from stream channel buffers (with few exceptions). Forest Plan standard SW40 requires skid trails/roads and landings to maintain a filter strip of at least 100 feet from all stream channels. In addition, project actions will decommission temporary roads using Forest Plan standard RF13, and address maintenance needs on existing Forest System roads within the project area.

Table 7. Water Chemistry and Stream Condition Summary of Monitoring within the GHFR project area

Stream	*Sample Date*	*pH*	*Conductivity – uS/cm*	*ANC – ueq/L*	*% Fines < 4mm*	*% Fines < 1mm*
Coats Run	3/25/2019	6.86	18.6	71.23	-	-
Coats Run	9/24/2019	7.12	29.7	221.84	-	-
Hunters Run	4/2/2018	6.39	16.3	42.41	33.28 (AEUI 2019)	14.33 (AEUI 2019)
Hunters Run	9/24/2018	7.08	31.3	193.3	-	-
Desert Branch	3/28/2017	5.45	16.1	21.56	15.82 (AEUI 2016)	9.86 (AEUI 2016)
Desert Branch	9/12/2017	5.64	16.5	23.16	-	-
North Fork Cherry River, lower	4/2/2018	6.60	29.1	67.82	-	-
North Fork Cherry River, lower	9/24/2018	6.75	22.6	93.28	-	-

Conventional Timber Harvesting - Timber harvesting for this project includes regeneration harvesting prescriptions, and thinning prescriptions remove approximately 1/3 of the standing basal area of timber in target stands. Roads, landings, and skid roads are necessary to implement these prescriptions using conventional harvest methods. Each of these activities require ground disturbance that can impact hydrology, riparian and aquatic resources to various degrees depending on several variables. Roads and landings will be evaluated after their near-term use to identify locations that require further action, consistent with ongoing restoration efforts, to get the area to a watershed stable condition. Disturbance of the forest floor and ground cover in the general treatment unit area (i.e. excluding haul roads, skid roads, or landings) is generally dispersed and not concentrated, and consequently has a much lower probability for impacts to hydrologic and aquatic resources. Soil disturbance typically only occurs at landing sites and where temporary roads (mainly skid roads) are created. Compaction is typically not an issue because the harvesting is not concentrated and heavy machinery is not repeatedly tramping the same area (the exception being skid roads and landings or temporary roads).

Water Yield - Annual water yield conveyed by streams is influenced by numerous environmental factors including rates of evapotranspiration associated with contributing watershed areas. Removing trees can reduce rates of evapotranspiration and consequently increase water yield transported by streams. Watershed studies in eastern deciduous forests in Appalachian regions found measurable increases in water yield when approximately 20-25% of the basal area of standing timber is removed from contributing watershed areas (Hornbeck, *et. al*., 1993; Stuart, Edwards, 2006). Increases were most apparent in the first few years after harvesting and were virtually nonexistent after approximately 5-10 years post-harvest in these studies. Increases were found to be measurable only during base flow or low flow conditions, potentially having a slight benefit.

Negative effects to aquatic resources from water yield variations are unlikely to occur. Additionally, the relatively small catchments that could experience increased water yields as a result of timber harvesting are located higher in the watershed, upstream from or otherwise outside of suitable candy darter habitat. Potential effects associated with increases in water yield from these small headwater streams are expected to dissipate as the smaller streams flow into increasingly larger receiving channels downstream where suitable candy darter habitat exists.

Water Chemistry - Most streams in the GHFR project area are currently impacted by relatively high rates of atmospheric acid deposition. This area of the forest faces high soil and water acidity because of the acid rain produced by coal burning power plants to the West; Cherry River watershed has some of the highest rates of acid deposition in the country (Farr et al. 2008). Stream acidification within this project area is a function of the watersheds being predominantly composed of soils and underlying geology that are highly vulnerable to the effects of the high rates of atmospheric acid deposition. Streams with an acid neutralizing capacity (ANC) of values nearing 0 are not able to buffer acid deposition and stream acidity as well as streams with an ANC value of 100 or more. Table 7 shows that most streams in the project action area have high values because of limestone treatments higher in the headwater. Applications of limestone are routinely applied by West Virginia Division of Natural Resources to various streams in the project area to help mitigate some effects associated with acid deposition. Desert Branch displays lower ANC values due to the absence of limestone treatment in this catchment.

Forest System Roads Maintenance - No new classified Forest system roads will be constructed in this project. System road maintenance of 19.1 miles is proposed. Existing system roads have been identified to receive maintenance as needed and would consider elements such as the purpose of the road, types of vehicles expected, duration and frequency of use, and environmental conditions currently causing resource concern. The type of maintenance that could occur includes mowing, grading, cleaning or replacing cross drain culverts, and applying gravel to the surface. One stream crossing will be a temporary bridge placed on Hacking Run and the other will be a culvert replacement on Spencer Run. Both stream crossing locations will be greater than one half mile from suitable candy darter habitat in North Fork Cherry River. The Hacking Run crossing will be in at a location where a temporary bridge has already been installed and removed previously. The Spencer Run crossing will be a replacement with a larger structure that would involve slightly more ground disturbance, however the footprint would still be less than one-half acre. View Table 8. Sediment and Erosion control measures will be applied at stream crossings to reduce the potential for effects. Following conservation measures outlined below and National Core BMP guidance (Road-7) (USDA Forest Service, 2012), these actions are not expected to affect suitable candy darter habitat. Road stream crossing structures that warrant replacement will be designed in accordance with stream simulation design methodology.

Table 8. Drainage Catchments with Proposed Road Maintenance.

Stream Catchment	Catchment Size (square miles)	Road Maintenance (miles)	Stream Crossings
Spencer Run	0.85	0.58	1
Desert Branch	1.51	3.8	1
Hacking Run	0.84	0.4	1
Hunters Run	3.38	4.3	1
Coats Run	1.55	4.1	2
Little Lick Run	1.34	1.2	0

Roads could potentially have negative effects on aquatic ecosystems as previously described. However, maintenance of Forest System roads associated with this project are unlikely to adversely affect the existing condition of the aquatic ecosystem in the project area. Road management actions that are key to facilitating the expected results for aquatic resources include: compliance with Forest Plan standards (SW35, RF04, and RF07) and National core BMPs to control the potential for adverse effects during road construction, reconstruction and maintenance activities.

Landings - Log landings are necessary for timber harvesting activities. Short-term effects related to the construction and use of landings will expose soil and may produce sediment. Proper application of West Virginia BMPs, National Core BMP direction (Veg. 6) and design features will be used to help limit potential effects associated with stream sedimentation coming from these sites. For example, the Forest Plan direction (Standard SW 40) requires that all landings be located at least 100' from any stream channel (perennial, intermittent and ephemeral) and to stabilize them upon completion of their intended use following the project. Treatments necessary to stabilize landings include vegetative ground cover and possibly other measures including regrading, soil de-compaction, and soil amendments (such as fertilizer and lime). The creation and use of these landings will follow direction as identified in the National Core BMP Technical Guide. Landings that satisfy these conditions are expected to have inconsequential effects to the aquatic ecosystem.

Temporary roads - Temporary roads are a necessary component for timber harvesting within the project area. Soil damage associated with roads includes removal of organic layer and topsoil, soil compaction, and erosion of exposed soil. Soil damage affects hillslope infiltration and surface and subsurface flows (Kolka 2004). In addition, roads can function as an extension of stream channel networks further altering natural hydrologic flow patterns for both surface water and shallow groundwater. Kochenderfer (1977) found that constructed or bladed skid roads occupy about 10% of timber harvest areas in steeper terrain (~10-45%); Stuart and Carr (1991) estimated the percentage to be more than 20%. Temporary roads proposed will make up 0.02% of the timber harvest areas. In consideration of the nature and extent of potential watershed-scale effects from accumulations of partially mitigated temporary roads through time, ground-based skidding can represent considerable alteration to natural landscapes and its inherent ecological condition and function. View Table 3 for proposed temporary road details. Temporary roads will be very minimum within the 2,825 acres of timber harvesting activities, and do not anticipate to change the existing conditions.

Decommissioning will occur within three years of final project actions. The method of decommissioning temporary roads and skid roads will consist of treatment with customary BMPs such as removing temporary crossings and culverts, establishing protective ground cover, and installing water-bars of appropriate spacing and design to reduce potential adverse watershed impacts. Decommissioning actions are outlined in Forest Plan guideline RF13, parts a-e. The greatest potential for erosion and sedimentation occurs the first-year post-harvest and generally decreases each year after that. Edwards and Williard (2010) found that the application of appropriate BMPs have been shown to be 53 to 94% effective at reducing sediment in the first year after harvesting. In a study conducted in recently, Lloyd et al. (2013) found ecosystem processes on abandoned roaded areas can remain altered for up to three decades following last entry. All temporary roads will be decommission within 3 years of final project actions and will not be abandon.

Non Native Invasive and Undesirable Species Control - The Forest-wide NNIS EA recommends that only an aquatic formulation herbicide be used for treatment within stream channel buffers indicated in the Forest Plan or within 100 feet of other water bodies, otherwise, non-herbicide control methods may be used. Direct and indirect effects of herbicide use are expected to be inconsequential for aquatic and riparian resources if application of aquatic formulations of herbicide are applied following manufacturers direction.

Insecticide use may occur in the project area to address hemlock woolly adelgid (HWA) infestations. Chemical treatment of HWA would adhere to manufacturer's application direction, avoid use within riparian buffers, and be restricted to seasonal application. Crayton (2019) concluded that areas with adjacent HWA treatment using the pesticide imidacloprid had direct correlation to concentrations being found in benthic macroinvertebrates. Bioaccumulation of the substance has the potential to occur in species that comprise the higher trophic levels that consume macroinvertebrates. Candy darter would not be considered to inhabit adjacent headwater streams where treatment would occur, thus effects of this treatment would consider a low potential of risk.

Stream Crossings - The crossing identified occurs on a stream with a higher stream gradient than what is typically considered suitable for candy darter. The identified stream crossing does not fall within proposed critical habitat. The crossing is within one-half to three-quarters mile proximity of suitable habitat.

Potential adverse effects of stream crossing would primarily be limited to localized clearing of streamside vegetation as well as potential short-term effects on water quality after project construction. Applying West Virginia BMPs for erosion and sediment control, Forest Plan standards, and other requirements associated with project permitting under the Clean Water Act (sections 401 and 404) would substantially reduce the amount of soil loss and sediment delivery to the stream channels. When site conditions are not suitable for replacement (i.e. wet conditions, high water, etc.) then soil disturbing actions will not commence until stream and soil conditions are within a manageable condition.

Expected long-term benefits associated with stream crossing replacement projects include reducing longer-term erosion and stream sedimentation at these sites by removing the effect of flow obstruction, improving flow hydraulics, improving in-stream sediment transport processes, and reducing occurrences of erosion associated with stream banks, riparian areas, and road prisms at road stream crossings. Stream crossing improvement projects will eliminate human-caused aquatic habitat fragmentation that can have pronounced impacts on the productivity and sustainability of populations of native aquatic communities.

Recognizing the priority to guard against potential risks to the genetic integrity of candy darter when contemplating stream crossing locations within the GHFR project area, long-term benefits associated with the restoration of aquatic habitat connectivity in the project area would be expected to outweigh potential short-term adverse effects of localized vegetation clearing and sediment production associated with road maintenance activities and construction activities at the project site.

Prescribed Fire - Duration and temperature are relevant concerns of prescribed fire risk to the aquatic resources. Management of prescribed fires are designed to create low temperature, efficient burns that accomplish the objective without sacrificing the integrity of the forest floor composition to capture and dissipate rain and snowfall. McNabb and Swanson (1990) concluded that generally, sediment production from fire-related activities is not a serious contributor when compared to other forest management practices, such as certain timber harvest methods and associated roads.

The prescribed burn area in the GHFR project totals 357 acres. This burn will incorporate minimum impact suppression tactics (MIST) to reduce the potential for impacts from fire line creation that may affect aquatic resources. This includes the use of hand blowers to clear fire line, or the use of existing features on the landscape, which limit the need for ground disturbance. It is expected that the isolated effects of prescribed fire pose a low risk to candy darter and proposed critical habitat, when using MIST control tactics, burns that slowly back down to riparian areas, and mosaic burn pattern extinguished within the riparian buffer. Fuel breaks and pile burns will pull slash material that is created from timber harvest activities away from riparian areas, which should have discountable effects to aquatic resources.

Cumulative Effects

☒The Gauley Healthy Forest Restoration Project will have cumulative effects similar to the effects analyzed in the 2006 Forest Plan PBA and PBO and subsequent amendments.

Site specific ESA cumulative effects:

Action Area (2.5 mile):

The action area consists of both private and USFS-owned lands. Approximately 73% of the land within the action area is managed by the MNF, with the remainder being held by various private parties. Currently, MNF-managed land within the action area is approximately 98% forested and 2% open, unknown or early successional stage. The majority (86%) of the forested MNF managed land, within the action area exists in mid to late successional stage, with trees 80-100 years old. The project area is adjacent to the Cranberry wilderness consisting of over 47,700 acres which will remain unmanaged. Approximately 5% of the action area is in the Cranberry Wilderness area and will remain undisturbed. The forest type is predominately oak-hickory and beech-maple-birch mixed hardwood. Open areas consist of maintained wildlife openings. Approximately 27% of the action area is privately owned. . Approximately 10,898 acres of the private land is forested, with 736 acres maintained in open habitat, consisting mainly of fields and residential yards. With 700 acres consisting of urban area (Richwood). Approximately 1200 acres of the privately held forest was logged in the past 15-25 years. A logging company owns portions of the private lands and will likely be logging in future, however the total acres are unknown at this time. However most logging companies harvest in a sustainable rotational basis. There are no other known logging activities planned within the action area at this time. Various streams within the project area receive regular treatments of limestone from the West Virginia Division of Natural Resources (WVDNR) to help mitigate some symptoms associated with stream acidification. Limestone treatments will be continued for the foreseeable future to maintain existing aquatic populations at their current levels in these streams. Forest-wide cumulative effects are analyzed on pages 61-62 of the 2006 Programmatic Biological Opinion for the Monongahela National Forest 2006 Forest plan Revision.

Table 9. Estimated acreage of proposed management actives that may contribute to take of Indiana bats.

Activity	Project Acres	Maximum Annual Acreage	Total Estimated Acreage During First Decade
Prescribed fire	373	3000-6000	10,000-30,000
Wildfire suppression	0		
Road construction and reconstruction (Temporary Roads)	3.03	78	630-780
Programmed regeneration harvest	350	4000	20,000-40,000
Programmed thinning	2,462	1300	7,000-13,000
Timber Stand Improvement (TSI) (>5-11"dbh)			
Timber Harvest Total:		6900	33,000-69,000
Total acreage of all activities that may contribute to take:	**3,280.6**	10,052	44,370-100,520

* Maximum Annual Acreage and Total Estimated Acreage is reference in the Incidental Take Statement of the PBO.

*3.03 acres of temporary roads will be access outside of disturbance areas and will go toward ITS.

*Timber activities will be conducted over a 3-5-year period. This will need to be capture in Annual ITS Reports

Table 10. Conservation measures (Forest Plan/PBO Standards and Guidelines)

Management Direction for TEP Species		
Type	**Number**	**Direction Description**
Indiana Bat		
Standard	TE23	Retain all shagbark hickory trees 5 inches in diameter at breast height (DBH) or greater in harvest units except where public or worker safety concerns or research opportunities exist.
Standard	TE24	After post-harvest treatments, retain an average of at least 6 snags per acre that are 9 inches DBH or greater within harvest units, except where public or worker safety concerns exist. Create additional snags, if needed, from the available leave trees to make up any difference. Prioritize snag retention and creation from the largest to the smallest DBH.
Standard	TE25	Retain all known roost trees until such time as they no longer serve as roost trees (e.g. lose their exfoliating bark or cavities, fall, decay, or are no longer used by bats).
Standard	TE27	If a maternity site is discovered, establish a management zone centered on the site. The management zone shall not exceed a 2.5-mile radius unless site-specific factors or new scientific information indicate that a larger zone is needed. The zone may be smaller than a 2.5-mile radius if an evaluation of topography, known roost tree locations, proximity of permanent water, or other site-specific habitat characteristics indicates that a smaller zone is likely to satisfy the habitat needs of the colony. Needed protection measures within the zone shall be determined at a site-specific level in cooperation with USFWS and WVDNR.
Standard	TE28	If any new Indiana bat hibernacula are discovered on the Forest, the Forest shall develop appropriate protection measures in cooperation with USFWS and WVDNR. These measures could include closure orders, signs, fences, or gates.
Standard	TE33	Leave at least 5 cull trees per acre, if available—preferably shagbark hickory, bitternut hickory, red oak, white oak, sugar maple, white ash, green ash, and/or sassafras. Prioritize cull retention from the largest to the smallest DBH.
Standard	TE34	New livestock grazing areas shall not cause maintained openings to exceed 5 percent of each primary range. Allotment Management Plans shall be modified, if needed, to ensure allotment management is compatible with Indiana bat habitat management.

Standard	TE35	When designing and implementing regeneration harvest units, the following direction shall be used to help retain appropriate leave trees for Indiana bat habitat: a) Preferred residual trees for shelterwood and two-aged regeneration harvests should include the following species as available: shagbark hickory, bitternut hickory, red oak, white oak, sugar maple, white ash, green ash, and/or sassafras. Prioritize residual trees from the largest to the smallest DBH. b) Retain clumps of live trees and shrubs at a rate of 1/3 an acre per 5 to 8 acres of regeneration harvest area. Clumps should be co-located with other retained features.
Standard	TE36	Maintain a component of large over-mature trees, if available, in all uneven-aged harvest units to provide suitable roosting habitat.
Guideline	TE40	Shelterwood and two-aged regeneration harvests are the preferred silvicultural methods. Alternate methods may be used to meet other vegetation or wildlife habitat objectives when compatible with Indiana bat habitat management. Thinning from below is the preferred management method for stands originating before 1905. Other appropriate or preferred measures to maintain or improve Indiana bat habitat within primary range may be developed under consultation with USFWS and WVDNR.
Guideline	TE41	Without preventing the regeneration of desired tree species, sufficient basal area should be retained in even-aged harvest units to meet the habitat needs of Indiana bats. Basal area determinations should be coordinated between the project silviculturist and wildlife biologist, based on site-specific vegetative conditions and habitat needs.
Guideline	TE56	New road or trail construction should avoid key areas and maternity sites.
Running Buffalo Clover		
Standard	TE71	To the extent practicable, avoid implementing activities in areas that support running buffalo clover that have the potential to eliminate or have long-term detrimental effects to populations, such as placement of fill and gravel; paving; constructing new roads, well sites, or ditching for pipelines.
Standard	TE72	To the extent practicable, avoid conducting prescribed burns or constructing fuel breaks for prescribed burns through known running buffalo clover populations or habitat. If prescribed fire is used within running buffalo clover habitat, protect known populations by wetting or removing fuel from the immediate area.
Guideline	TE73	Where needed to help maintain or restore running buffalo populations, the Forest should implement habitat management measures such as creating selective canopy openings, initiating controlled levels of disturbance, controlling invasive species, or creating patches of potentially suitable habitat in adjacent areas. Measures should be coordinated with the USFWS and WVDNR prior to implementation and include pre and post implementation site evaluations.
Guideline	TE75	Surveys for running buffalo clover should be conducted June through no later than mid-August. Surveys should be conducted by personnel trained specifically to identify running buffalo clover.
Guideline	TE76	Prior to initiating project activities, running buffalo clover locations should be flagged so that managers, contractors, permittees, or cooperators are aware of running buffalo clover locations, unless it is determined on a case-by-case basis that marking populations would have more potential to cause negative effects.
Guideline	TE77	Prior to initiating project activities, managers, contractors, permittees, or cooperators should be informed about avoiding or limiting management activities in the immediate vicinity of running buffalo clover populations within the project area. Projects should be monitored to ensure that populations are not detrimentally affected over the long term.
Guideline	TE80	Piling slash around running buffalo clover populations should be avoided.
Added Measure	1	All proposed activity areas will be surveyed prior to management activities. Survey coverage will average of one transect every 100 feet per acre and will be distributed across the entire activity area. Efforts will be focused on optimal habitat conditions that, in the judgement of the botanist, are most likely to harbor running buffalo clover.

Added Measure	2	The Forest will provide completed survey results (survey protocols, survey tracks, personnel, dates) upon survey completion to the FWS. The FWS will respond to the Forest within 7 business days of receipt of survey results verifying that surveys were completed per the established protocols. If a FWS response is not received, the Forest will proceed with project implementation.

Type	Number	Direction Description
Northern Long Eared Bat (NLEB)		
4d rule (streamline) Consultation	Appx. A	All associated Conservation Measures associated with NLEB can be in Appendix A.
Small whorled pogonia		
---	---	Will be incorporated, when agreement is established with FS and FWS.
Added Measure	1	All proposed activity areas will be surveyed prior to management activities. Survey coverage will average of one transect every 100 feet per acre and will be distributed across the entire activity area. Efforts will be focused on optimal habitat conditions that, in the judgement of the botanist, are most likely to harbor running buffalo clover.
Added Measure	2	The Forest will provide completed survey results (survey protocols, survey tracks, personnel, dates) upon survey completion to the FWS. The FWS will respond to the Forest within 7 business days of receipt of survey results verifying that surveys were completed per the established protocols. If a FWS response is not received, the Forest will proceed with project implementation.
Candy darter		
Standard	SW34	No programmed timber harvest shall occur within the channel buffers identified in the table in SW37. Tree removal from the buffers may only take place if needed to meet aquatic or riparian resource management needs, or to; a) Provide habitat improvements for aquatic or riparian species, or threatened, endangered, sensitive, and locally rare species; b) Provide for public or worker safety; c) Construct or renovate an approved facility; d) Construct temporary road, skid road, or utility corridor crossings; e) Conduct aquatic or riparian-related research, or Allow for cable yarding.
Standard	SW35	Where new roads and skid roads cross stream channels, channel and bank stability shall be maintained.
Standard	SW37	During project-level planning and implementation, determine channel buffers for streams that would potentially be affected by proposed activities. The following table represents default buffer widths to be applied to both sides of the channel.

Stream Classification	Buffer Width
Perennial	100 feet
Large Intermittent (>50-acre drainage area	100 feet

		Small Intermittent (<50-acre drainage area)	50 feet
		Ephemeral	25 feet
		Buffer widths may be adjusted based on interdisciplinary review and site-specific field investigation. The buffers shall, at a minimum, encompass the riparian area defined on the basis of soils, vegetation and hydrology and the ecological functions and values associated with the riparian area.	
Standard	SW40	Skid trails and landings shall not be constructed within 100 feet of perennial, intermittent, and ephemeral channels except at crossings or when location outside the 100-foot zone pose a greater risk to aquatic or riparian resources. The 100-foot filter strip may be modified based on site-specific conditions such as soil type, slope, and stability.	
Goal	RF04	Maintain or restore late successional stands to a pre-fire suppression condition consistent with management prescription emphasis and desired conditions.	
Goal	RF07	Prepare a Fire Management Action Plan to help implement Forest Plan Fire Management direction. Identify available resources and plan-specific prevention, detection, suppression, and prescribed burning actions based on the Fire Regime Condition Class and the following: a) An analysis of probable fire locations. b) Expected fire intensities c) Potential net resource value changes Risk to health and safety.	
Standard	RF13	Wildland Fire Use may only occur under a fire management plan that evaluates a full range of management responses.	
Added Measure	1	Apply West Virginia BMPs for erosion and sediment control, Forest Plan standards, and other requirements associated with project permitting under the Clean Water Act (sections 401 and 404).	
Added Measure	2	Continue to monitor aquatic resource conditions in the project area in accordance with established survey methodologies, locations, and schedules associated with the Forest's on-going Aquatic Ecological Unit Inventory efforts.	

Maps:

Figure 1.

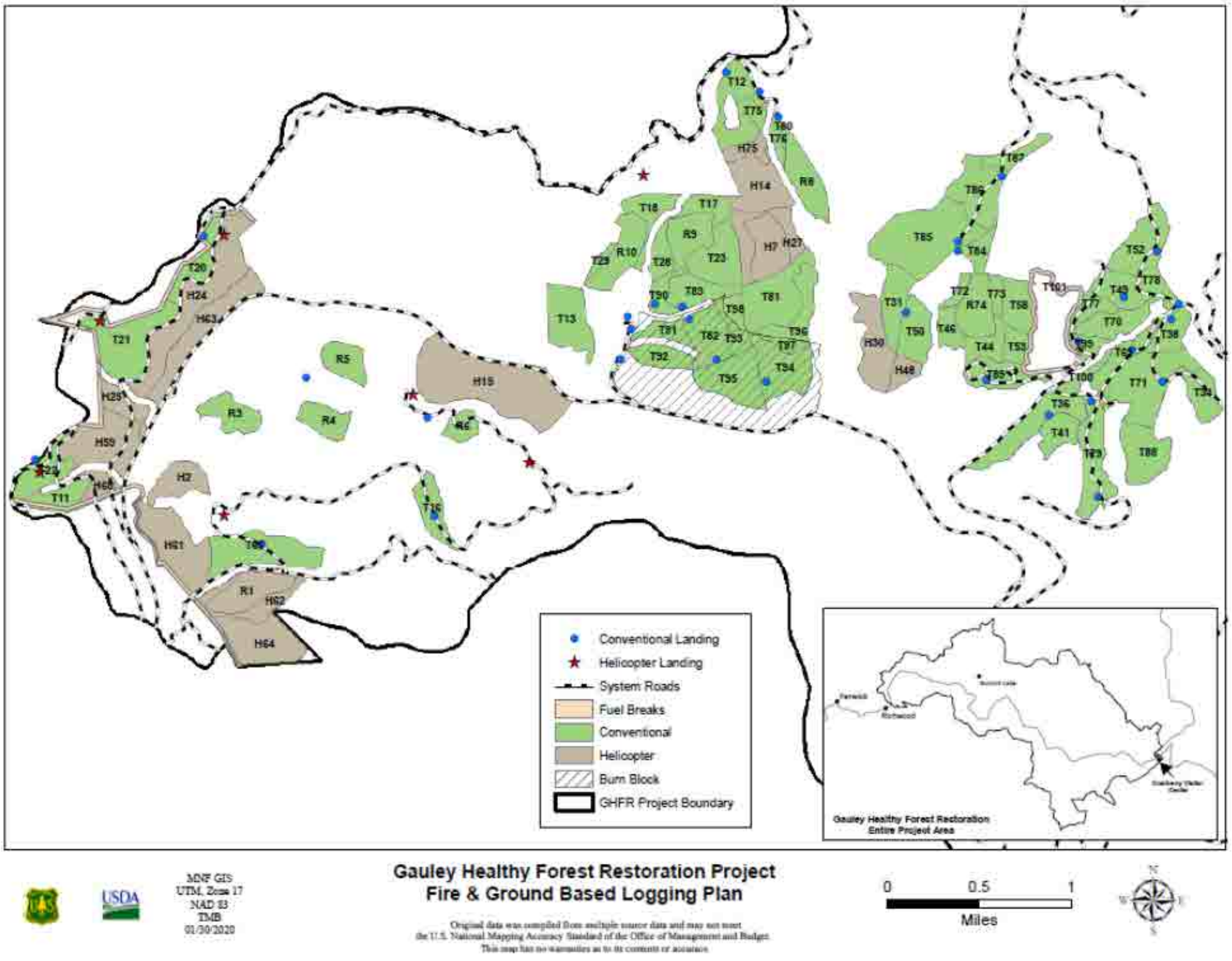
Conventional Landing
Helicopter Landing
System Roads
Fuel Breaks
Conventional
Helicopter
Burn Block
GHFR Project Boundary
Gauley Healthy Forest Restoration
Entire Project Area
MNF GIS
UTM, Zone 17
NAD 83
TMB
01/30/2020
Gauley Healthy Forest Restoration Project
Fire & Ground Based Logging Plan
Original data was compiled from multiple source data and may not meet
the U.S. National Mapping Accuracy Standard of the Office of Management and Budget.
This map has no warranties as to its contents or accuracy.
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Figure 2.

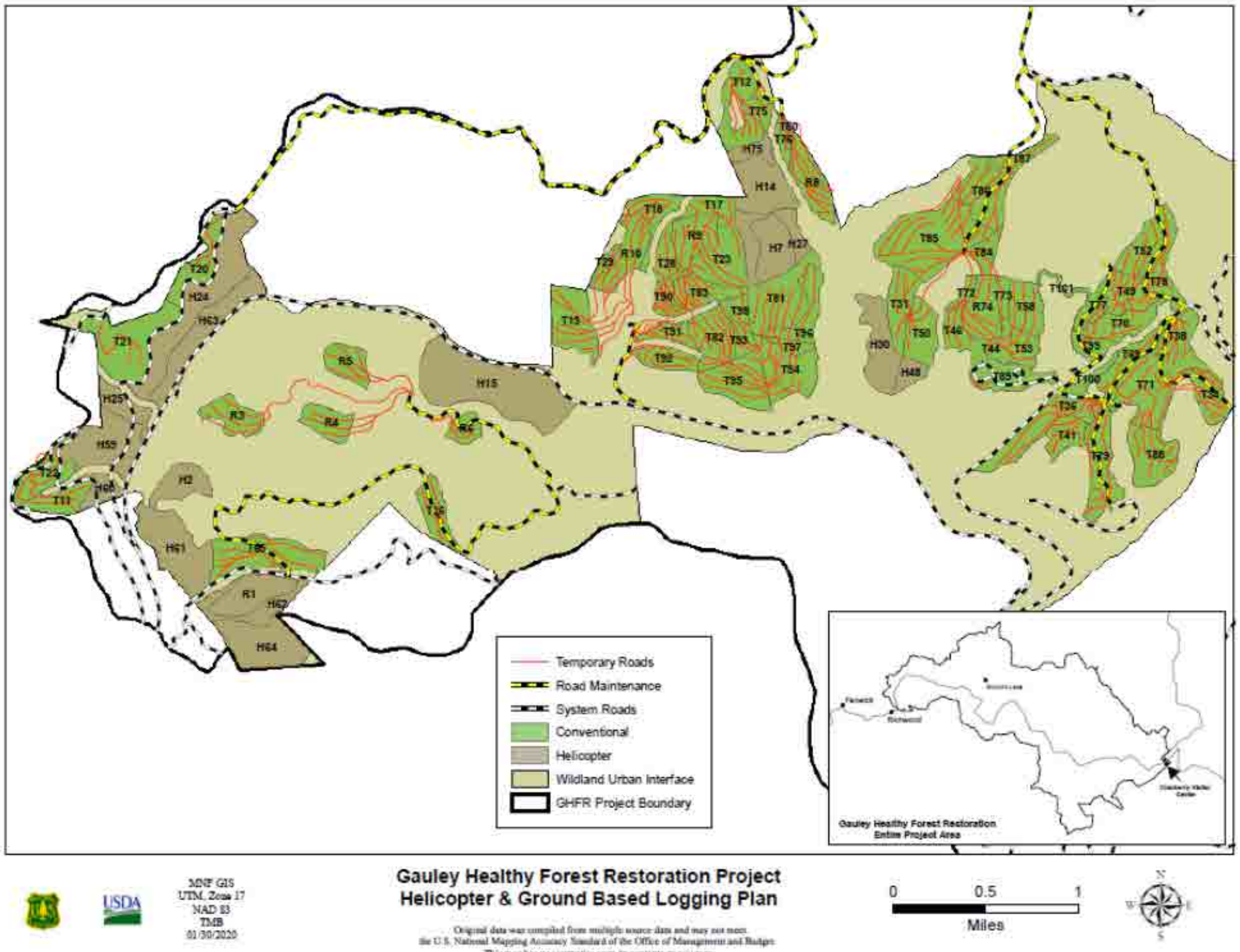
Temporary Roads
Road Maintenance
System Roads
Conventional
Helicopter
Wildland Urban Interface
GHFR Project Boundary
Gauley Healthy Forest Restoration
Entire Project Area
MNF GIS
UTM, Zone 17
NAD 83
TMB
01/30/2020
Gauley Healthy Forest Restoration Project
Helicopter & Ground Based Logging Plan
Original data was compiled from multiple source data and may not meet
the U.S. National Mapping Accuracy Standard of the Office of Management and Budget.
This map has no warranties as to its contents or accuracy.
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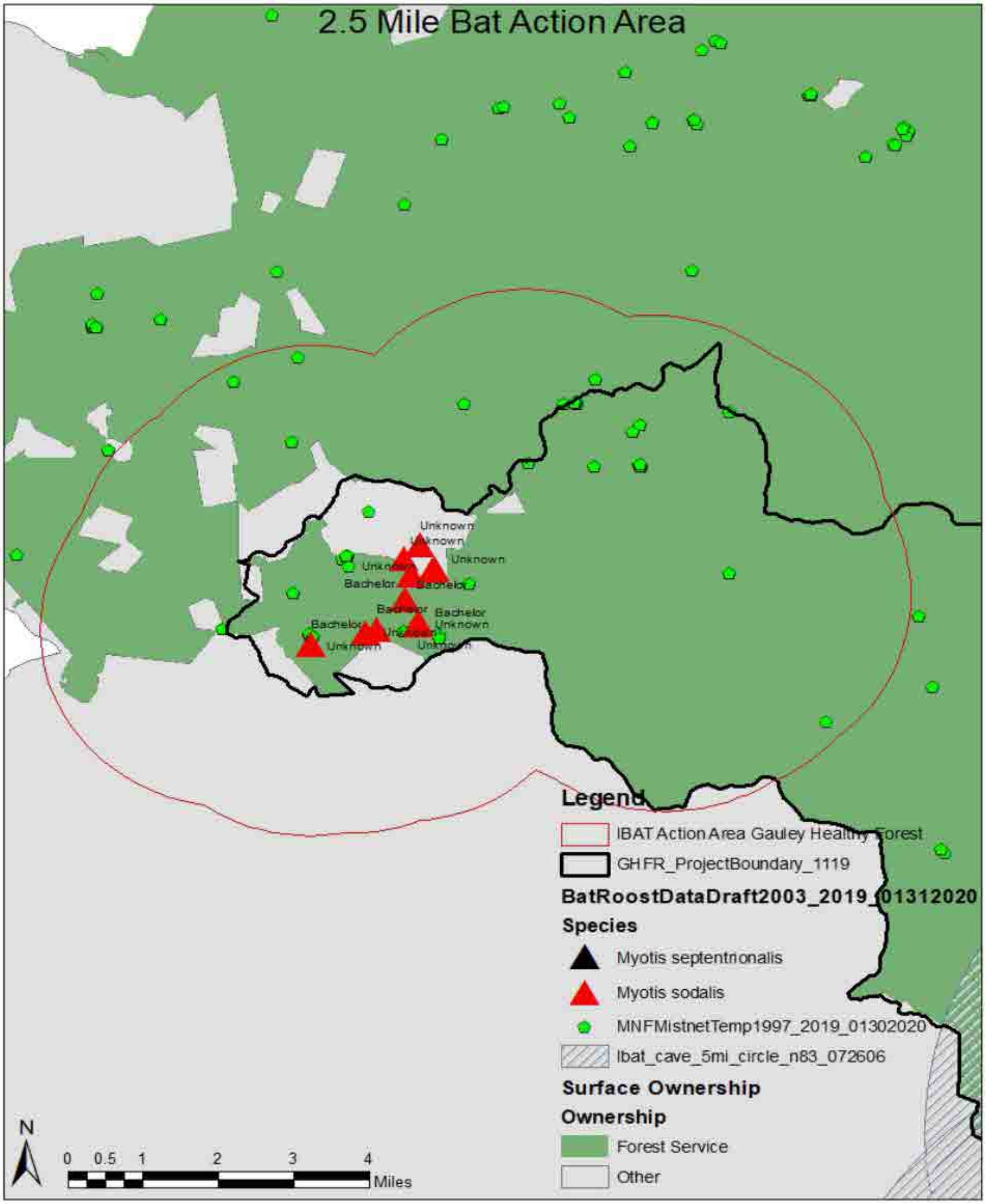
Figure 3.



Forest Service Signatures

BA Prepared by: Click here to enter text. **Signature:** ____________________

Email: Click here to enter text. **Phone:** Click here to enter text.

Date: Click here to enter a date.

Reviewed by FPM: Click here to enter text. **Signature:** ____________________

Email: Click here to enter text. **Phone:** Click here to enter text.

Date: Click here to enter a date.

U.S. Fish and Wildlife Service Signatures

☐The USFWS agrees with the determination of effects outlined in this Biological Assessment for the Click here to enter text. Project. The effects are consistent with the 2005 Programmatic Biological Opinion and subsequent amendments.

☐The USFWS signatures below constitute our concurrence with the determinations of no effect or not likely to adversely affect the following species:

☐The USFWS signatures below constitute our Tiered Biological Opinion for the Indiana bat and running buffalo clover. The re-initiation clauses on the 2006 Programmatic Biological Opinion still apply.

> ☐The Indiana bat take table is accurate and up to date. No additional Reasonable and Prudent Measures (RPM's) or Terms and Conditions (TC's) are necessary.
>
> ☐ The USFWS is proposing these additional RPM's/TC's (include rationale for new RPM's/TC's):
>
> ☐The USFWS has reviewed the status of the species for all species in this consultation and has determined that it:
>
> ☐Has not changed.
> ☐Has changed. (Update here)

Biologist Reviewing BA: Click here to enter text. Phone:Click here to enter text.

Signature: __________________ Date: Click here to enter a date.

For Formal Consultation, the Field Supervisor must review and sign.

Field Supervisor: Click here to enter text.

Signature: ______________________ Date: Click here to enter a date.

APPENDIX A – Page Number References for Tiered Documents and NLE Bat 4(d) Rule

From the Programmatic Biological Opinion (U.S. Fish and Wildlife Service 2006)

Indiana Bat	pages 27 to 68
Running Buffalo Clover	pages 13 to 27

From the Forest Management Plan (USDA Forest Service. 2006, Revised 2011)

TES	II-22 to II-28

From the Forest Plan EIS (USDA Forest Service. 2006.)

Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form for the Gauley Healthy Forest Project

Federal agencies should use this form for the optional streamlined consultation framework for the northern long-eared bat (NLEB). This framework allows federal agencies to rely upon the U.S. Fish and Wildlife Service's (USFWS) January 5, 2016, intra-Service Programmatic Biological Opinion (BO) on the final 4(d) rule for the NLEB for section 7(a)(2) compliance by: (1) notifying the USFWS that an action agency will use the streamlined framework; (2) describing the project with sufficient detail to support the required determination; and (3) enabling the USFWS to track effects and determine if reinitiation of consultation is required per 50 CFR 402.16.

This form is not necessary if an agency determines that a proposed action will have no effect to the NLEB or if the USFWS has concurred in writing with an agency's determination that a proposed action may affect, but is not likely to adversely affect the NLEB (i.e., the standard informal consultation process). Actions that may cause prohibited incidental take require separate formal consultation. Providing this information does not address section 7(a)(2) compliance for any other listed species.

Information to Determine 4(d) Rule Compliance:	**YES**	**NO**

1. Does the project occur wholly outside of the WNS Zone[1]?	☐	☒
2. Have you contacted the appropriate agency[2] to determine if your project is near known hibernacula or maternity roost trees? List agencies and data sources consulted and the date reviewed: BatRoostDataDraft2003_2019_01312020, MNFMistnetTemp1997_2019_01302020, NLEBhib_WvDnrCaves_0605, MonongahelaNF_NLEB_known_hib_090715 (Reviewed 02/06/2020)	☒	☐
3. Could the project disturb hibernating NLEBs in a known hibernaculum?	☐	☒
4. Could the project alter the entrance or interior environment of a known hibernaculum?	☐	☒
5. Does the project remove any trees within 0.25 miles of a known hibernaculum at any time of year?	☐	☒
6. Would the project cut or destroy known occupied maternity roost trees, or any other trees within a 150-foot radius from the maternity roost tree from June 1 through July 31.	☐	☒

You are eligible to use this form if you have answered yes to question #1 **or** yes to question #2 **and** no to questions 3, 4, 5 and 6. The remainder of the form will be used by the USFWS to track our assumptions in the BO.

Agency and Applicant[3] (Name, Email, Phone No.): See Part A

Project Name: See Part A

Project Location (include coordinates if known): See Part A

Basic Project Description: See Part A

General Project Information

	YES	NO

[1] http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf

[2] See http://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html

[3] If applicable - only needed for federal actions with applicants (e.g., for a permit, etc.) who are party to the consultation.

Does the project occur within 0.25 miles of a known hibernaculum?	☐	☒
Does the project occur within 150 feet of a known maternity roost tree?	☐	☒
Does the project include forest conversion[4]? (if yes, report acreage below)	☒	☐
Estimated total acres of forest conversion	3,272 acres (see Table 4.)	
If known, estimated acres[5] of forest conversion from April 1 to October 31	3,272 acres (see Table 4.)	
If known, estimated acres of forest conversion from June 1 to July 31[6]	unknown	
Does the project include timber harvest? (if yes, report acreage below)	☒	☐
Estimated total acres of timber harvest	2915 (see Table 4.)	
If known, estimated acres of timber harvest from April 1 to October 31	2915 (see Table 4.)	
If known, estimated acres of timber harvest from June 1 to July 31	unknown	
Does the project include prescribed fire? (if yes, report acreage below)	☒	☐
Estimated total acres of prescribed fire	357 (see Table 4.)	
If known, estimated acres of prescribed fire from April 1 to October 31	357 (see Table 4.)	
If known, estimated acres of prescribed fire from June 1 to July 31	No broadcast burning during this period	
Does the project install new wind turbines? (if yes, report capacity in MW below)	☐	☒
Estimated wind capacity (MW)	N/A	

[4] Any activity that temporarily or permanently removes suitable forested habitat, including, but not limited to, tree removal from development, energy production and transmission, mining, agriculture, etc. (see page 48 of the BO).
[5] If the project removes less than 10 trees and the acreage is unknown, report the acreage as less than 0.1 acre.
[6] If the activity includes tree clearing in June and July, also include those acreage in April to October.

Agency Determination:

By signing this form, the action agency determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule.

If the USFWS does not respond within 30 days from submittal of this form, the action agency may presume that its determination is informed by the best available information and that its project responsibilities under 7(a)(2) with respect to the NLEB are fulfilled through the USFWS January 5, 2016, Programmatic BO. The action agency will update this determination annually for multi-year activities.

The action agency understands that the USFWS presumes that all activities are implemented as described herein. The action agency will promptly report any departures from the described activities to the appropriate USFWS Field Office. The action agency will provide the appropriate USFWS Field Office with the results of any surveys conducted for the NLEB. Involved parties will promptly notify the appropriate USFWS Field Office upon finding a dead, injured, or sick NLEB.

Forest Service Biologist: ______________________

Signature: ____________________________________ Date Submitted: __________

USFWS Biologist Reviewing: _____________________

Signature: _____________________________________ Date Reviewed:____________

Section 7(a)1 Activities - Discretionary Conservation Recommendations:

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further its purposes by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to minimize or avoid the adverse effects of a proposed action, implement recovery plans, or develop information useful to the conservation of listed species. Below are a list of 7(a)1 conservation measures that will be included in this project:

Standard and Guidelines from the Land and Resources Management Plan:

- Retain all shagbark hickory trees 5 inches in diameter at breast height (DBH) or greater in harvest units except where public or worker safety concerns or research opportunities exist (See TE24).

Regional Conservation Measures Developed for the NLEB:

1. Designate caves and mines that are occupied by bats as smoke-sensitive targets. Avoid smoke entering these caves and mines any time of the year when Threatened, Endangered, or Sensitive (TES) bats are present.
2. Within 0.25 miles of known, occupied NLEB hibernacula, timber harvest will be designed to maintain, enhance, or restore swarming, staging, roosting, and foraging habitat. The future desired condition is that these areas will feature structurally complex, resilient forest communities with a continuous supply of snags, culls, cavities, and other quality roosts.
3. Application of herbicides and other pesticides will be planned to avoid or minimize direct and indirect effects to known, occupied TES bat hibernacula and maternity roosts.
4. Before old buildings, wells, cisterns, bridges, and other man-made structures are structurally modified or demolished, they will be surveyed for bats. If TES bat roosting is found, demolition or modification of these structures will not occur when bats are present and the need for alternative roosts will be evaluated.
5. Avoid cutting or destroying known, occupied NLEB maternity roost trees unless they are an immediate safety hazard.
6. Where needed to provide drinking sources for bats, create small wetlands or water holes.

Additional Project-Level Conservation Measures for the NLEB:

- No broadcast burning during the pup season (June 1 to July 31). Piles can still be burned.

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United States
Department of
Agriculture

Forest
Service

Monongahela
National
Forest

Gauley
Ranger
District

Gauley Healthy Forest Restoration – Biological Evaluation

Threatened, Endangered, and Sensitive Plants

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Resource Impacts or Issues Addressed

This biological evaluation discloses expected direct and indirect effects of the Gauley Healthy Forest Restoration project on threatened and endangered plants, as well as Regional Forester's Sensitive Species plants. Regional Forester's Sensitive Species plants are hereafter referred to as sensitive plants; threatened, endangered, and sensitive plants are collectively referred to as TES plants.

The Proposed Action would involve various types of vegetation management activities that have the potential to affect TES plants (see the Categorical Exclusion (CE) Review for a detailed description of the Proposed Action).

Scope of the Analysis

For direct and indirect effects, the spatial boundary of the analysis is the Richwood Wildland Urban Interface (WUI) boundary (see Gauley Healthy Forest Restoration Project Helicopter & Ground Based Logging Plan map in CE Review). The Richwood WUI boundary includes all parcels of land that would be affected by project activities, therefore it is an appropriate boundary for the analysis of direct and indirect effects on TES plants. The Richwood WUI boundary encompasses approximately 7029 acres, which includes 7028 acres of National Forest land and one acre of private land.

The temporal boundary for direct and indirect effects on TES plants is 120 years from the beginning of project implementation. This is the time frame within which effects to forested habitat will persist. While effects to each individual species may not persist that long, successional changes set in motion by regeneration harvesting will continue for at least that long, potentially affecting some species that occur in forested habitats. T

Methodology

Surveys for TES plants were conducted in many of the proposed activity areas that would involve soil disturbance and/or removal of 20 percent or more of the overstory in mature stands. Field surveys covered representative habitats in areas proposed for commercial timber harvest, temporary road and landing construction, prescribed fire, and fuel break establishment. Areas proposed for road maintenance were generally not surveyed because these activities have little potential to affect TES plants (see discussions of direct and indirect effects below). Surveys for TES plants will be conducted in proposed activity areas that have not been previously surveyed, where optimal habitat conditions exist, prior to implementation.

Surveys were conducted by experienced botanists and consisted of meandering walks through the proposed activity areas. Surveys covered representative habitats in all parts of the activity areas, with the goal of traversing 100 linear feet per acre of activity area on average. Surveys were intended to locate substantial populations of TES plants that could be important for maintaining Forest-wide population viability. Locations of TES plants were noted and documented using global positioning system technology. As a precaution in case additional species are listed prior to project implementation, botanists generally listed all plant species that were encountered.

Field surveys were conducted from 2001-2006. All surveys were conducted between June 1 and September 30, inclusive, which constitutes the active growing season for TES plants that are known to occur on the Monongahela National Forest. Field surveys were supplemented by existing records of TES plants from files at the Monongahela National Forest Supervisor's Office and the West Virginia Division of Natural Resource's Natural Heritage program.

Discussions of the effects of proposed activities were based on reviews of scientific literature and other information, as well as the general observation and experience of the Ecologist. The likelihood of occurrence in the project area for each TES plant was assessed in the Likelihood of Occurrence document, which is filed in the project record. The likelihood of occurrence was based on field surveys, historic records, and the presence of potential habitat in the project area.

Affected Environment – Threatened and Endangered Plants

Four federally-listed threatened and endangered plant species are known to occur on the Monongahela National Forest: running buffalo clover (*Trifolium stoloniferum*), shale barren rockcress (*Arabis serotina*), Virginia spiraea (*Spiraea virginiana*), and small whorled pogonia (*Isotria medeoloides*). Based on field surveys and existing records, none of these species are known to occur in the analysis area. Following is a brief description of the typical habitat and likelihood of occurrence in the analysis area.

Virginia Spiraea - Virginia spiraea is a clonal shrub found on damp, rocky banks of large, high-gradient streams (USFWS 1992a). Within the analysis area, potential habitat for Virginia spiraea is limited to the channels and banks of larger streams such as the North Fork Cherry River and some of its larger tributaries.

Existing records show that the nearest known occurrence of Virginia spiraea is along the Greenbrier River approximately 25 air miles southeast of the analysis area. Virginia spiraea is not known to occur along any streams in the analysis area, so the likelihood of occurrence is considered to be low. However, streams were not included in the field surveys, so the potential for occurrence in the analysis area cannot be ruled out completely.

Running Buffalo Clover – Running buffalo clover is typically found in mesic habitats with partial to filtered sunlight and a prolonged pattern of moderate and periodic disturbance, such as grazing, mowing, trampling, selective logging, or flood-scouring. Running buffalo clover is often found in areas underlain with limestone or other calcareous bedrock, but not exclusively. In West Virginia, sites have also been identified on the Mauch Chunk formation, which is primarily shale (Harman 2016). Running buffalo clover is found in a variety of habitat types, including mesic woodlands, streambanks, grazed woodlots, mowed paths, old logging roads, trails, mowed wildlife openings within mature forests, savannahs, sandbars, steep ravines and infrequently used ATV trails and gravel drives (USFWS 2007, 2008a). Sites that were recently discovered occur in hawthorn thickets and locust savannah communities. The Monongahela National Forest is a stronghold for running buffalo clover, with the largest and highest quality populations range-wide occurring on the Forest (USFWS 2007).

Existing records show that the nearest known occurrence of running buffalo clover is located along a Forest Service road, approximately 9 air miles northeast of the analysis area. The likelihood of occurrence for running buffalo clover is considered low because it is not known to occur in the analysis area, and field surveys have not located it.

Small Whorled Pogonia – Small whorled pogonia habitat preferences are poorly known, but could include a variety of forested habitats. The available literature indicates occurrence in mixed deciduous and pine-hardwood habitats of a variety of ages, often near partial canopy openings (USFWS 1992b) or in open understories. Small whorled pogonia appears to be associated with acidic soils having a pan layer, and slopes of 11 to 17 percent near small streams (USFWS 2008b).

The likelihood of occurrence for small whorled pogonia is considered low because it is not known to occur in the analysis area, and field surveys have not located it. However, the potential occurrence cannot be completely ruled out based on habitat preferences and due to the difficulty of locating this species using conventional survey techniques.

Shale Barren Rockcress – Shale barren rockcress occurs in specialized habitats known as shale barrens in eastern West Virginia and western Virginia (USFWS 1991). Shale barrens are limited to the drier areas of the Monongahela National Forest. Therefore, shale barren rockcress is not likely to occur in the analysis area due to a lack of habitat.

Affected Environment – Regional Forester's Sensitive Species Plants

Seventy plant species are listed as Regional Forester's Sensitive Species on the Monongahela National Forest. Based on field surveys and existing records, one sensitive plant species is known to occur in the analysis area: longstalk holly (*Ilex collina*). Based on the Likelihood of Occurrence table, potential habitat exists for an additional 32 species, for a total of 33 sensitive species that could occur in the analysis area. However, for the 33 species with potential habitat but no known occurrences, field surveys did not locate them in the activity areas. Therefore, the probability of occurrence of these 33 species in areas that would be affected by project activities is low.

To facilitate analysis, sensitive plant species have been grouped according to their primary habitat. The three habitat groupings are mesic forests, wetland/riparian habitat, and rocky habitat. Mesic forest is a broad grouping that includes mixed hardwood and northern hardwood forests, as well as hemlock-hardwood mixed forests. Mesic forests cover the majority of the analysis area. Forests dominated by oaks are scattered throughout the analysis area, but they do not cover large areas and generally fall toward the mesic end of the oak forest moisture spectrum. Therefore, the oak forests are included with the mesic forests for this analysis. Riparian habitat and small areas of wetland habitat occur along streams throughout the analysis area. Small seep wetlands also occur on slopes in areas that are not near streams. Dry rocky habitat includes dry rock outcrops and ledges that occur at various elevations along ridge tops and side slopes, whereas moist rocky habitat includes the wet outcrops and moist colluvial rubble that occur along streams and in cove bottoms. The analysis area has the potential to contain patches of both types of habitat. Some overlap among the habitat types occurs. For example, mesic forests, wetland/riparian habitat, and moist rocky habitat co-occur in the deep, narrow coves. The following table lists sensitive species that could occur in the analysis area.

Table 1. Sensitive species that could occur in the Gauley Healthy Forest Restoration analysis area.

Scientific Name	Common Name	Habitat Comments	Known Occurrence(s)	Potential Habitat
Mesic Forests				
Botrychium lanceolatum var. *angustisegmentum*	Lanceleaf Grapefern	Moist, shady woods and swamp margins		X
Carex lucorum var. austrolucorum	Blue Ridge Sedge	Well-drained, acidic soils on mesic to dry slopes		X
Carex roanensis	Roan Mountain Sedge	Mid- to high-elevation mesic forests		X
Corallorhiza bentleyi	Bentley's Coralroot	Habitat preferences poorly understood		X
Cypripedium reginae	Showy Lady's Slipper	Swamps and woods		X
Juglans cinerea	Butternut	Variety of wooded situations; does not require rich soil, but generally does not occur on the poorest sites		X
Platanthera shriveri	Shriver's Purple Fringed Orchid	Deciduous forests; wooded roadsides		X
Rosa blanda var. blanda	Smooth Rose	Thickets, grassy verges, edges of woods, ditches, stream banks, gravelly and sandy flats		X
Triphora trianthophora	Threebirds Orchid	Deep leaf litter or humus		X
Viola appalachiensis	Appalachian Violet	Often in riparian areas, but can occur in other mesic situations		X
Wetland and Riparian Habitat				
Amelanchier bartramiana	Oblongfruit Serviceberry	High elevations in wet and moist sites		X
Baptisia australis var. *australis*	Blue Wild Indigo	Primarily early successional wetlands		X
Hasteola suaveolens	False Indian Plantain	Riverbanks and disturbed wetlands		X
Hypericum mitchellianum	Blue Ridge St. John's Wort	Riverbanks and disturbed wetlands		X

Scientific Name	Common Name	Habitat Comments	Known Occurrence(s)	Potential Habitat
Ilex collina	Longstalk Holly	Open or closed canopy wetland/riparian	X	
Listera cordata	Heartleaf Twayblade	Mossy hummocks in forested wet areas; moist, mossy sites in conifer and conifer-hardwood forests		X
Marshallia grandiflora	Monongahela Barbara's Buttons	Banks of large streams		X
Potamogeton tennesseensis	Tennessee Pondweed	Slow-flowing rivers		X
Ranunculus pensylvanicus	Pennsylvania Buttercup	Wetlands in full sun and filtered sunlight		X
Ribes lacustre	Bristly Currant	Wetlands in partial shade or full sun		X
Vitis rupestris	Sand Grape	River banks		X
Woodwardia areolata	Netted Chainfern	Swamps and wet woods		X
Rocky Habitat				
Clematis occidentalis var. occidentalis	Western Blue Virginsbower	Rocky habitats in at least partial shade		X
Cornus rugosa	Roundleaf Dogwood	Rocky areas within forests		X
Gymnocarpium appalachianum	Appalachian Oak Fern	Rocky woods along streams		X
Heuchera alba	White Alumroot	Rocky areas within forests		X
Piptatherum canadense	Canadian Ricegrass	Sandstone barrens		X
Pycnanthemum beadlei	Beadle's Mountainmint	Open canopy over rocks		X
Saxifraga michauxii	Michaux's Saxifrage	Wet ledges, boulder fields, and rocky slopes, usually in thin soil over rock		X
Scutellaria saxatilis	Smooth Rock Skullcap	Variety of rocky situations, but most common in moist, partially shaded talus.		X
Taxus canadensis	Canada Yew	Moist, rocky habitats along streams; wetlands and spruce forests		X

Scientific Name	Common Name	Habitat Comments	Known Occurrence(s)	Potential Habitat
Tortula ammonsiana	Ammon's Tortula Moss	Wet, cool outcrops		X
Trichomanes boschianum	Bristle-fern	Dripping rocks		X

Effects – Threatened and Endangered Plants

Direct and Indirect Environmental Effects

Virginia spiraea– Proposed activities would not occur in or near potential habitat for Virginia spiraea. Therefore, these activities would not affect Virginia spiraea.

Running buffalo clover is not known to exist in any of the proposed activity areas. Therefore, direct effects on running buffalo clover are not likely to occur. If any undiscovered occurrences of running buffalo clover exist in proposed activity areas effects could occur. Potential habitat could be impacted but such effects on habitat would not translate into actual impacts on running buffalo clover unless undiscovered populations exist.

The open canopy created in regeneration units likely would lead to running buffalo clover being out-competed by sun-loving herbs, shrubs, and saplings. Beneficial effects could occur in thinning units due to the partial opening of the canopy. If any undiscovered occurrences of running buffalo clover exist within temporary road and landing sites, they could be damaged or eliminated. In conventionally-yarded thinning units, the soil disturbance due to skidding could benefit running buffalo clover by providing a suitable habitat for it to colonize. Temporary road construction and reconstruction could also create additional habitat.

The possible effects outlined are considered unlikely due to the low probability that any undiscovered occurrences of running buffalo clover exist. Therefore, the potential for adverse effects is considered discountable.

Small whorled pogonia is not known to exist in any of the proposed activity areas. Therefore, direct effects on small whorled pogonia are not likely to occur. If any undiscovered occurrence of small whorled pogonia exists in the proposed activity areas, effects could occur. Potential habitat could be impacted but such effects on habitat would not translate into actual impacts on small whorled pogonia unless undiscovered populations exist.

Commercial regeneration harvest, temporary road and landing construction, and prescribed fire have the potential to damage or eliminate small whorled pogonia. The effects of thinning harvest on small whorled pogonia are difficult to predict but may have a beneficial effect due to the partial opening of the canopy. Small whorled pogonia is not likely to be affected by road maintenance which would be limited to the existing footprint of heavily traveled roads that are not likely to support small whorled pogonia.

The possible effects outlined are considered unlikely due to the low probability that any undiscovered occurrences of small whorled pogonia exist. Therefore, the potential for adverse effects is considered discountable.

Shale barren rockcress – Habitat for shale barren rockcress does not occur in the analysis area. Therefore, none of the activities proposed would affect shale barren rockcress.

Cumulative Effects of Proposed Action

Under the Proposed Action, the potential for direct and indirect effects to threatened and endangered plants is so small it is considered discountable. Therefore, the Proposed Action would be unlikely to make any measurable contribution to the effects of other past, present, and reasonably foreseeable actions.

Effect Determinations for Threatened and Endangered Plants

Virginia spiraea - None of the proposed actions would have any potential to affect Virginia spiraea. Therefore, the proposed action would have **no effect** on Virginia spiraea.

Running buffalo clover - Under the Proposed Action, the potential for direct and indirect effects on running buffalo clover would be so low as to be discountable. Therefore, the Proposed Action **may affect but is not likely to adversely affect**, running buffalo clover.

Small whorled pogonia - Under the Proposed Action, the potential for direct and indirect effects on small whorled pogonia would be so low as to be discountable. Therefore, the Proposed Action **may affect but is not likely to adversely affect**, small whorled pogonia.

Shale barren rockcress - Shale barren rockcress has no potential to occur in the analysis area. Therefore, the Proposed Action would have **no effect** on shale barren rockcress.

Consistency with the Forest Plan

The Proposed Action would be unlikely to affect threatened and endangered plants adversely. Therefore, the Proposed Action would be consistent with Forest Plan direction to avoid and minimize adverse impacts to threatened and endangered plants.

Consistency with Laws, Regulations, Handbooks and Executive Orders

The Proposed Action would be unlikely to affect threatened and endangered plants adversely. Therefore, all alternatives would be consistent with Endangered Species Act protections and consultation requirements, as well as all regulations, directives, and policies that implement that act with respect to threatened and endangered plants.

Effects – Sensitive Plants

Direct and Indirect Environmental Effects

Activities that are unlikely to affect sensitive plants – Several activities that are proposed by the Proposed Action would have little or no potential to affect sensitive plants:

- **Site preparation and vine control using hand tools, crop tree release, and targeted herbicide applications.** Hardwood stands that would be commercially harvested also would be subject to various associated treatments. Cutting non-merchantable stems and vines would be accomplished using hand tools, so it would not involve any ground disturbance that might impact sensitive plants. If any butternuts are encountered, they would be protected by a project design feature. Tree planting, fencing or caging could be used to reduce deer browse but would involve no appreciable ground disturbance. Crop tree release would be conducted in young stands that are not likely to support sensitive plants due to intense competition from the low, dense saplings canopy. Applying herbicides using cut surface and basal spray methods would cause little or no overspray and would be unlikely to affect non-target plants, including sensitive species.

- **Nonnative invasive plant control** was analyzed in the Forest-wide Nonnative Invasive Plant Management Project Environment Assessment, which is filed in the project record.

Because the activities listed above have little or no potential to affect sensitive plant species, they will not be analyzed further in this report.

Activities that may affect sensitive plants – All other proposed activities involve ground and vegetation disturbance and could have at least a small chance of affecting sensitive plant species. These activities are analyzed according to their potential to affect sensitive plant species.

- **Commercial timber harvesting and associated temporary road and landing construction.** Proposed commercial timber harvesting includes regeneration of hardwood stands (351 acres), commercial thinning of hardwood stands (2464 acres), fuel break establishment (75 acres including 72 acres within commercial harvest units) and associated temporary road construction/reconstruction (62 miles) and landing construction (40 sites). These activities cover large portions of the analysis area, and while survey coverage of representative habitats will be obtained in the proposed units, the large total area proposed for harvest precludes 100 percent survey coverage within each unit. Therefore, some potential exists for undiscovered sensitive plants to be impacted.

- **Prescribed fire and fuels reduction**. Proposed prescribed fire includes broadcast burning of one unit (357 acres) and associated fire line construction, prescribed fire to maintain fuel breaks (75 acres), and pile burning within fuel breaks to reduce logging slash and woody debris created from commercial timber harvest. Survey coverage of representative habitats was obtained in the proposed units but the large total area proposed precluded 100 percent survey coverage. Therefore, some potential exists for undiscovered sensitive plants to be impacted.

- **Maintenance of existing roads.** In general, the roads that are proposed for maintenance (19 miles) are heavily used, maintained, and compacted. Many of the roads were used as travel routes by botanists during their surveys of the other activity areas. However, despite the low probability of sensitive plants occurring on these routes, the possibility cannot be completely discounted, and survey coverage is not complete. While the probability is considered low, some potential exists for undiscovered sensitive plants to be impacted.

Longstalk holly is a deciduous shrub or tree with stalked red berries found at higher elevations in moist soil, especially riparian areas of high energy streams, but also present, though less common, in wet meadows, bogs, and seeps (NatureServe 2019). Longstalk holly is known to occur at 8 locations in the analysis area. The known occurrences are not within proposed activity areas and therefore would be directly affected by proposed activities. However, because longstalk holly is known to occur in scattered locations across the analysis area, additional undiscovered occurrences probably exist. Whether any undiscovered occurrences exist within proposed activity areas is not known.

Forest Plan direction that protects stream channels and wetlands would limit the potential effects of commercial harvest and associated activities on longstalk holly. Forest Plan direction prohibits programmed timber harvest in channel buffers (SW34) and limits roads, skid trails and landing to essential crossings (SW44, SW40). Similar protection is required for wetlands (SW51). Because of the allowance for essential crossings of streams and wetlands, temporary roads, skid trails, and landings would have some potential to impact longstalk holly. Impacts on undiscovered occurrences could include directly damaging or eliminating plants through grading, applying gravel, and installing culverts.

Prescribed fire is unlikely to carry through wetland/riparian habitat with much intensity. Recent experience on other prescribed fire projects on the Forest suggests that fire in mesic oak-hickory ecosystems will burn into the riparian area, but typically at low intensity. Such low intensity fire usually consumes the undecomposed leaf litter without substantial effects on the organic and mineral horizons of the soil. The effects of fire on longstalk are not known. Presumably, longstalk holly would be top-killed unless a lack of fuel limits the intensity of the fire. The extent to which roots and seeds would be damaged and plants potentially subjected to total mortality is not known, but likely would be related to fire intensity.

Other sensitive species - An additional 32 sensitive species have the potential to occur in the analysis area (Table 1). No occurrences of these sensitive species are known in the analysis area, so the potential for effects on these species is low. However, due to the representative nature of the surveys, the potential for impacts to undiscovered occurrences cannot be ruled out completely.

Mesic forest species –If any undiscovered occurrences of these species exist in areas proposed for commercial regeneration harvesting or temporary road and landing construction, they likely would be damaged or eliminated. One possible exception would be butternut, which is shade-intolerant and requires an open canopy to regenerate (Burns and Honkala 1990). If any undiscovered butternut seedlings or saplings survive the harvest, or if any seedlings become established following site preparation, they would benefit from the open canopy in even-aged regeneration units. For most species in this group, the effects of thinning harvests would be uncertain because preferred light levels are not precisely known. However, any undiscovered butternuts likely would benefit from thinning.

The effects of prescribed fire on species in this group are unknown. Presumably, butternut would be top-killed or damaged by fire. The extent to which roots and seeds would be damaged and plants potentially subjected to total morality is not known, but would likely be related to fire intensity.

Wetland and riparian habitat species – Forest Plan direction that protects stream channel corridors and wetlands would limit the potential effects of commercial timber harvest and associated activities on wetland/riparian habitat sensitive plants (see longstalk holly direct and indirect effects discussion above). In contrast to the potential for negative impacts from road and skid trail crossings, habitat adjacent to the crossings could be improved for species that prefer an open or partially open canopy. Actual benefits to these species would not occur if no individuals are present nearby to colonize the habitat.

Prescribed fire is unlikely to carry through these habitats with much intensity, although the potential for effects cannot be ruled out completely (see longstalk holly direct and indirect effects discussion above).

Rocky habitat species – If any undiscovered occurrences of these species exist in areas proposed for commercial regeneration harvesting or temporary road and landing construction, they likely would be damaged or eliminated. Construction of temporary roads and landings typically avoids major outcrops due to excavation difficulties, but smaller outcrops could be damaged. In addition, project activities are designed to avoid rocky habitats along streams and seeps.

The effects of prescribed fire on species in this group are unknown. Presumably, the woody species and semi-evergreen species (purple clematis and white alumroot) would be top-killed unless a lack of fuel in rocky areas limits the intensity of the fire. The extent to which roots and seeds would be damaged and plants potentially subjected to total mortality is not known, but likely would be related to fire intensity.

Effect Determinations for Sensitive Plant Species

The Proposed Action could affect any undiscovered occurrences of longstalk holly. However, as discussed above, such losses would not be expected to impact population viability within the analysis area or on a Forest-wide basis. Also, the Proposed Action would pose a very small risk of damaging or extirpating undiscovered occurrences of other sensitive plant species with potential habitat in the analysis area. Therefore, for all sensitive plant species listed in Table 1 above, the Proposed Action **may impact individuals but are not likely to lead to loss of viability or a trend toward federal listing.**

Sensitive plant species that are not listed in Tables 1 above are not expected to occur in the analysis area. Therefore, for all sensitive plant species not list in Tables 1, the action alternatives would have **no impacts.**

Consistency with the Forest Plan

The Proposed Action could affect undiscovered occurrences of sensitive plants, particularly longstalk holly. However, damage to known occurrences would be avoided or minimized through design criteria, so the Proposed Action would be consistent with Forest Plan direction to avoid and minimize negative impacts on sensitive plants to the extent practical (see Forest Plan standard VE13, p. II-19).

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ID_1	GIS_Miles	Cut_Type	Method	GIS_Acres	mi^2	Density, new	Density, existing	Density, total	ID_1	COMENTS
R10	1.60	Regen	Conventional	38.73	0.06		26.40	26.40	R10	
R3	1.61	Regen	Conventional	29.14	0.05	11.44	6.89	18.34	R3	
R4	0.65	Regen	Conventional	25.44	0.04	9.61	6.71	16.31	R4	
R5	0.86	Regen	Conventional	25.58	0.04	19.71	1.74	21.45	R5	
R6	0.34	Regen	Conventional	15.46	0.02		13.96	13.96	R6	
R74	1.08	Regen	Conventional	35.83	0.06	7.74	11.57	19.31	R74	
R8	1.81	Regen	Conventional	37.63	0.06	6.30	24.55	30.85	R8	
R9	1.29	Regen	Conventional	34.28	0.05	3.72	20.33	24.04	R9	
T11	0.70	Thinning	Conventional	24.28	0.04	18.49		18.49	T11	
T12	0.89	Thinning	Conventional	44.36	0.07	8.48	4.30	12.78	T12	
T13	1.30	Thinning	Conventional	48.28	0.08	7.82	9.45	17.27	T13	
T16	0.62	Thinning	Conventional	27.97	0.04	14.09		14.09	T16	
T18	1.18	Thinning	Conventional	25.38	0.04	14.12	18.61	29.72	T18	
T20	0.53	Thinning	Conventional	33.03	0.05	10.23		10.23	T20	
T21	0.70	Thinning	Conventional	74.85	0.12	5.97		5.97	T21	
T22	0.76	Thinning	Conventional	34.23	0.05	14.23		14.23	T22	
T23	1.11	Thinning	Conventional	45.18	0.07	8.19	7.49	15.68	T23	
T28	0.54	Thinning	Conventional	17.36	0.03	4.40	15.58	19.99	T28	
T29	0.19	Thinning	Conventional	6.23	0.01		19.83	19.83	T29	
T31	0.81	Thinning	Conventional	33.59	0.05	15.40		15.40	T31	
T34	0.99	Thinning	Conventional	27.16	0.04	16.34	6.92	23.26	T34	
T36	1.55	Thinning	Conventional	50.15	0.08	7.90	11.92	19.82	T36	
T38	0.76	Thinning	Conventional	23.00	0.04	20.51	0.70	21.21	T38	
T41	0.86	Thinning	Conventional	22.99	0.04		19.71	23.90	T41	
T44	0.48	Thinning	Conventional	21.91	0.03	4.01	9.86	13.88	T44	
T46	0.55	Thinning	Conventional	16.95	0.03	10.99	9.68	20.67	T46	
T49	1.11	Thinning	Conventional	29.48	0.05	8.03	16.06	24.09	T49	
T50	0.60	Thinning	Conventional	33.40	0.05	11.53		11.53	T50	
T52	0.72	Thinning	Conventional	31.41	0.05	14.73		14.73	T52	
T53	0.46	Thinning	Conventional	16.90	0.03	6.00	11.56	17.56	T53	
T58	0.75	Thinning	Conventional	30.39	0.05		15.73	15.73	T58	
T65	1.63	Thinning	Conventional	67.87	0.11	15.38		15.38	T65	
T69	0.44	Thinning	Conventional	31.35	0.05	8.90		8.90	T69	
T70	0.74	Thinning	Conventional	32.71	0.05	2.89	11.52	14.41	T70	
T71	2.09	Thinning	Conventional	72.93	0.06	16.51	18.00	34.51	T71	
T72	0.36	Thinning	Conventional	7.51	0.01	6.37	24.13	30.50	T72	
T73	0.22	Thinning	Conventional	9.38	0.01	15.30		15.30	T73	
T75	0.23	Thinning	Conventional	10.59	0.02	14.19		14.19	T75	
T76	0.17	Thinning	Conventional	8.00	0.01	13.26		13.26	T76	
T77	0.36	Thinning	Conventional	18.46	0.03	3.38	9.17	12.55	T77	
T78	0.83	Thinning	Conventional	29.57	0.05	14.31	3.64	17.95	T78	
T79	1.46	Thinning	Conventional	52.93	0.08	2.01	15.62	17.62	T79	
T80	0.10	Thinning	Conventional	2.18	0.00	18.73	10.74	29.47	T80	

T81	1.38	Thinning	Conventional	59.91	0.09		14.75	14.75	T81	
T82	1.74	Thinning	Conventional	39.19	0.06	16.77	11.72	28.49	T82	In Burn Block
T83	1.41	Thinning	Conventional	30.33	0.05	0.98	28.42	29.68	T83	
T84	0.61	Thinning	Conventional	15.36	0.02	25.36		25.36	T84	
T85	3.03	Thinning	Conventional	101.86	0.16	9.90	9.14	19.04	T85	
T86	1.36	Thinning	Conventional	50.08	0.08	15.10	2.32	17.42	T86	
T87	0.37	Thinning	Conventional	16.42	0.03	14.57		14.57	T87	
T88	1.11	Thinning	Conventional	42.78	0.07	15.09	1.45	16.54	T88	
T89	0.17	Thinning	Conventional	34.86	0.05	3.07		3.07	T89	
T90	1.04	Thinning	Conventional	15.74	0.02	30.53	11.83	42.36	T90	
T91	0.83	Thinning	Conventional	16.46	0.03	21.64	10.69	32.33	T91	In Burn Block
T92	0.90	Thinning	Conventional	22.53	0.04	22.05	3.62	25.67	T92	In Burn Block
T93	0.48	Thinning	Conventional	13.15	0.02	11.77	11.59	23.36	T93	In Burn Block
T94	1.51	Thinning	Conventional	49.06	0.08	2.08	17.58	19.67	T94	In Burn Block
T95	1.75	Thinning	Conventional	50.72	0.08	3.29	18.77	22.07	T95	In Burn Block
T96	0.80	Thinning	Conventional	30.00	0.05		17.14	17.14	T96	
T97	0.30	Thinning	Conventional	8.61	0.01		22.22	22.22	T97	In Burn Block
T98	0.27	Thinning	Conventional	10.43	0.02	15.02	1.71	16.72	T98	
T99	0.15	Thinning	Conventional	14.55	0.02	2.49	4.28	6.77	T99	
Total	55.23			1,926.11	2.96			18.68		
Total	55.23			2,013.66	3.09			17.86		

(miles of temporary roads within each conventional harvest units)

total, new	**27.55**
Total, re-const	**26.90**

(from GIS layer "*GHFR_TempRoads_011620*".

United States Department of Agriculture

Gauley Health Forest Restoration

Categorical Exclusion

Effects to the Soil Resource

Forest Service
Monongahela National Forest

January 2020

Methodology

A combination of desktop analyses, limited field work and historic soil chemistry results were used to determine soil resource effects that may be incurred from implementing the proposed actions outlined in the Gauley Healthy Forest Restoration (GHFR) CE. The spatial data sets used to complete the desktop analysis have varying scales. Minor differences in acreage or spatial extent can be attributed to these scale variations and the inherent limitations of mapping spatial features. Limited field surveys were conducted in the project area but soil chemistry data from within the project area on similar soils and geologies are available and were used. For a more detailed description of methodology and assumptions used in this report see *GHFR_MethodologyandMeasures*.

Existing Condition

The soil resource in this project areas has been negatively impacted by multiple factors including historic exploitative logging, severe wildfires and acidic deposition which resulted in detrimental soil disturbance (USDA Forest Service, 2006). Soil sensitivities in the project area are soils with high acidic deposition risk, soil wetness and soil carbon loss. About 70% of the project area is mapped as having high acidic deposition risk. This is supported by soil chemistry data taken within the project area and soil chemistry data from the same geologic formation in other areas of the Monongahela National Forest (USDA Forest Service, 2006; Connolly et al., 2007; Farr et al., 2008) (see *GHFR_AcidDep_Briefing_FD*). Soil wetness and carbon loss sensitivities also exist throughout most of the project area. There are approximately 1285 acres of prime farmland, farmland of statewide importance, and farmland of local importance in the GHFR project area. Today, the landscape is primarily forested and has experienced varying levels of soil recovery over the past century (USDA Forest Service, 2006). For more detailed information regarding acid deposition, see the *Air_resource_update_dec_2018* and *AcidDep_ForestHealth_BriefingPaper_O'dea* (Note this briefing paper was written for a different project area within the 5th level HUC and with the same geologies and similar soil types).

Direct and Indirect Effects

Conventional Timber Harvest

A total of 1,934 acres of conventional timber harvesting is proposed. Timber harvesting has limited impacts to the soil resource. Clear cutting has been shown to result in increased soil moisture, soil temperatures and organic matter (Prescott, 2002). Microclimatic conditions return to pre-harvest conditions once the forest canopy closes (about 10 years). In timber harvest units, areas other than temporary roads and landings typically experience only dispersed disturbance and consequently result in short-term, non-detrimental impacts to soil productivity (see the reports within the *SoilDisturbanceMonitoring* folder) (Hatchell and Ralston, 1971; Johnson et al., 1985; Kozlowski, 1999).

Helicopter Timber Harvest

Helicopter timber harvesting is proposed on 880 acres. Helicopter yarding minimizes the amount of soil disturbance that occurs because no skid roads are used to move the logs from the units to the landings. Consequently, helicopter logging results in relatively little direct and/or long-term impacts to the soils in the form of compaction, rutting and erosion. Field observations and ocular estimates of MNF timber sales in 2007 (North Gauley Mountain, Marlinton RD), and 2004 (Smoke Camp Timber Sale, Greenbrier RD; Dry Run Timber Sale, Cheat RD) show that very little ground disturbance (less than 1%) occurs within an activity area during helicopter timber harvest. Therefore, no short- or long-term detrimental effects to the soil resource are expected within helicopter harvest units.

Temporary Roads
A total of 29.5 miles of temporary road construction and 32.3 miles of temporary road reconstruction is proposed which would result in 44 and 50 acres (respectively) of long-term detrimental soil disturbance and ultimately decreased soil productivity (Kozlowski, 1999; Ares et al., 2005; McNabb et al., 2001; Agherkakli et al., 2010). Both the temporary road construction and temporary road reconstruction proposed for this project will result in short-term and potentially long term negative impacts to the soil resource in the form of erosion, soil compaction and topsoil (nutrient) loss (Kozlowski, 1999; McNabb et al., 2001; Ares et al., 2005; Agherkakli et al., 2010).

The deep compaction observed on skid roads recovers very slowly (50-100+ years) if left to natural processes and consequently results in both short- and long-term detrimental soil disturbance (Power, 1974; Froehlich et al., 1985; Corns, 1988; Shepperd, 1993 and Grigal, 2000). Soil compaction negatively effects soil quality and productivity because it impedes water infiltration and root penetration which results in decreased herbaceous growth and increased runoff, erosion and sedimentation (Reisinger et al., 1992; Grigal, 2000). The soil disturbance required when constructing and using temporary roads results in long-term detrimental impacts to soil productivity due to the loss of alkalinity and nutrients incurred when topsoil is bladed to create a safe skidding/driving surface (see *GHFR_AcidDep_Statement and AcidDep_ForestHealth_BriefingPaper_O'dea*). The majority of nutrients and alkalinity in these soils is contained in the uppermost soil horizons and when disturbed (as is required during temporary road construction and use), these nutrients are lost which may result in the inability to grow trees and even herbaceous vegetative cover without lime and fertilizer additions.

Landings
The construction of 13 conventional and 4 helicopter landings is proposed. This construction will result in about 13 acres of long-term detrimental soil disturbance in the form of nutrient loss and soil compaction (ultimately resulting in decreased soil productivity) (Kozlowski, 1999; Ares et al., 2005; McNabb et al., 2001; Agherkakli et al., 2010). Additionally, the reconstruction of 20 conventional and 3 helicopter landings is proposed. Reconstruction and use of these landings will eliminate the minimal soil recovery that has taken place on these existing features since the last timber entry and will result in approximately 15 acres of soil disturbance. Both the landing construction and reconstruction proposed for this project will also result in short-term negative impacts to the soil resource in the form of erosion, soil compaction and nutrient loss (Kozlowski, 1999; McNabb et al., 2001; Ares et al., 2005; Agherkakli et al., 2010). The deep compaction on landings (necessary for safe decking of logs) recovers very slowly (50-100+ years) (Power,

1974; Froehlich et al., 1985; Corns, 1988; Shepperd, 1993 and Grigal, 2000) if left to natural processes and consequently results in both short- and long-term detrimental soil disturbance. As described above, the majority of nutrients and alkalinity in these soils is contained in the uppermost soil horizons and when disturbed (as is required during landing construction and use), these nutrients are lost which may result in the inability to grow trees and even herbaceous vegetative cover without lime and fertilizer additions.

Prescribed Fire, Fuel Breaks and Pile Burning
Prescribed fire is proposed on 357 acres. Natural features (existing roads, rivers, trails, streams, etc.) will be utilized as fire breaks to the extent possible to reduce soil disturbance. Minimum Impact Suppression tactics (MIST) will be used where hand or dozer line is necessary (see proposed action). The low to moderate intensity prescribed fire itself is not expected to result in detrimental soil disturbance in the short- or long-term (see *SoilDisturbanceMonitoring* folder). The amount of dozer line needed was not known at the time of this analysis. Dozer line construction is similar to temporary road construction and consequently has similar soil resource effects including short-term erosion and long-term detrimental soil disturbance in the form of topsoil and nutrient loss, soil compaction and diminished soil productivity. Hand line is typically 2 feet wide and may be created using leaf blowers or hand tools to expose mineral soil. If the latter is required, short-term soil erosion and sedimentation would be expected in those areas. In general, prescribed fire is restorative to a landscape where fire is in inherent part of the nutrient cycling process. (Boerner et al., 2006). Nutrient levels in areas where prescribed is effective at minimizing fuels should increase. However, soil carbon losses are expected to occur especially in areas where inclusions of thicker soil surface horizons may exist from historic vegetative cover.

About 75 acres of fuel breaks are proposed around Summit Lake and Richwood. Thinning (of basal area) is proposed in these areas. Any limbs, slash or debris generated from thinning operations will be hand piled and burned resulting in additional loss of nutrients from a landscape with limited nutrients and alkalinity (Curzon et al., 2013; Slesak et al., 2016). Research about soil resource effects incurred from pile burning for this region, and respective environmental site conditions, is limited. The primary soil resource concern regarding pile burning is soil heating and the subsequent soil physical, chemical and microbial changes (Busse, et al., 2013). Busse et al., (2013) concluded that for a variety of pile sizes, soil heating was moderate and would not cause major shifts in soil quality in the long term. However, if large wood (>22.5 cm diameter) is the major component of the pile, extreme soil temperatures (300-500°C) and long-term effects to soil quality are likely (Busse et al., 2013). Pile burning has also been shown to result in altered clay minerology (Arocena and Opio, 2003), increased pH, and changes to macronutrients and their availability (Arocena and Opio, 2003; Jonsson and Nihlgard, 2003; Thorpe and Timmer, 2005). Limited studies are available regarding the effects of pile burning on soil microbial communities, but it is likely pile burning will have a negative impact on the microbial populations and composition (Esquilin et al., 2007). Given the soil resource conditions in this project area, it is likely that pile burning will result in long-term detrimental soil disturbance and impacts to soil productivity in discrete locations.

Herbicide Use

Herbicide use to treat existing and new infestations of high-priority nonnative invasive species (NNIS) is proposed throughout the project area. Species that may be controlled as well as herbicides that may be used can be found in the 2010 Forest-wide Nonnative Invasive Plant Management Project Environmental Analysis (page 2-7). Any treatment of NNIS within the GHFR project area will tier to the Forest-wide Nonnative Invasive Plant Management Project. Refer to the soil resource report of the 2010 Forest-wide Nonnative Invasive Plant Management Project EA for information about direct and indirect effects for given herbicides and treatment options (USDA Forest Service, 2010).

Pesticide Use

Emamectin benzoate, Imidacloprid, Dinotefuran and neem oil may be used on a maximum of 20 acres to treat emerald ash borer, hemlock wooly adelgid and beech bark disease. Application methods and rates were not provided at the time of analysis. It is assumed that application will follow manufacturer specifications as well as MNF Forest plan standards, guidelines and direction. Consequently, long-term detrimental impacts to the soil resource are not expected.

Unavoidable Adverse Impacts

The proposed actions would implement activities that would disturb soils with high acidic deposition risk and consequently may cause unavoidable adverse erosion, compaction and nutrient and soil carbon loss, ultimately adversely affecting soil productivity in the short and long-term (see *GHFR_AcidDep_Briefing_FD).* Implementation of all Forest Plan direction, design features and mitigations would reduce the potential for adverse impacts. To summarize, this project would result in approximately 122 acres of adverse impacts to the soil resource from soil disturbance. Additionally, there is potential for adverse effects to soil productivity and forest health on 2,814 acres where timber (and associated nutrients) is being removed from high risk acid deposition landscape (Cronan and Grigal, 1995; Elias et al., 2009; https://www.srs.fs.fed.us/airqualityportal/critical_loads/map_terr.php_).

Irreversible or Irretrievable Commitment of Resources

The proposed action does not result in irreversible commitments of the soil resource. An irretrievable commitment of the soil resource results in permanently altered soil properties in the long-term. Approximately 122 acres (temporary road construction and reconstruction, landing construction and reconstruction) would be considered an irretrievable commitment of the soil resource. Natural soil recovery in these areas could require 50-100 years. Soil recovery from any potential nutrient losses is uncertain at this time and dependent upon factors like long term control of atmospheric pollutants and natural weathering of soils from inherently acid geologies underlaying the project area. (https://webcam.srs.fs.fed.us/impacts/acid/index.shtml)

Consistency with the Forest Plan

The proposed action alternative would be consistent with the Forest Plan. Temporary roads are not expected to be needed on slopes >50%. Where possible, building or using temporary roads on slopes 40-50% will be avoided. Based on the desktop analysis, nearly a mile of temporary road construction is proposed on slopes greater than 40%. If operations on these slopes are found to be necessary, operations on these slopes would be analyzed on a case-by-case basis.

Consistency with Laws, Regulations, Handbooks and Executive Orders

The Proposed Action would be consistent with FSM 2550. FSM 2550.2 is an objective that states actions must "Maintain or restore soil quality on National Forest System lands. Manage resource uses and soil resources on National Forest System lands to sustain ecological processes and function so that desired ecosystem services are provided in perpetuity".

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GAULEY HEALTHY FOREST RESTORATION CE

FIRE AND FUELS EFECTS

/S/ John Fry 02/24/2020

Assistant Fire Management Officer

For most of the 20th century, any form of wildland fire, was quickly suppressed for fear of uncontrollable and destructive wildfires. In the 1960's, policies governing wildfire suppression changed due to ecological studies that recognized fire as a natural process. Today, polices advocating complete fire suppression have been replaced by policy that allows fire to act as a tool to meet resource objectives. Fire played an important role in the development and maintenance of oak forest in the eastern United States (Van Lear, Brose, and Keyser 2000). Declines of oak forests have been noted throughout much of the East and are often attributed to reduced frequency. Prescribed fire can be an important tool for regenerating oak stands by reducing competition and oak sprout vigorously after fire.

The identified proposed prescribed and fuels treatments are in conjunction with the Monongahela National Forest Plan. The Forest-wide desired condition is to use fire as a tool to achieve and maintain desired vegetative conditions and fuel levels. The Forest-wide goals and objectives of implementing fuels reduction and fuels break projects are to be located in areas that would reduce the wildfire risk to communities, municipal water supplies, and at risk federal land and prescribed fire would be used to mimic natural process to accomplish resource objectives.

Proposed Action

The proposed fire and fuels treatments include the creation and maintenance of fuel breaks adjacent to private property, municipal water sheds, and recreation sites. Biomass would be removed or treated, thus allowing fuel loading and fire hazards to decrease. Prescribed fire would be reintroduced into fire-adapted ecosystems thus fulfilling the Forest Plan objectives and goals.

The purposed treatments would move the project area towards a more resilient landscape and reducing overall surface fuel loading in the stands being treated. Crown-to-crown contact would be eliminate where thinning activities occur. Without crown-to-crown contact the potential for crown fire development and the subsequent destruction of the trees on site would be greatly reduced. Overall, the probability of intense surface fires in mixed hardwood stands would be reduced.

Prescribed Burning:

Periodic prescribed burning would reduce hazardous fuel conditions and the reintroduce fire into fire-adapted ecosystems thus fulfilling the Forest Plan.

The direct effects of implementing using prescribed fire would be a decrease in fuel loading. The proposed action would have a positive effect on restoring the natural fire regime by maintaining disturbances in ecosystems that have adapted over time to periodic short-return interval disturbances. Studies show that areas that have prescribed fire introduced prior to a wildfire exhibit lower rates of spread, less intensity, less severity, and a smaller final wildfire size. When combined with past, present and future activities this project would provide short term and long term positive contributions within the analysis boundary by reducing fuels and reintroducing fire into the ecosystem.

The effects would be a gradual decrease in fuel loadings. After a couple of burns, the effectiveness of prescribed burning would start to decline, at which time maintenance burns would be implemented every 5-10 years. Periodic prescribed burning would reduce hazardous fuel conditions and the reintroduction of fire into the fire adapted ecosystems thus fulfilling Forest Plan objectives and goals. There would also be a reduction in the probability of damage to private and public improvements should a wildfire occur, a reduction of fuel loading to provide for public and firefighter safety, and protection of public and private property adjacent to the burn units in the event of a wildfire. There would be a very low risk of any effects to private property during or following prescribed burn implementation.

Prescribed fire would generate primarily short term smoke emissions. Smoke would disperse quickly and have no effect on air quality parameters. The majority of emissions from smoke produced by prescribed fires should typically occur within the first 8 to 24 hours of the prescribed burn being initiated. Residual smoldering, with small amounts of smoke production would continue for several days afterward in 100 and 1000 hour fuels sizes, but should disperse quickly. It is expected that smoke from the prescribed burns could impact roads and commercial and residential areas downwind, causing reduced visibility and very short term local air quality reduction. Signage maybe be used to warn motorists to slow down along sections of roadways if visibility is greatly reduced.

This activity would have no long-term negative effects on visitor safety and should increase public safety due to the decreased chance of wildfire from the controlled reduction of fuels. The proposed action would have a positive effect on restoring the natural fire regime by maintaining disturbances in ecosystems that have adapted over time to periodic short-return interval disturbances. Studies show that areas that have prescribed fire introduced prior to a wildfire exhibit lower rates of spread, less intensity, less severity, and a smaller final wildfire size. When combined with past, present and future activities this project would provide short term and long term positive contributions with the analysis boundary by reducing fuels and reintroducing fire into the ecosystem.

Mechanical Treatment:

Fuel breaks would be created by removing both understory and over story trees. Trees would be removed to allow for open canopy (no tree to tree contact). Hardwood species would be selected to remain because of their fire resistant properties. Tree density will vary with more open conditions closest to private property to encourage grasses and fade into a heavier density as distance from private property increase. The desired condition is a more natural appearance of forest transitioning to open conditions near private property. Any residual fuels left after treatment implementation will wither be burned (piles or broadcast burn) or mechanically treated (chipped). Subsequent maintenance at three to seven year intervals by mechanical treatments or by prescribed burning to remove encroaching vegetation and ladder fuels would be done to maintain their effectiveness.

The direct effects of would be a decrease in fuel loading. The effectiveness of the activities would decease as biomass increased. The indirect effects would result in fuel loadings slowly increasing within the project area without maintenance treatments. The treatments would decline in effectiveness over time, with mechanical treatment declining over a ten-year period. The three-to-ten year maintenance schedule of the fuel breaks provide a constant benefit to the analysis area by maintaining lighter fuel loadings and thus low fire intensity.

The desired condition from a Fire and Fuels perspective is the protection of life and property, the reduction of hazardous fuels accumulations and the restoration of a fire adapted and resilient ecosystem. The project's proposed vegetation management activities and use of prescribed fire are needed to help restore the project area's natural fire regime, reduce the intensity of a wildfire and subsequent damage to the public and/or private property.

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Effects to Heritage Resources

The proposed action has been analyzed for expected direct, indirect, and cumulative effects to historic property. For the purpose of this analysis, effect means the alteration to the characteristics of a historic property qualifying it for inclusion in, or eligibility for, the National Register of Historic Places (NRHP) per the definition in 36 CFR 800.16(i). Historic property means any prehistoric or historic district, site, building, structure, object or historical/cultural landscape included in, or eligible for inclusion in, the NRHP. The term historic property also applies to any cultural resource or property not yet evaluated to determine whether it is eligible for the NRHP. The term includes artifacts, features, records, and remains that are related to and located within such properties. The term also includes properties of traditional religious and cultural importance to an Indian tribe or native Hawaiian organization and that meet the National Register criteria per the definition in 36 CFR 800.16(l).The area of potential effect (APE) for the analysis of direct effects is defined spatially as the project area boundary. All management activities proposed by the project are confined within the project area boundary. The spatial boundary for the analysis of indirect effects extends beyond the project area boundary by 0.25 miles to consider potential visual effects to adjacent historic properties. The temporal limit used to evaluate direct, indirect and cumulative effects was ten years because the proposed actions will be completed within five years and the visual effects are likely to continue for up to five years post-treatment.

Field Survey and Consultation

The Forest Service will award a task order through contract to survey the APE. The survey will be a focused approach to identify historic properties at locations where previous surveys either had not been conducted, or where previous surveys were inadequate for the current analysis. The survey will be conducted in consultation with the West Virginia Division of Culture and History (WVDCH), the Absentee Shawnee Tribe of Oklahoma, the Eastern Shawnee, the Shawnee Tribe, the Delaware Nation, and the Seneca Nation. The resulting technical report will be reviewed by all consulting partners prior to implementation of ground disturbing activities. Protection measures, including avoidance, will be established for all historic properties identified to avoid adverse effects.

Direct and Indirect Effects to Historic Properties

The proposed action will have no adverse effect to historic properties. Protection measures established during consultation will eliminate or minimize direct and indirect effects to historic property. All historic properties identified would be marked and avoided during all phases of project implementation. Ground disturbing activities shall be prohibited within marked boundaries of historic properties.

- **Thinning and Associated Treatments, including vine control** have the potential to effect historic properties. Protection measures, including avoidance where necessary, would be necessary to eliminate or minimize adverse effects.
- **Clearcutting (Regeneration) and Associated Treatments have** the potential to effect historic properties. Protection measures, including avoidance where necessary, will be necessary to eliminate or minimize adverse effects.

- **Herbicide** – Herbicide use has limited-to-no potential to adversely affect historic properties.

- **Prescribed fire** activities have no adverse effect to historic property when natural or existing fire barriers, such as streams, ridges, roads and trails are used for fire control lines. Fire control barriers requiring ground disturbance will not occur where historic properties have been identified. Non-ground disturbing methods, such as hand line, wet line or black line would have no adverse effect to historic property.

- **Road Maintenance** activities have no adverse effect to historic property where work is confined to previously maintained surfaces, ditches, culverts, and cut and fill slopes where there are no known historic properties because proposed work is clearly within disturbed context. None of the culverts to be replaced are historic property.

- **Temporary Roads** have the potential to effect historic properties. Protection measures, including avoidance where necessary, would be necessary to eliminate or minimize adverse effects.

- **Non-Native Invasive Species Treatments** such as hand-pulling, mowing, grubbing, biological control, and herbicide application have limited-to-no potential to adversely affect historic properties.

Cumulative Effects to Historic Property from Proposed Project Activities:

The potential for direct and indirect effects to historic property is negligible. As such, Alternative 2 would have no cumulative effect to historic property.

Consistency with the Forest Plan

Forest Goal HR01 provides for the identification and management of cultural resources on the Forest, as does direction in Heritage Resources Standards HR04, HR05.

Consistency with Laws, Regulations, Handbooks and Executive Orders

Executive Order 11593, promulgated in 1971, instructs that all archaeological resources on Federal land are to be evaluated, while the 1988 amendment to the Archaeological Resources Protection Act (16 USC 470 mm) instructs federal land-managing agencies to develop and implement a plan for archaeological survey and evaluation. Provided that National Register eligible sites are avoided or mitigated, and unevaluated sites are avoided or evaluated and appropriate management taken, then any of the Alternatives is consistent with the Forest Plan and legal statute.

Relevant Laws, Regulations and Authorities

Antiquities Act of 1906 (16 USC 431-433)
Historic Sites Act of 1935 (16 USC 461-467)
National Historic Preservation Act of 1966 (16 USC 470)
National Environmental Policy Act (42 USC 4321-4347)
Archaeological Resources Protection Act of 1979 (16 USC 470)
Archaeological and Historic Conservation Act of 1974 (16 USC 469)
Executive Order 11593
FSM 2361

Gauley Healthy Forest Restoration Project

Monongahela National Forest,

Gauley Ranger District

Categorical Exclusion Report for Hydrology

Timothy Tolley, Hydrologist

February 6, 2020

Existing Conditions

The project area contains portions of six 6th level (HUC-12) sub-watersheds although project activities will occur in only the western portion of the 23,756-acre North Fork Cherry River sub-watershed. The proposed project activities are mostly contained within nine catchments ("watersheds") of streams that are tributaries to the North Fork Cherry River. The remaining project activities occur in areas that drain directly to the North Fork Cherry River and not via one of its tributary streams.

The project area contains an estimated (from GIS LiDAR) 472 miles of non-system (i.e. legacy)features, of which approximately 32 miles will be reconstructed for use by this project. These are of various ages and have undergone varying degrees of recovery in the years or decades since their original use. They have mostly become covered with duff and other organic material over this time and thus erosion and sedimentation are generally minimal to nonexistent.

Effects:

Impacts Associated with Timber Harvesting.

The largest source of sediment in forested systems is from skid roads, haul roads, and landings associated with forest harvesting. In particular, the effects are generally associated with landings and the road system rather than on areas disturbed by tree cutting and dispersed skidding (Ketcheson et al. 1999 and Swift 1988). Roads and landings associated with timber harvesting produce effects that generally fall into the following three categories: 1) sedimentation and erosion, 2) altered natural hydrologic flow regimes of hillslopes, and 3) diminished resource productivity.

The GHFR project proposes no new permanent system roads so the impacts from roads will be limited to those from temporary roads. The temporary roads and their respective impacts are grouped into those that are created on existing features on the landscape (i.e. reconstructed on existing "legacy" features), and those created on previously undisturbed ground (i.e. temporary roads).

The GHFR project proposes creating a total of 61.9 miles of temporary roads, 32.3 miles of which will be created on existing features and 29.6 miles created on undisturbed ground. Most temporary roads (54.5 miles) will be created within the 1,961 acres of conventional harvest units. Of these conventional harvest units, 27.6 miles will be created on undisturbed ground and 26.9 miles on existing features. The remaining 7.4 miles are outside of any harvest units.

The creation of temporary roads, especially on hillslopes, generally consists of using a bulldozer to excavate a road prism into the hillside, thus creating a cut-slope on the uphill side of the roadbed, and a fill-slope on the downhill side.

Temporary roads constructed or reconstructed for this project be decommissioned within 3 years of project completion. Guidance on road decommissioning is provided by the MNF Land and Resource Management Plan (i.e. Forest Plan), National Core Best Management Practices (BMP) Technical Guide FS-990a, and FSM 7734. The Forest Plan (RF15, p. II-55) and the National

Core BMP Technical Guide (Road-5, Temporary Roads, p. 114) state that temporary roads are to be decommissioned/rehabilitated and the area returned to resource productivity after the access is no longer needed. FSM 7734.02 states the objective of road decommissioning is to "Stabilize, restore, and revegetate unneeded roads to a more natural state to protect and enhance NFS lands". It is expected that erosion and sedimentation impacts can be addressed with the successful application of these decommissioning steps. The greatest potential for erosion and sedimentation occurs the first-year post-harvest and generally decreases each year after that. The application of appropriate BMPs have been shown to be 53 to 94 percent effective at reducing sediment in the first year after harvesting (Edwards and Williard 2009). Altered hydrology and diminished productivity that result from the altered morphology of the hill slope during the construction of temporary roads on previously undisturbed ground are anticipated to remain as long-term impacts to the hydrologic resources. The impacts of altered hydrology and diminished site productivity are not specifically addressed by water bars and revegetation alone (Kolka and Smidt 2004).

The project proposes 17 new landings and 23 existing landings as indicated below.

- New, helicopter (4), approximately 8 acres
- New, conventional (13), approximately 6.5 acres
- Existing, helicopter (3), approximately 6 acres
- Existing, conventional (20), approximately 10 acres

As with road construction/reconstruction, landings pose a risk of erosion and sedimentation due to the bare ground that results from their creation and use. The BMPs applied to landings are expected to adequately address erosion and sedimentation risks. Landings incorporate drainage along the upslope perimeter to prevent water from flowing on to the landing, thus the only water on a landing is what has fallen directly onto it from precipitation. Additionally, landings do not present a linear, connected flow path for water, they are generally seeded, and generally include logging slash at the toe of the landing slope to help arrest sediment movement. Landings are not located closer than 100 feet from a perennial, intermittent, or ephemeral stream (Forest Plan Standard SW40, p. II-13).

Impacts Associated with Prescribed Fire and Fuels Reduction Treatments.

The prescribed low to moderate burn is expected to produce a mosaic of burn areas on the forest floor. This mosaic burn pattern will produce some parts of the forest floor that have burned at a greater intensity than others but overall it is expected to retain a ground cover of duff and organic matter sufficient to protect the underlying soil from erosion. The mosaic pattern will not be expected to produce the long, linear flow paths that are conducive to concentrated flow and erosion.

Suppression activities have a greater potential to create the extended linear flow paths, primarily in the form of dozer lines and hand lines. Dozer lines are not proposed for this project. To address this potential, the Forest proposes using natural features such as streams or rivers whenever possible, and to use the Minimum Impact Suppression Tactics (MIST) when the natural features are not available. Features created to control the prescribed burn will be rehabilitated after use. By implementing the prescribed burn in the manner described in the Proposed Action, the impacts to hydrologic resources resulting from prescribed burn are expected to be minimal and of short duration.

Impacts Associated with System Road Maintenance

Maintenance of roads has been shown to reduce erosion and sedimentation input that these roads pose to water bodies of the watershed in which the roads are located. While they may produce some minor short-term erosion and sedimentation effects during and immediately after maintenance, an overall reduction in erosion and sedimentation is anticipated.

References

Edwards, P.J., and KWJ Williard. 2010. Efficiencies of forestry best management practices for reducing sediment and nutrient losses in the eastern US. Journal of Forestry.

Ketcheson, G. L., W. F. Megahan, and J. G. King. 1999. R1-R4 and BOISED Sediment Prediction Model Test using Forest Roads in Granitics. Journal of the American Water Resources Association, 35(1): 83-98.

Kolka, R. K. and M. F. Smidt 2004. Effects of forest road amelioration techniques on soil bulk density, surface runoff, sediment transport, soil moisture, and seedling growth. Forest Ecology and Management, 202: 313-323

Swift Jr., J. W. 1988. Forest access roads: design, maintenance, and soil loss. In: Swank, W. T., Crossley, Jr., D. A. (eds.). Forest Hydrology and Ecology at Coweeta, Springer-Verlag. New York, 313-324

Supplemental Information to Gauley Health Forest Restoration CE
Soil Resource: Methodology
February 7, 2020

Methodology

Soil resource effects outlined in the Gauley Healthy Forest Restoration (GHFR) soil resource report were ascertained mainly through a desktop analysis that used GIS to evaluate potential effects of proposed actions to the soil resource. A variety of spatial boundaries were used to evaluate direct, indirect and cumulative impacts to the soil resource. The GHFR project boundary was used to evaluate the existing condition as well as direct, indirect and cumulative effects resulting from proposed actions. Shapefiles depicting the location and extent of proposed actions were intersected with soils data to assess direct and indirect effects. Effects are analyzed in both short- and long-term time frames. Direct, indirect and cumulative effects can occur within both time frames. Soil resource effects are considered short-term if they persist a decade or less. Effects are considered long-term if soil recovery does not occur in the short-term. Soil formation, and thus, soil replacement are long-term processes that require a century or longer to occur. Consequently, historic actions that resulted in long-term effects are considered in the cumulative effects analysis.

Soils within the GHFR project area were mapped and characterized by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Soil Survey Program. USDA NRCS soil data can be accessed via Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). This information is mapped at a scale of 1:24,000. Information that can be accessed in Web Soil Survey includes, but is not limited to, soil map unit descriptions, typical series descriptions, and soil map unit interpretations for various land management activities. Although site-specific soil characterization data (soil pedons described, sampled and chemically analyzed) in this project area is limited, it is an accepted practice to use soil survey data for large scale planning given soil forming factors (Jenny, 1941; Dokuchaev, 1999). However, due to the inherent limitations of mapping, not all soil variability is captured in soil surveys. One known discrepancy in soil survey data is the under-representation of colluvial soils. Many soils mapped as having residuum parent material (formed from bedrock) are forming from colluvial parent material (transported by gravity). This is problematic because colluvial soils are typically wetter, deeper and less stable than residual soils and consequently require additional mitigations to maintain stability and have different interpretations for use and management.

A soil sensitivity layer was generated for the Monongahela National Forest (MNF) using soil survey data coupled with management limitations for soil types based on their physical and chemical properties. This information is derived from NRCS soil survey data and mapped at a 1:24,000 scale. More than one soil sensitivity may exist at a given site. The soil sensitivity layer is used to help identify where soils may respond negatively to proposed actions. In this way, highly sensitive areas can be avoided, or design criteria/mitigation measures can be applied to allow proposed activities to proceed while reducing the risk of adverse soil resource effects. This is needed to ensure that proposed actions are compliant with MNF Forest Plan standards SW01, SW02, SW07 and SW08 (USDA Forest Service, 2006).

Multiple other spatial data layers including geology, acid deposition ratings, slope and LiDAR data were used in this analysis. This data generally has the same inherent limitations and assumptions as described above. The geology data has known alignment issues. The LiDAR data used in this analysis is high resolution (1 ft^2). In general, any minor differences in acreage or spatial extent between data layers can be attributed to differences in scale between data and the inherent limitations of mapping spatial features.

Indicators and Measures

Most soils related concerns in the project area revolve around management-created soil disturbance. All proposed actions under the Proposed Action Alternative are intersected with slope, geology, soil and soil sensitivity data to estimate acres or miles of soil disturbance. The table below displays assumptions used to estimate the extent of soil disturbance incurred from given actions.

Activity	Disturbance Footprint	Acres Disturbed
1. Temporary Road (for skidding)	12 feet	1.45 acres/mile
2. Temporary Road (for hauling)	25 feet	3.03 acres/mile
3. Conventional Landing	½ acre	½ acre/landing
4. Helicopter Landing	1.5 acres	1.5 acres/landing

Assumptions

Per direction provided in the proposed action: "All design criteria, best management practices, and mitigation measures developed for this project (as approved by the authorized officer) will be implemented as well as all applicable measures outlined in the Forest Plan Standards and Guidelines. As such, resource specialist will conduct their analysis with the assumption that these practices will be applied in full force and effect during project implementation" (page 27). The proposed action also states that "The road profile should not normally be returned to contour during decommissioning" (page 5). Topsoil segregation, stockpiling and reapplication post-implementation will also not occur per discussions with the line officer. However, all temporary roads will be revegetated to effectively reduce erosion and subsequent sedimentation. Findings outlined in the soil resource report are based on the abovementioned assumptions.

References

Dokuchaev, V.V., 1999. On the concept of natural zones- St Petersburg, 1899. European Journal of Soil Science. 32, 726-727.

Jenny, H., 1941. Factors of Soil Formation. McGraw-Hill, New York, New York.

USDA Forest Service. 2006, updated 2011. Monongahela National Forest Land and Resource Management Plan. USDA Forest Service, Eastern Region, Milwaukee, WI.

Description of Integrated Pest Management within the GHFR project

Integrated Pest Management methods would be used to minimize or prevent the development of pest problems, and could include the use of pesticides, for example, to preserve hemlock trees facing mortality from hemlock wooly adelgid. (VE26,27, 28, 29, 32,34,35,36,37)

The CE category used for the GHFR project (HFRA (16 U.S.C.6591b) (FSH 1909.15, 32.3(3)): Insect and Disease Infestation) is applicable for this project because all project activities comply with the Healthy Forest Restoration Act section 603 requirements. Under this category, herbicides, insecticides, and pheromones may be used, but their use must be consistent with the Forest Plan.

Harvest treatments themselves are one component of the integrated pest management approach to be used in the project area. Diseased and infested trees will be removed in thinnings, leaving the most healthy trees available to form a fully stocked stand. In addition, regeneration harvests (commercial timber harvest that removes most or all of the trees in an area, with the intention of developing a new stand of young trees.) will remove most of the mature trees to develop a forest composed of smaller and younger trees that are more resilient when impacted by forest insects and disease organisms. Developing and maintaining tree species diversity in thinned and regenerated areas is another component of the project that can help to provide increased resilience to forest insects and diseases.

Use of insecticides that are registered and labeled for use on forest trees and shrubs, employing the methods and restrictions for such use, could potentially help maintain high value individual trees and species on the landscape. Labeling of such insecticides includes required measures to protect ground and surface waters, pollinating insect species and other flora and fauna. Most of these insecticides would be used on individual trees using hand labor.

It is anticipated that use within the project area would be unlikely to be needed on more than 20 acres overall, with less than 20 stems per acre being treated in most cases.

Gauley Healthy Forest Restoration

Recreation/Scenery Analysis

Existing Condition

Recreation
Camping, hunting, fishing, and driving for pleasure are the primary recreation activities within this analysis area. The North Fork of the Cherry River is stocked several times a year with hatchery trout. Summit Lake Campground, dispersed campsites, and trails are located within the area. Summit Lake visitors are consistent users (hunting, fishing, hiking, and biking) of the Gauley Healthy Forest Restoration project area. A dispersed camping area is located near the Fisherman's Trailhead and Forest Road 99 is used by equestrian users.

7.6-miles of multi-use trail (hiking, biking, equestrian, and cross-country skiing) are located within the analysis area.

A 5.9 mile portion of the Highland Scenic Byway, a designated National Scenic Byway and State of West Virginia Byway, is located within the analysis area.

Scenery
The landscape within the view shed of the analysis area provide outstanding scenic variety. The area consists of mountains separated by valleys ranging from narrow to wide. The steep hillsides are covered with an even textured hardwood forest. Openings along routes provide valuable visual interest. The Summit Lake and North Fork of the Cherry River arescenic attributes in the project area. Visually sensitive positions are on the State Route 39/55 portion of the Highland Scenic Highway (HSH), along the North Fork of the Cherry River and in Summit Lake Campground.

Wild and Scenic Rivers
The Wild and Scenic River Study completed by the Monongahela National Forest in 1995 identified a 10.8 mile segment of the North Fork of the Cherry River as eligible wild and scenic rivers, recreational river segment. Management is proposed adjacent to 5.9 miles of the river.

Wilderness
There are no federally designated wildernesses within the Gauley Healthy Forest Restoration Analysis Area.

Forest Service Inventoried Roadless or Roadless Conservation Rule Areas
No Inventoried Roadless or Roadless Area Conservation Rule Areas are located within the analysis area.

Effects

This section describes the effects of the proposed action.

Developed Recreation

The Summit Lake Campground is located within the analysis area.

Helicopter landing zones,conventional landings, hazardous fuels reduction, and a fuel break are proposed adjacent to Summit Lake Campground andDay Use Area. .Proposed timber harvest units mayenhance wildlife viewing. The fuel breaks are consistent with Forest Plan guideline TR12.

General Forest Areas (Dispersed Recreation)

Timber harvest units may enhance wildlife viewing and hunting opportunities within the project area.

Scenery/ Visual Quality Management

The primary viewpoints that were used to evaluate the effects of the alternatives on the scenic/ visual quality resources of the project area include Summit Lake Campground/Day Use Area, the SR 39/55 portion of the Highland Scenic Highway the North Fork of the Cherry River, Forest Service trails, open and gated Forest Service roads, and associated dispersed campsites.

There are 8 units totaling 242 acres proposed for ground-based regeneration harvest. Units R3, R4, and R5 are located within foreground 1(fg1) in a high scenery level concern zone. Units R6, R8, R9, R10, and R74 located within fg1 in a moderate scenery level concern zone. There are 3 units totaling 109 acres proposed for helicopter regeneration harvesting. Units R1 and H2 are located within fg1 in a high scenery level. Unit H7 is within mg1 in a moderate scenery level. No regeneration units are visible from primary viewpoints along the Highland Scenic Highway (HSH) or North Fork of the Cherry River. Only unit R6 will be seen from gated road FR946 by hunters or other non-motorized users of the area.

There are 48 units, totaling 1,519 acres proposed for ground-based conventional thinning. A total of 7 units, totaling 200 acres are proposed for ground based conventional thinning along with prescribed burning. There are 14 units, totaling 741 acres proposed for helicopter thinning. All units are consistent with the SMS and will not change the landscape character of the project area.

There is one unit, totaling 157 acres, proposed for prescribed burning without thinning. 3 units, totaling 16 acres areproposed as fuel breaks.

Generally, from the primary viewpoints identified above, most of the proposed timber harvesting activities will either not be noticeable or only noticeable for a short duration while traveling along a road or trail. With the exception of Unit #T101 (fuel break) which can be seen from the Summit Lake Trail in the immediate foreground, units H15, H63, H25, H59, H60, and the prescribed burn block which can all be seen from the 39/55 portion of the Highland Scenic Highway. Units T36, T44, T53, T89, and T100 can be seen from State Route 35/3 near Summit Lake. Visual effects from viewpoints in the foreground and harvesting in the middle-ground and background should be relatively short-term (2-5 years).

The visual affects of these proposed harvesting activities will be more noticeable to hunters and other visitors using the local forest roads within the project area to access specific recreation activities such as hunting, fishing, and access to trails.

Implementation of the proposed action will continue to maintain the textured visual pattern of the area.
Temporary roads will be decommissioned within 3 years of the end of the project. This will mitigate any affects to the landscape character resulting from road reconstruction.

All proposed actions are located in Management Area 3.0 and is consistent with the Monongahela National Forest Land and Resource Management Plan and Standards and Guidelines for Recreation Management (pages: 164, 169-171)

/s/ Matthew J. Edwards, South Zone Recreation Manager
19 years of experience in Recreation Management with the USDA Forest Service
Former R9 representative on the Wilderness Information Management Steering Team
BA in Parks and Resource Management

Gauley Healthy Forest Restoration

Recreation/Scenery Analysis

Scope of the Analysis

Affected Environment

Recreation
Camping, hunting, fishing, and driving for pleasure are the primary recreation activities within this analysis area. The North Fork of the Cherry River is stocked several times a year with hatchery trout. Summit Lake Campground, dispersed campsites, and trails are located within the area. Summit Lake visitors are consistent users (hunting, fishing, hiking, and biking) of the Gauley Healthy Forest Restoration project area. A dispersed camping area is located near the Fisherman's Trailhead and F.R. 99 that has a modest following from equestrian users.

There are 7.6-miles of multi-use trail (hiking, biking, equestrian, and cross-country skiing) are located within the analysis area.

A 5.9 mile portion of the Highland Scenic Byway, a designated National Scenic Byway and State of West Virginia Byway, is located within the analysis area. This route is an important asset to tourism efforts of local governments, businesses and non-governmental agencies. It is also important in providing recreation opportunities and access to recreational lands within and adjacent to the Gauley Healthy Forest Restoration project area.

Scenery
The landscape within the view shed of the analysis area provide outstanding scenic variety. The area consists of mountains separated by valleys ranging from narrow to wide. The steep hillsides are covered with an even textured hardwood forest. Openings along routes provide valuable visual interest. The North Fork of the Cherry River is a scenic attribute when seen in the foreground. Summit Lake is another water body of visual interest. The most visually sensitive viewer positions are on the State Route 39/55 portion of the Highland Scenic Highway (HSH), along the North Fork of the Cherry River, and in Summit Lake Campground.

Wild and Scenic Rivers
The Wild and Scenic River Study completed by the Monongahela National Forest in 1995 identified a 10.8 mile segment of the North Fork of the Cherry River as eligible wild and scenic rivers, recreational river segment. Management is proposed adjacent to 5.9 miles of the river.

Until a suitability determination and a recommendation to and action by Congress, no projects that could change the eligibility of a river segment should occur within the river corridor (1/4 mile on either side of the river) in order to protect the outstanding and remarkable values for which this river was determined eligible (scenic and recreational). For eligible recreational river designations, some management actions may be approved within the one-quarter mile buffer. The Land Management Planning Handbook Chapter 80, Wild and Scenic Rivers under vegetation management, for Scenic and Recreational Rivers states that a range of vegetation management and timber harvest practices are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character.

The thinning units proposed are to improve forest health so that it is more resistant to insects, disease, and weather impacts. A more resilient forest stand in turn would also maintain scenic values and safety if the forest is healthier.

Wilderness
There are no federally designated wildernesses within the Gauley Healthy Forest Restoration Analysis Area.

Forest Service Inventoried Roadless or Roadless Conservation Rule Areas
There is no Inventoried Roadless or Roadless Area Conservation Rule Areas located within the analysis area.

<u>Desired Future Condition</u>

Recreation
Consistent with Public Law-97-424 and the West Virginia Back-ways Program the Highland Scenic Highway will be managed as a major focus of recreation and tourism on the Monongahela National Forest, attracting visitors from across the United States. Developed facilities adjacent to the Scenic Highway will be managed and operated to maximize their potential to provide pleasing, safe and enjoyable recreation experiences for both the touring public and local, return users. Maintenance of recreation facilities and opportunities will be at the highest level.

The existing Recreational Opportunity Spectrum (ROS) classes within the proposed project area range include Rural (R), Roaded Natural (RN), and Semi-Primitive Motorized (SPM). The Forest Plan identifies a secondary management objective for management prescription 3.0 as an area that provides a Roaded- Natural (RN) **ROS setting** which includes a system of roads and trails to provide abundant opportunities for motorized recreation, high scenic integrity is maintained along visually sensitive viewpoints and travel-ways.

More detailed information pertaining to the specifics of the ROS classes are found below:

Recreation Opportunity Spectrum Class within Gauley Healthy Forest Restoration Project:

ROS Class - Roaded Natural:
Setting Characterization – Area is characterized by predominantly natural appearing environments with moderate evidence of the sights and sounds of man. Such evidence usually harmonize with the natural environment. Interaction between users may be low to moderate, but with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.

Experience Characterization – About equal probability to experience affiliation with other user groups and for isolation from sights and sounds of humans. Opportunity to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive type of recreation are not very important. Practice and testing of outdoor skills might be important. Opportunities for both motorized and non-motorized forms of recreation are possible.

ROS Class-Semi-Primitive Motorized
Setting Characterization – Area is characterized by predominantly natural or natural appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

Experience Characterization – Moderate probability of experiencing isolation from the sights and sounds of humans, independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. Opportunities to have a high degree of interaction with the natural environment. Opportunity to use motorized equipment while in the area.

Scenery
As a Designated National Scenic Byway the outstanding scenic quality of the Highland Scenic Highway should be protected and improved. Vegetative management practices should be designed to maintain healthy stands that will be more resistant to insect and disease damage.

The area within the proposed action for the Gauley Healthy Forests Restoration project area is located in Management Prescription (MP) 3.0 which emphasizes vegetation diversity. The desired condition of this MP is a mosaic of stands of predominately hardwood trees and associated under-stories that provide habitat for a variety of wildlife species. The stands vary in size, shape, height, and species depending on the silvicultural system applied. Management activities result in relatively high levels of sustainable timber and mast production. The Scenic Integrity objectives for the proposed project area range from high along sensitive roads and trails to moderate in the middle-ground and background.

Management Prescription 3.0

Goal 3004 – Feature Roaded Natural ROS class recreation opportunities

"Motorized recreation is featured—including driving for pleasure and firewood collecting—but non-motorized recreation also occurs. A number of visually sensitive viewpoints and travel ways occur within or adjacent to the prescription area".

Scope of the Analysis

This section describes the area of analysis for direct and indirect effects and the area evaluated for cumulative affects.

The scope of the analysis includes the recreation resources within the Gauley Healthy Forest Restoration Analysis Area and potential visual quality affects from roads trails, developed and dispersed recreation sites, the North Fork of the Cherry River and the Highland Scenic Highway. Because the Forest provides a wide range of recreation opportunities, there are no recreation activities limited or specific to the proposed Gauley Healthy Forest Restoration Project Area. Therefore, any analysis beyond that described above will not be necessary.

Methodology

This section describes the process that will be used to describe how the alternatives will affect the resources and the units of measures used to measure change.

The following materials were used to evaluate the affects of alternatives on the recreation resources within the analysis area:

* The Monongahela National Forest Land and Resource Management Plan Standards and Guidelines,
* Landscape Aesthetics, Handbook for Scenery Management (Agriculture Handbook #701),
* Recreation Opportunity Spectrum,
* The Wilderness Act of 1964,
* Monongahela National Forest Wild and Scenic River Study Report,
* The National Wild and Scenic Rivers Act of 1968.

The units of measure which are used to analyze change are as follows:

Recreation Resource	Unit of Measure
Developed and Dispersed Sites	# of Sites effected
Public Access Roads (Q Roads)	# of miles/ or roads effected
Scenery Management	# units/ acres not consistent with Scenic Integrity and Concern Levels
Wild and Scenic Study River	Yes/ No Consistent or not consistent with Wild and Scenic Rivers Act
Wilderness	Yes/ No Consistent or not consistent with Wilderness Act and FLMP
Trails 1. Trails affected by adjacent harvesting 2. Type of harvest/ degree of effect	 1. Number/ linear feet 2. Type of harvest/ minimal, moderate , high

<u>Effects</u>

This section describes the effects of the proposed action.

Developed Recreation

The Summit Lake Campground is located within the analysis area.

There is a mix of helicopter landing zones and conventional landings located adjacent to Summit Lake Campground/Day Use Area. There is also a fuel break and proposed hazardous fuels reduction activities within the Summit Lake Campground/Day Use Area. These sites, if used, should be closed to the public when these proposed activities are occurring.

The proposed timber harvest units are thinning units which may enhance wildlife viewing. The fuel breaks are consistent with Forest Plan guideline TR12, which states that in and around developed recreation sites, activity fuel should be removed by chipping, burning, or other means.

General Forest Areas (Dispersed Recreation)

Timber harvesting activities identified in the proposed action may enhance wildlife viewing and hunting opportunities within the project area.

Scenery Management

Scenery/ Visual Quality Management

The primary viewpoints that were used to evaluate the effects of the alternatives on the scenic/ visual quality resources of the project area include Summit Lake

Campground/Day Use Area, the SR 39/55 portion of the Highland Scenic Highway the North Fork of the Cherry River, Forest Service trails, open and gated Forest Service roads, and associated dispersed campsites.

The Scenery Management System (SMS) Objectives are designed to blend with the natural character of the landscape (meet ROS objectives) and are identified in the chart below. A majority of the Analysis Area is located in areas of moderate and high visual concern with primarily typical scenic attractiveness and a majority of the project area having a Moderate to High.

Recreation Opportunity Spectrum and Scenery Integrity Objectives Matrix

Scenic Integrity Objectives

ROS Class	Very High	High	Moderate	Low	Very Low
Primitive	**Norm**	**Inconsistent**	**Unacceptable**	**Unacceptable**	**Unacceptable**
Semi-Primitive Non-Motorized	**Fully Compatible**	**Norm**	**Inconsistent**	**Unacceptable**	**Unacceptable**
Semi-Primitive Motorized	**Fully Compatible**	**Fully Compatible**	**Norm (1)**	**Inconsistent**	**Unacceptable**
Roaded Natural	**Fully Compatible**	**Norm**	**Norm**	**Norm (2)**	**Inconsistent (3)**
Urban	**Fully Compatible**	**Fully Compatible**	**Fully Compatible**	**Fully Compatible**	**Not Applicable**

Scenic Integrity Levels within Gauley Healthy Forest Restoration Project:

Scenic Integrity Levels:
***High* -** Changes/impacts are present but they mimic the scenic character so closely that they are not evident.

***Moderate* -** Changes/impacts are noticeable but remain visually subordinate to the scenic character described.

Proposed Action

There are 8 units totaling 242 acres proposed for ground based regeneration harvesting. Units R3, R4, and R5 are located within foreground 1(fg1) in a high scenery level concern zone. Units R6, R8, R9, R10, and R74 located within fg1 in a moderate scenery level concern zone. There are 3 units totaling 109 acres proposed for helicopter regeneration harvesting. Units R1 and H2 are located within fg1 in a high scenery level.

Unit H7 is within mg1 in a moderate scenery level. None of the regeneration units are visible from primary viewpoints along the Highland Scenic Highway (HSH) or North Fork of the Cherry River. Only unit R6 will be seen from gated road FR946 by hunters or other non-motorized users of the area.

There are 48 units, totaling 1,519 acres are proposed for ground based conventional thinning. A total of 7 units, totaling 200 acres are proposed for ground based conventional thinning along with prescribed burning. There are 14 units, totaling 741 acres proposed for helicopter thinning. All units are consistent with the SMS and will not change the landscape character of the project area.

There is one unit, totaling 157 acres, proposed for prescribed burning without thinning There is also one 3 units, totaling 16 acres, proposed as fuel breaks.

Generally, from the primary viewpoints identified above, most of the proposed timber harvesting activities will either not be noticeable or only noticeable for a short duration while traveling along a road or trail. With the exception of Unit #T101 (fuel break) which can be seen from the Summit Lake Trail in the immediate foreground, units H15, H63, H25, H59, H60, and the prescribed burn block which can all be seen from the 39/55 portion of the Highland Scenic Highway. Units T36, T44, T53, T89, and T100 can be seen from State Route 35/3 near Summit Lake. Visual effects from viewpoints in the foreground and harvesting in the middle-ground and background should be relatively short-term (2-5 years).

The visual affects of these proposed harvesting activities will be more noticeable to hunters and other visitors using the local forest roads within the project area to access specific recreation activities such as hunting, fishing, and access to trails.

Implementation of the proposed action will continue to maintain the textured visual pattern of the area. This includes a variety of permanent and temporary openings (agricultural and timber harvest) and an even textured appearance brought on by partial timber harvests.

Road construction can have a permanent and obtrusive effect on a natural appearing landscape. The affects from road reconstruction on the scenic attractiveness will be minimal and may cause these roads to be more visible due to clearing and graveling. This proposal details that temporary roads will be decommissioned within 3 years of the end of the project. This action should offset and/ or mitigate any affects to the landscape character resulting from road reconstruction.

Recommended Mitigation Measures

Require 100% cleanup at helicopter landing zones along the Highlands Scenic Highway

Road cut slopes should be revegetated where needed to eliminate the distraction of exposed soil and erosion within the immediate foreground, and to reduce the color contrasts of the road cuts when seen in background.

Trails should be posted during any harvesting activities to inform trail users of any potential safety concerns.

Trails should be protected by: (1) minimizing or eliminating trail crossings by vehicles or harvesting equipment during harvesting operations (2) A sufficient number of trees should be maintained along the trail corridor to permit signing/ blazing and to provide shade to minimize undergrowth (grasses/brush, etc.)

Locate all proposed timber harvesting and timber stand improvement units outside of the ¼ mile corridor of the Eligible Gauley Healthy Forest Restoration Wild and Scenic Study River.

Effects of the Proposed Action

This section provides a brief comparison chart of the effects of the proposed action.

Unit of Measure	Proposed Action
Number of Developed Recreation Sites Effected	0
Miles of FS Trails Effected	2
Dispersed Recreation Sites Effected	0
Public Access Roads (class Q) Miles Effected	0
Harvest Units/ Acres	0

changing the overall scenic condition of the area	
Effects to Wild and Scenic study Rivers	5.9
Wilderness – Consistent with Act & Forest Plan	Yes

Cumulative Effects

This section describes the cumulative impacts including past, present, and reasonably foreseeable future actions.

Past and present recreation opportunities within the proposed Gauley Healthy Forest Restoration Project Area consist primarily of dispersed recreation activities including; hunting, fishing, hiking, site seeing, and undeveloped camping. A majority of the recreation use within the area is focused on the Highland Scenic Highway, Summit Lake Campground, the North Fork of the Cherry River Corridor, and trails within the project area. Recreation use within the area is moderate to high. Reasonably foreseeable future actions regarding recreation opportunities in the analysis area are expected to remain about the same. Recreation use of the area is expected to increase slightly.

Implementation of the proposed action is not expected to result in any cumulative effects to existing or future recreation opportunities or resources. Any affects to the scenic attractiveness of the area would be minimal and of a short duration (2-5 years). Recreation resources would continue to be preserved under the proposed action, although some mitigation measures may be needed at certain locations to ensure that the quality of recreation opportunities is maintained.

Irreversible or Irretrievable Commitments to Recreation Resources

No Irreversible or Irretrievable Commitments to Recreation Resources have been identified in any of the action or no action alternatives.

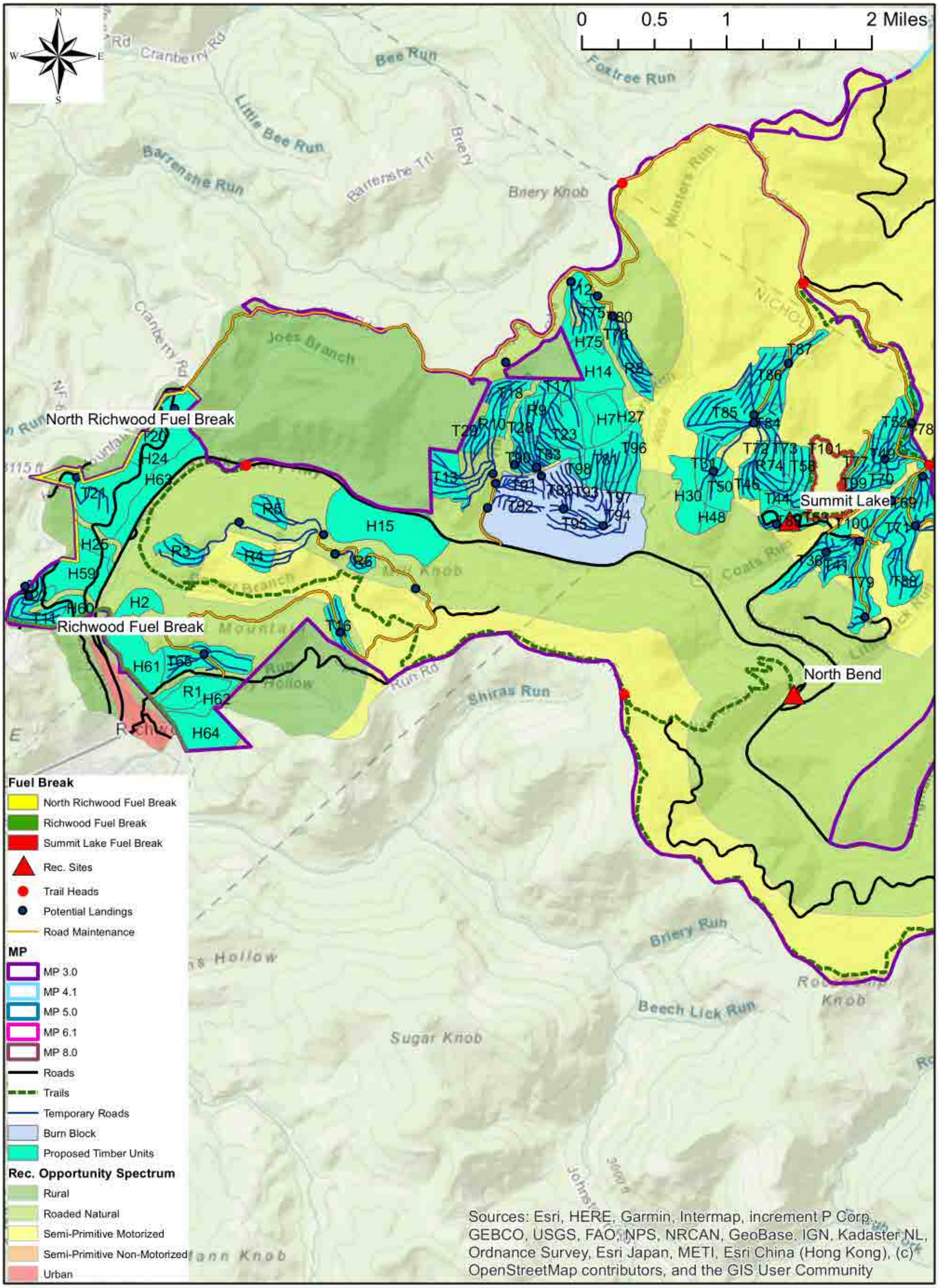
Forest Plan Consistency

This section indicates whether or not all actions would be consistent with the Forest Plan, references to the plan will be used as needed.

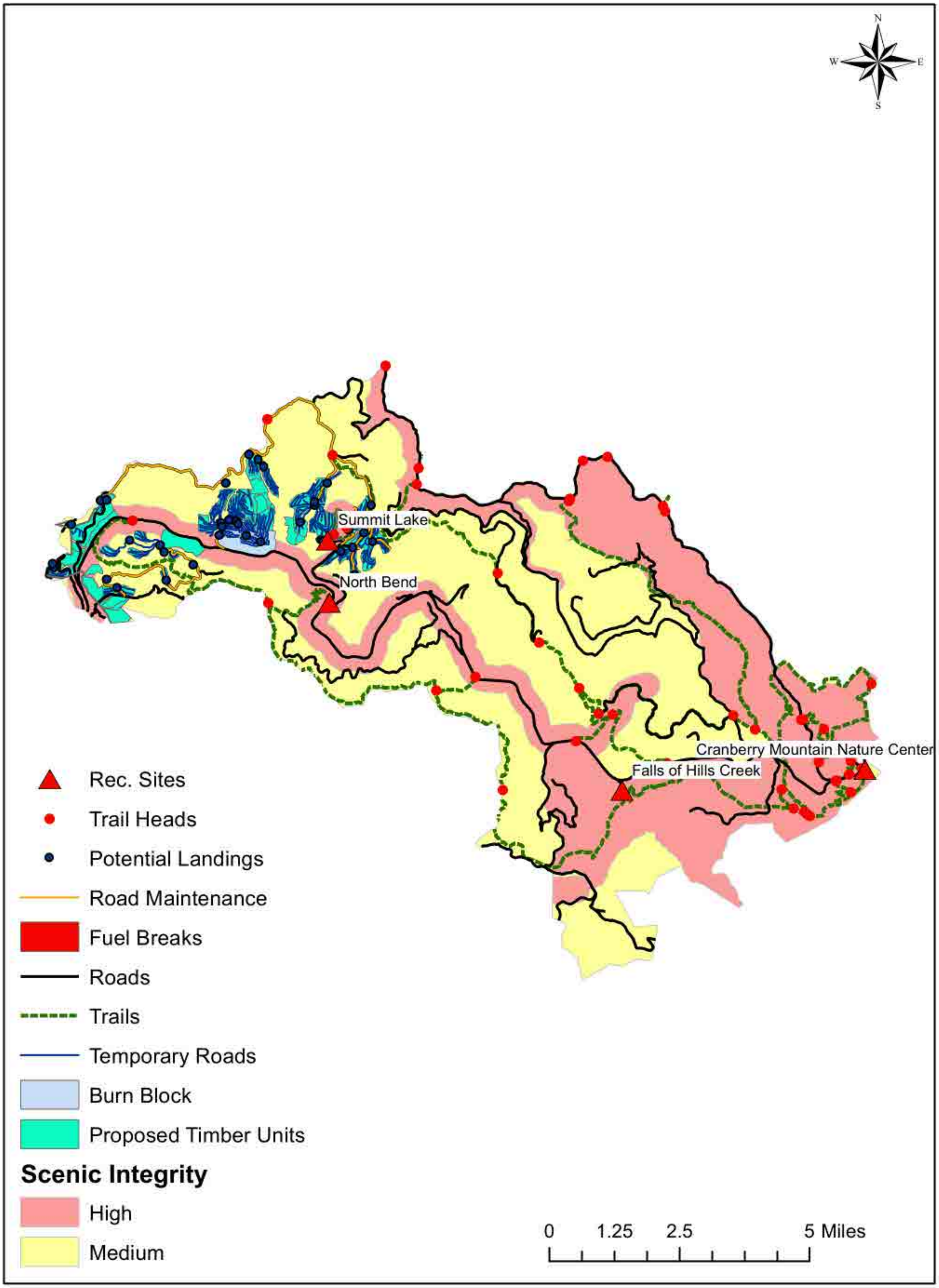
All proposed actions are located in Management Area 3.0 and is consistent with the Monongahela National Forest Land and Resource Management Plan and Standards and Guidelines for Recreation Management (pages: 164, 169-171)

/s/ Matthew J. Edwards, South Zone Recreation Manager
19 years of experience in Recreation Management with the USDA Forest Service
Former R9 representative on the Wilderness Information Management Steering Team
BA in Parks and Resource Management

GHFR Fire/Timber Units with Rec. Opportunity Spectrum



GHFR Fire/Timber Units with Scenic Integrity



United States Department of Agriculture

Gauley Health Forest Restoration

Categorical Exclusion

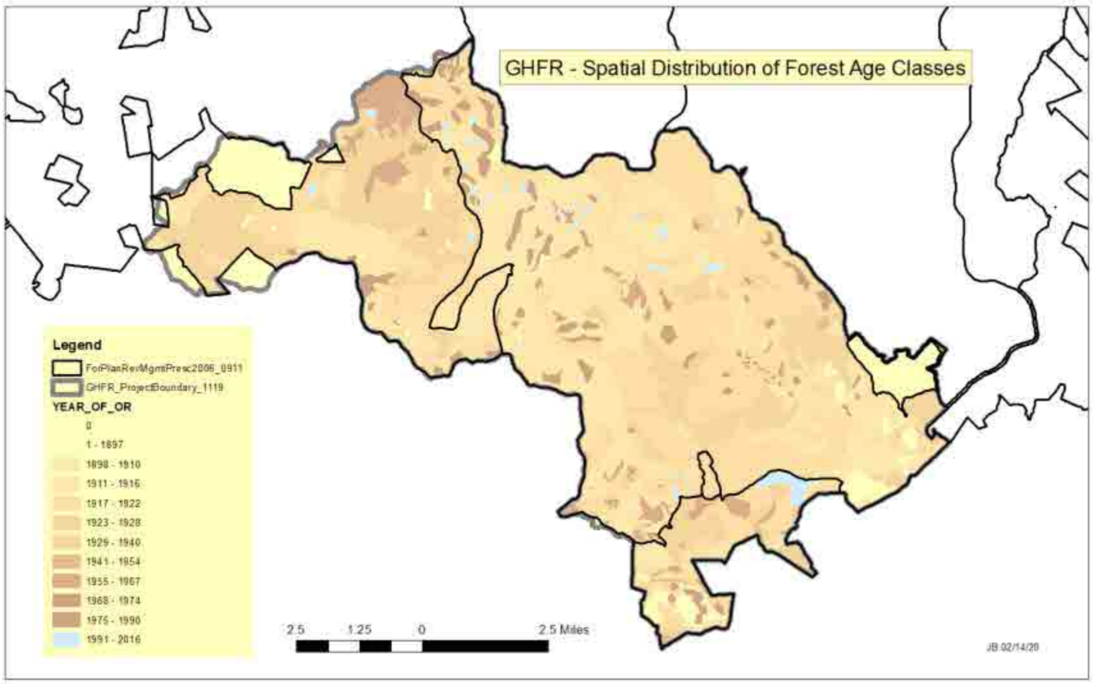
Effects on Vegetation

Forest Service
Monongahela National Forest

January 2020

Existing Condition

The Gauley Healthy Forest Restoration project area is composed of mostly contiguous forest stands that originated between 1900 and 1930 when the owner Cherry River Boom and Lumber Company built and used an extensive system of logging railroads to harvest their entire land ownership. Stand age, as shown on the map, is determined by counting tree rings on sampled trees, or by the year of timber harvest.



The following table shows the approximate distribution of age classes for forest vegetation within the project area, using the categories for age class desired conditions on page III-6 of the Forest Plan. Also shown are approximate acreages of private and non-forest vegetation. Vegetation GIS layers were cut to the project area, and the GISR FSVeg 2018 layer was used for the most part, for these calculations. However, the land ownership layer provided the acreage in private lands. An additional layer that was used was the Maintained WL opening layer from 2009.

Private lands	Water*	Non-forest**	Maintained Wildlife Openings***
2023	187	998	143

Maintained Wildlife Openings***	Early Successional Forest (0-19)****	Early-Mid Successional Forest (20-39)	Mid Successional Forest (40-79)	Mid Successional Forest (80-120)	Late Successional Forest (>120)
143	94	673	3228	39753	860

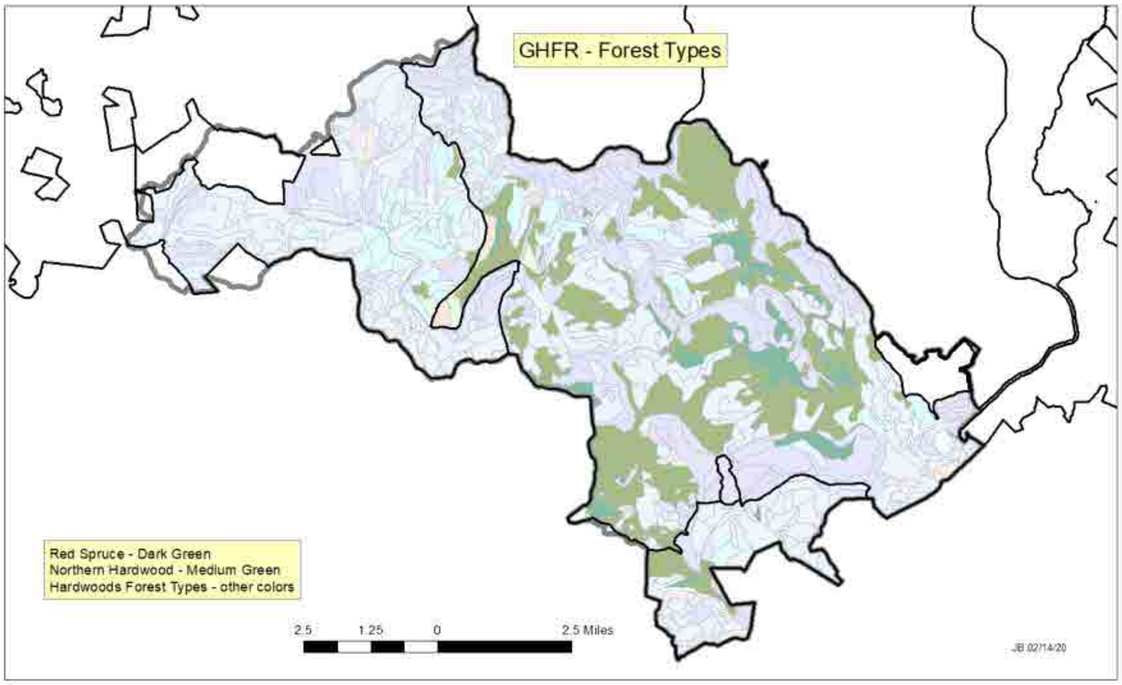
*Water includes portions of the North Fork of Cherry, Cranberry River and Summit Lake.
**Non-forest includes stands with data base land classes in the 200 series, which includes a variety of wetlands, mine sites and 777 acres of the Cranberry Glades. The Cranberry Glades includes a substantial amount of forested area, however it is included here. The mine sites could also be considered as forested, since most of them have tree cover, particularly planted pines which are of commercial size.
*** Maintained wildlife openings were taken from a different layer than FSVeg, which includes some small patches of open areas within other stands. Combining the maintained wildlife openings and non-forest lands gives a better picture of small amounts of open or non-forest lands scattered within the project area.
****Early successional forest includes 59 acres of recently regenerated stands in the Desert Branch area, as well as an estimated 35 acres which were blown down by the 2016 tornado, mostly in the Summit Lake area.
The total acreage contained in the FSVeg layer is 47937. The total presented above is approximately 20 acres larger, because of rounding, and the use of the land ownership layer and the maintained opening layer for several of the acreages. While calculating the acreage in each category, I viewed each selection for approximate accuracy, and compared the selections to personal knowledge of the area, but it should not be considered to be accurate to the nearest acre.

The Forest Plan established a Desired Vegetation Condition within each Management Prescription, for each forest type group, based on age class. All of the early successional forest listed above is Appalachian Cove Hardwood and it is within Management Prescription 3.0. Within this MP, the DFC is 12-20% in early successional forest. Within the 11,061 acres of national forest system land in MP 3.0 in the project area, 94 acres, or 0.8% is currently in the early successional category.

Forest Types in the eastern portion of the project area can mostly be classified as Appalachian Cove Hardwoods. Moving towards the east, the elevation increases and the forest regenerated as Northern Hardwood types and Red Spruce for the most part. Red spruce forests make up substantially less acreage than prior to the cutting, both within the project area and range wide. A variety of hardwood forest types are shown on the map, but not detailed specifically, since they can be grouped as Appalachian Cove Hardwoods, and Northern Hardwood. A few stands have been typed as Northern Red Oak, or as Mixed Oak, primarily in the Hacking Run drainage.

Although they are currently listed as oak types, the detailed stand descriptions show little or no oak component other than northern red oak. The Forest Plan considers red oak stands to be in the Appalachian Mixed Hardwoods Type (p. A –11)

The areas classified as Northern Hardwood are similar to the Appalachian cove hardwood stands, but are more dominated by maples, beech and birch and generally have fewer tree species in plot data.



Site productivity, as the ability of the forest stands in the project area to produce wood products. It has been estimated using the most commonly used method of expressing forest site quality: site index (p. 197, Johnson, Shifley and Rogers). Total height and age of a typical tree or trees in each stand was measured in the field and classified according to site index curves appropriate for the species and location. Site indices for oak are mostly above 76 up to 100, which indicates that volume growth is over 100 cubic feet per acre per year. For yellow poplar, they are mostly above 100 which indicates volume growth over 173 cubic feet per acre per year. These are considered high site indices, appropriate for timber production.

The age class distribution map shows few young stands established by regeneration harvests (clearcuts or clearcuts with reserve trees). However, many stands have been thinned commercially in the past. Thinning is a partial harvest to remove some trees, allowing more room for others to expand and grow.

Forest health within the project area is impacted by several abiotic and biotic factors. Abiotic factors are primarily weather related, and include frequent ice storms, both regional and local, late frosts, and wind events. Noteworthy, recent, region-wide storm events impacted the project area, including the Derecho and Hurricane Sandy in 2012 and flooding in July of 2016, along with the EF1 tornado in June 2016. Storm events impact forest health by tree and limb breakage and blowdown. Wood rot fungi enter trees through such breaks and have long term forest health effects. Winter storm damage can interact with the weight of vines in tree tops to damage and break more tree tops and large branches.

The project area is affected by the presence of several important forest pests: gypsy moth, beech bark disease, hemlock wooly adelgid and emerald ash borer. Field indications are that some of these insects and diseases have killed many trees, but this mortality has not been a stand replacement event, because they are species specific and unaffected species continue to grow. Even if all susceptible tree species died from one of these non-native invasive forest pests, the area would still be forested, because of the diversity of tree species represented within the area, and within each stand. These pests could result in high levels of mortality on particular species within the project area: gypsy moth- oaks and basswood; hemlock wooly adelgid- hemlock; emerald ash borer-white ash; and beech bark disease- American beech. Gypsy moth defoliates many other species, but within the area, the oaks and basswood are the species that occur in largest numbers that would be most heavily impacted in an outbreak situation. The red oak that is the most prevalent oak species in the project area is less preferred by gypsy moth than the white oaks; the very common tulip poplar trees are rarely defoliated by gypsy moths. White ash trees do not make up a large proportion of stands in this area, but nevertheless, recent mortality of white ash from the emerald ash borer is very noticeable.

Many native pests also occur within the project area, including the poplar weevil, poplar scale, Sugar maple borer, maple anthracnose, oak anthracnose and other insects and diseases.

Dead and dying trees are increasing due to the forest health factors described above, but also as a result of the aging forest. Frazer magnolia generally falls out of stands after 70 years (Burns and Honkala, 1990). Other species such as black locust, aspen and fire cherry have shorter average life spans, and have already contributed to the increasing number of dead trees in the forest.

Another factor contributing to the number of dead trees in this area is density dependent mortality. Overstocking is a significant factor in this area, with basal areas in some cases over 200 square feet per acre. Suppressed trees or those weakened by insects or disease are an additional component of tree mortality.

Dead and down trees or parts of trees contribute to a buildup of fuel on the forest floor. Because of the local climate and rainfall, this fuel generally decays quickly, reducing its contribution to fire risk. However, in long seasonal dry periods, such as occurred in late summer of 2016, these fuels can contribute to the risk and intensity of fires. One such late summer fire occurred historically in the 1930's when the Black Mountain fire started in August and continued burning for two months, in logging slash and other fuels.

Standing dead trees, especially eastern hemlock, with its low, fine branches, or dead trees with persistent leaves, such as American beech, can contribute to fire spread.

Direct and Indirect Effects

Thinning and Associated Treatments

Forest Plan, page A2 "The thinning method is an intermediate cut that . . . removes high risk . . . low quality, diseased, and over mature trees to increase the health, development, and growth of the residual trees in a stand. . .. Thinning is applicable to all of the forest types found on the Forest."

Only one of the units to be thinned, T52 occurs in a stand classified as northern hardwood/spruce (type code 87). This code is used for northern hardwood stands with either spruce or hemlock. Detailed stand data from 2001 does not list red spruce in the stand composition, but does show about 10% of the stand composition to be made up of eastern hemlock. Red spruce, however, is a component of several of the stands for thinning in the Summit Lake vicinity, in the understory, midstory or overstory.

The primary purpose of treatment is stand improvement to develop resilient healthy stands more resistant to insects, disease, or fire. One way that thinning will have this effect is by maintaining appropriate tree species diversity mentioned above. Maintaining within stand diversity of species will help stands to resist species-specific insects and diseases and maintain a forested condition overall, even if some species are eliminated from the stand. In addition, insect and diseases may spread more slowly if host species density is low.

Some, but not all of the trees to be removed in the thinning treatment are dead, dying, or damaged from an active infestation of insects or disease (See Forest Service Handbook 2409.19 Chapter 70) such as hemlock wooly adelgid, beech bark disease, emerald ash borer, and other native pests. Many of the trees to be removed are actively infected by wood rot fungi related to damage from recurrent storm events (including the Derecho and Hurricane Sandy in 2012 and tornados in 2016) are also a major factor in the need to remove and salvage trees. Timber volume from salvage will vary depending on individual stand characteristics, but it is estimated to be less than 25 percent of the volume. Depending on timing of salvage needs, additional entry into specific areas could be needed for salvage.

Thinning is expected to remove about one-third of the basal area in a commercial harvest, which removes mostly sawtimber. Within treatment areas, large trees will be favored to be left to the extent that they are healthy and have potential to persist within the stand. Many large trees would be cut to salvage, or because of dead tops and branches, or because of active infestations of insects or diseases. Removing some trees by thinning, whether commercially or non-commercially, is part of an Integrated Pest Management method to minimize or prevent the development of pest problems (Forest Plan Goal VE26). In some areas, especially in or near the fuel breaks and around Summit Lake campground, treatment may be needed in addition to commercial harvests or instead of commercial harvests if trees to be removed are not suitable for timber products.

Vine Control may be done in stands to be thinned– Forest Plan page A16. "Vines interfere with the growth of trees, causing decreased growth, deformity, and broken tops. Broken tops allow entrance for insect and diseases, decreasing the vigor of a stand. Vines are severed with cutting tools near the ground. (This treatment may be done three growing seasons prior to harvest.)

To the extent that thinning removes trees likely to die or contribute to down woody material on the forest floor through dead branches, it is expected to reduce fuels on the forest floor and thus reduce the risks of fire over time. Healthy trees remaining will have room for expansion to retain the health of the trees and shade the forest floor. Logging slash would provide short term additions to fuels.

The effect of thinning on forest vegetation is similar, whether helicopter or ground based skidding is used. Excavation, use and decommissioning of roads for timber removal entails some tree removal which will contribute to the thinning treatment. After use, the road surfaces will contribute to forest floor function, with a variety of plants colonizing the surface. Stand level effects of most roads previously used for harvesting are difficult to discern on leaf-on aerial photos, because trees on either side have grown over the road itself, fully utilizing the additional space for photosynthesis and to some extent, for root growth. Landings restored after completion of the project are likely to persist mostly in herbaceous vegetation for several years, before tree seedlings and saplings begin to colonize them.

Within the stands with both thinning and prescribed burning, thinning will open up the crown canopy and additional oak seed production is expected to result. Thinning, and to some extent, burning, will increase light reaching the forest floor. The burning is expected to reduce the expansion of fire intolerant understories, including red maple, sugar maple and striped maple. Broadcast burning may result in some mortality or damage to larger trees, for example those with fuel or open cankers at the base of the tree, but this effect would be minor at the stand level, and would not open up the overstory canopy to the extent that thinning would. Oak leaf litter will be reduced. The resulting effect will be to enhance oak regeneration initiation and development on the forest floor of these stands. Currently, both numbers and size of oak seedlings present within the stands to be thinned would not be sufficient to compete well with maple and Appalachian cove hardwood seedings in the understory, or if a natural event such as blowdown or wildfire were to occur.

Within the area where broadcast burning is planned, without a thinning treatment, oak advance regeneration effects would not be as pronounced, since dense overstory trees would not have increased seed production, and light on the forest floor would not increase to the same extent. Oak leaf litter and understory would still be removed or killed by fire. Fuel would be removed in both treatments. Firewood permits would help to reduce additional fuels.

Fuel breaks within the thinned areas would maintain the open understory over time for the purpose of reducing fuels and increasing access near private lands. Private lands protected include both forested and grassy areas. Near open grassy areas, burning of piles would help to reduce the rapid regrowth of vegetation that can sometimes result in forest areas exposed to sunlight. Near forested areas, regrowth of understory would be similar to that occurring in other thinned forested areas.

Clearcutting (Regeneration) and Associated Treatments

Clearcutting (Regeneration). Forest Plan, page A2 "The clearcutting method harvests most or all of the trees within a stand in one removal. Typically, some reserve trees are left to meet wildlife habitat or other resource needs." Commercial timber harvest involves the use of hand or mechanical felling and removal from the forest by helicopter or skidder. Firewood gathering opportunities may be provided with these treatments also, as described under thinning.

The primary purpose of treatment is to develop healthy resilient young stands that will be more resistant to insects, disease, or fire in the long-term. Up to 10 percent of timber to be removed may be salvage of material that is dead, dying, or damaged from an active infestation of insects or disease. This percentage is smaller than the salvage quantity from thinning, because almost all trees would be removed in the regeneration (clearcut with residual) treatment, and thinning focuses on removing the highest risk trees, and so would include a greater percentage of salvage.

Associated with the clearcutting treatment is ***Site Preparation with Hand Tools for Natural Regeneration*** – Forest Plan page A15. "The objective of site preparation is to enhance germination, sprouting, and survival of natural regeneration. Site preparation includes cutting down residual trees between 1 and 5 inches in diameter during or immediately after a regeneration harvest. Normally red spruce, hemlock, dogwood, serviceberry and shrub species that produce mast for wildlife are not cut. This treatment opens up the forest floor to increased sunlight to improve seed germination potential, promotes sprouting of cut trees, and reduces shading that could inhibit the growth of shade intolerant and moderately tolerant species."

Vine Control may be done in stands to be regenerated– Forest Plan page A16. "Vines interfere with the growth of trees, causing decreased growth, deformity, and broken tops. Broken tops allow entrance for insect and diseases, decreasing the vigor of a stand. Vines are severed with cutting tools near the ground. (This treatment may be done three growing seasons prior to harvest to prevent sprouting of vines during the regeneration period that would harm young trees.) Cutting vines in advance of harvest, in combination with deer browse on the sprouts that result, reduces the number of sprouting vines (grapevine and camphor vine) to a level that regenerating trees can develop and grow freely. Vines that originate from seed at the time of harvest are not as damaging as sprout origin vines, and will develop without destroying young seedlings. They may be cut to release young trees as part of crop tree release.

The potential for deer-browse damage to regenerating stands is a factor relevant to the project. Deer browse has impacted regenerating areas near the project area, to the extent that planting was required in a few stands in the late 1990s to supplement the diversity of natural regeneration.

Additional associated treatments may be included as needed to enhance regeneration such as hand tree planting, fencing, or caging to protect from deer browse, weeding to enhance species composition, and treatment of non-native invasive plant species. These treatments would involve hand tools and hand labor, which would involve minimal ground disturbance. Scalping of each planting spot with hand tools, spot spraying of herbicides, or individual tree fertilization could be part of the tree planting methodology. These potential treatments would occur during the regeneration period (normally 1 to 5 years after the harvest and site preparation) and are done with hand tools. Natural regeneration is typically rapid and successful in this area, so tree planting and associated treatments are unlikely to be needed on more than 100 acres, and planting could be used to enhance species diversity.
Crop tree release (Forest Plan, page A – 16) may be done within regenerated areas to increase tree species diversity that would further enhance resistance to insects, disease, or fire. Integrated Pest Management methods would be used to minimize or prevent the development of pest problems, and could include the use of insecticides, for example, to preserve hemlock trees facing mortality from hemlock wooly adelgid (VE26, 27, 28, 29, 32, 34, 35, 36, and 37). It is anticipated that use of insecticides within the project area would be unlikely to be needed on more than 20 acres overall, with less than 20 stems per acre being treated in most cases.
Herbicide. Forest Plan page A16. This treatment will be used to control competition with diseased beech sprouts, only in stands where beech bark disease occurs and has resulted in dense competition that excludes tree and understory species. In most cases, it will be possible to control competition with diseased beech sprouts by cutting alone, as described above in **Site Preparation with Hand Tools for Natural Regeneration**. The percentage of American beech in stands for regeneration, based on plot data, varies greatly, from no beech in plot data to over 50% of the basal area in beech. Diseased American beech trees should not be left standing in regeneration cuts, since the resulting diseased beech thickets are not a desired outcome of the treatment. For herbicide treatment of diseased beech, herbicides would be applied to individual stems by stem injection (cut surface treatment) or basal spray, both methods using manual labor. This treatment is operationally easier to accomplish prior to harvest, when walking through the stand is easier. In some cases, especially where beech thickets have been developing over decades, opening up the understory with herbicide treatments can be more effective at enhancing the diversity of regeneration following the harvest, allowing advance regeneration to develop over a period of several years. The goal of herbicide treatment, where needed, is to remove diseased beech sprouts from the regeneration of healthy, diverse species that is expected to result from seedling sprouts, seeds mostly from the seedbank, and stump sprouts.

The effect of regeneration using clearcut with residuals and associated treatments is expected to result in healthy, resilient stands of young trees that add 351 acres, or 3.2% of the 3.0 MP portion of the project area, to the early successional forest which is part of the desired future condition of Forest Plan MP 3.0. All of these harvests are within MP 3.0. When combined with the 94 acres of early successional forest already present, the percentage of early successional forest in MP 3.0 within the project area would be 4%. This is less than the Desired Vegetation Conditions in MP 3.0, which is 12-20-% of the Mixed Cove Hardwoods Forest Community.

There is little or no difference in effects on vegetation in clearcutting with residuals between units harvested with helicopter and those harvested with ground based systems, in regeneration harvests. Compacted areas of skid roads generally develop fewer seedlings and may have more unvegetated soil for a period of time, but crown closure provides complete coverage between age 5 and 13 after the harvest. An additional feature of skid roads is that they provide access for deer, with resultant browse damage and reductions of tree species diversity in the short term along the road corridor.

Emamectin benzoate, Imidacloprid, Dinotefuran and neem oil may be used if needed to retain or protect individual trees as elements of diversity. Since they would be applied by hand if needed to individual trees, they would only protect a few trees from insects (up to 20 trees per acre on up to 20 acres), and would have negligible harmful impacts on pollinators and tree seed production, even in the short term.

There are no planned actions within or near the project area that would have cumulative effects when combined with the Gauley Healthy Forest Restoration project actions.

Timber Harvest treatments within the GHFR project CE comply with the National Forest Management Act requirements, except for the typographical error on page 7. One regeneration unit is listed as 41 acres, which is greater than the maximum size for clearcut regeneration areas, which is 40 acres, under NFMA.

All treatments are appropriate for the Forest Types to be treated. Clearcutting is the optimum method to regenerate Appalachian (also called Mixed Cove Hardwoods) Cove Hardwoods where a diversity of tree and shrub species that are intolerant of shade are a desired component of the regenerated forest.
Single tree selection and group selection were not appropriate, in that these treatments would have increased the amount of American beech, hemlock and sugar maple within the stands, and reduced overall numbers and types of tree species present in the regenerated stands. Maintaining and increasing the diversity of tree species is a factor that helps trees to better resist insects and forest tree diseases. Since American beech and hemlock in this area are being actively impacted by Beech bark disease and hemlock wooly adelgid, these treatments would reduce the health and resilience of the forest, had they been chosen. See Appendix A, Forest Plan.
Two aged and shelterwood harvests were not selected, since they were not needed to regenerate the desired mix of healthy, diverse trees of varied shade tolerance.
Commercial thinning is an appropriate treatment to achieve the goals of the project in the stands to be so treated.

Table 1. Calcium to aluminum ratios (Adapted from Cronan and Grigal, 1995).

Lab Result Ranges for Ca:Al Molar Ratio	Risk of Adverse Impacts to Forest Health
1.0	50% risk of adverse impacts
0.5	75% risk of adverse impacts
</= 0.2	Nearly 100% risk of adverse impacts

Table 2. Calcium to aluminum molar ratios per horizon

Soil Pedon ID	Horizon	Depth (cm)	Ca:Al Molar Ratio
FS14WV075001	Oe	2-5	70.67
	A	5-15	0.33
	BA	15-32	0.16
	Bw	32-71	0.19
	Bs	71-101	0.3
	C	101-120	1.21
FS14WV075002	Oe	5-13	36.57
	Oa	13-20	2.66
	A	20-32	0.13
	BE	32-38	0.12
	Bs	38-67	0.12
	Bhs	67-101	0.2
FS04WV025005	A	0-3	0.6
	AB	3-13	0.1
	Bt1	13-25	0.1
	Bt2	25-48	0.1
	Btx1	48-78	0.1
	Btx2	78-104	0.1
	Btx3	104-127	0.1
	BC	127-152	0.1
FS04WV025004	O/A	0-2	1.8
	BA	2-13	0.3
	Bw	13-30	1.1
	Bt1	30-51	0.2
	Bt2	51-78	0.1
	Bt3	78-109	0.1
	Btx	109-130	0.2
	BC	130-145	0.2
FS04WV025003	A	5-10	0.8
	BA	10-20	0.2

	Bt	20-53	0.1
	Btx1	53-74	0.1
	Btx2	74-91	0.1
FS04WV025001	A	0-8	5.1
	AE	8-13	1.9
	BA	13-20	0.4
	Bt1	20-41	0.3
	Bt2	41-58	0.3
	Bw1	58-89	0.3
	Bw2	89-109	0.1
	BC	109-152	0.4
FS04WV101001	A	0-5	3.7
	E	5-10	0.5
	Bt2	10-25	0.1
	Bt1	25-48	0.1
	Bt3	48-61	0.1
FS05WV075001	Oa	2.5-7.5	0.23
	A	7.5-11	0.2
	E	11-19	0.1
	Bh	19-26	0.08
	Bs1	26-44	0.04
	Bs2	44-64	0.16
	C	64-93	0.1
FS05WV075002	Oa	2.-6.5	6.75
	A	6.5-11	0.42
	E	11-21	0.18
	Bt1	21-46	0.08
	Bt2	46-74	0.12
	BC	74-99+	0.15
FS05WV075004	A	2-14	1.15
	BA	14-27	1.54
	Bt1	27-50	2
	Bt2	50-100	1.24
	Bt3	100-126	1.05
	BC	126-153	1
FS05WV075006	Oa	2-4	1.09
	A	4-9	0.62
	E1	9-20	0.19
	E2	20-28	0.08
	Bw1	28-47	0.13

Bw2	47-64	0.07
Bw3	64-82	0.12
Bw4	82-112	0.06
Bw5	112-132	0.05
BC	132-158+	0.17

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United States Department of Agriculture

Gauley Health Forest Restoration

Categorical Exclusion

Effects to the Soil Resource

Forest Service
Monongahela National Forest

March 2020

Existing Condition

Approximately 70% of the project area is mapped as having high acidic deposition risk (USDA Forest Service, 2006). Soil acidification is the net result of acid inputs (primarily acid rain) and mineral weathering (breakdown of bedrock) (Weil and Brady, 2017). On the MNF, soils that have been impacted by acidic deposition have limited stores of plant available base cations, including calcium which is essential to healthy tree growth (Huntington, 2000; Jenkins, 2002; Johnson and Todd, 1990). To summarize, acidic deposition and heavy soil disturbance, soil loss, and soil mixing could result in soil chemistry that is unfavorable for plant growth and survival due to nutrient loss (Cronan and Grigal, 1995). Soil wetness and carbon loss sensitivities also exist throughout portions of the project area (USDA Forest Service, 2006; Soil Survey Staff, 2020).

Direct and Indirect Effects

Conventional Timber Harvest

A total of 1,934 acres of conventional timber harvesting is proposed. Timber harvesting has limited impacts to soil quality and productivity and would occur on slopes suitable for timber management. Erosion should be prevented and revegetation promoted due to project design and placement of units combined with following the MNF Land and Resource Management Plan standards and guidelines and BMPs (USDA Forest Service, 2006; USDA Forest Service, 2012). Removing trees from the site (through timber harvest) would result in calcium removal from the ecosystem. This effect is lessened by the retention and dispersal of tops and limbs within each unit because the majority of calcium in trees is contained in the tops and limbs (Ovington, 1958). The dispersed disturbance anticipated throughout timber harvest units would result in non-detrimental effects to soil quality and productivity.

Helicopter Timber Harvest

Helicopter timber harvesting is proposed on 880 acres. Helicopter yarding minimizes the amount of soil disturbance that occurs because no skid trails are used to move the logs from the units to the landings. No detrimental effects to the soil resource are expected within helicopter harvest units.

Temporary Roads

A total of 29.5 miles of temporary road construction and 32.3 miles of temporary road reconstruction is proposed which would result in 44 and 50 acres of soil disturbance (respectively). Construction and use of temporary roads require the removal of topsoil and blading of the soil surface on slopes greater than 20% for equipment operability. Placement of the temporary roads would utilize breaks in terrain, avoid steep slopes where feasible, and follow all Forest Plan standards and guidelines, BMPs and timber sale contract provisions (USDA Forest Service, 2006; USDA Forest Service, 2012). These actions would minimize or avoid disturbance to soil properties such as detrimental soil erosion and excessive compaction. It is expected that temporary soil compaction would occur on temporary roads in discrete locations resulting in detrimental effects in those areas, which is expected to recover soil productivity and function in 5-7 years. All temporary roads would be decommissioned after use for this project.

Log Landings
The construction of 13 conventional and 4 helicopter landings is proposed (13 acres). Selection of landing locations would be placed on gentle terrain. Truck traffic and skidder operations would churn the soil surface and expose mineral soil leading to on-site soil erosion within the footprint of the log landing. The combination of careful site selection and management of the log yard during use would minimize or avoid disturbance to soil properties such as detrimental soil erosion and excessive compaction. The reconstruction of 20 conventional and 3 helicopter landings is also proposed. Reconstruction and use of these landings would reverse the soil recovery that has taken place on these existing features since the last timber entry and would result in approximately 15 acres of soil disturbance resulting in non-detrimental soil disturbance and discreet areas of detrimental soil disturbance due to compaction and nutrient loss. These impacts would recover soil productivity and function by activities put in place to reclaim the landings, including backblading and leveling to ensure positive drainage and seeding and mulching to establish ground cover.

Prescribed Fire, Fuel Breaks and Pile Burning
Prescribed fire is proposed on 357 acres. Prescribed fire is restorative to a landscape where fire is an inherent part of the nutrient cycling process (Boerner et al., 2006). Nutrient levels in areas of prescribed fire should generally increase. Soil carbon losses are expected in areas where inclusions of thicker organic horizons may exist from historic vegetative cover. Low to moderate intensity prescribed fire is not expected to result in detrimental soil disturbance.

Natural features (existing roads, rivers, trails, streams, etc.) would be utilized as fire breaks to the extent possible. No dozer line creation is proposed, but some handline may be required. Handline is created using leaf blowers (no soil disturbance) or hand tools to scarify the soil surface (exposing mineral soil). If the latter is required, this action would result in non-detrimental soil displacement and erosion.

Fuel breaks (totaling approximately 75 acres) are proposed around Summit Lake and Richwood. These areas would be treated with thinning for the purpose of fuel reduction. Slash and debris less than 6” in diameter would be hand piled and burned. Unlike in timber harvest units where slash and limbs are left scattered throughout the unit, the slash and limbs within fuel breaks will be concentrated into piles and burned, resulting in nutrient losses (Curzon et al., 2013; Slesak et al., 2016). Busse et al., (2013) concluded that for piles where the majority of the wood was less than 8” diameter, soil heating was moderate and would not cause major shifts in soil quality. Given the soil resource conditions in the project area, it is likely that pile burning will not result in detrimental soil disturbance due to nutrient losses. Nutrient loss would be minimal from burning slash and would be localized and limited because slash piles would be burned during times when either snow is on the ground or when there is enough moisture in the soil to prevent the spread of fire. This would be consistent with low and moderate fire danger days. The litter layer and organic matter would be kept in tack throughout the rest of the stand and nitrogen fixing plants are expected to colonize sites following fire to help restore nitrogen to the ecosystem.

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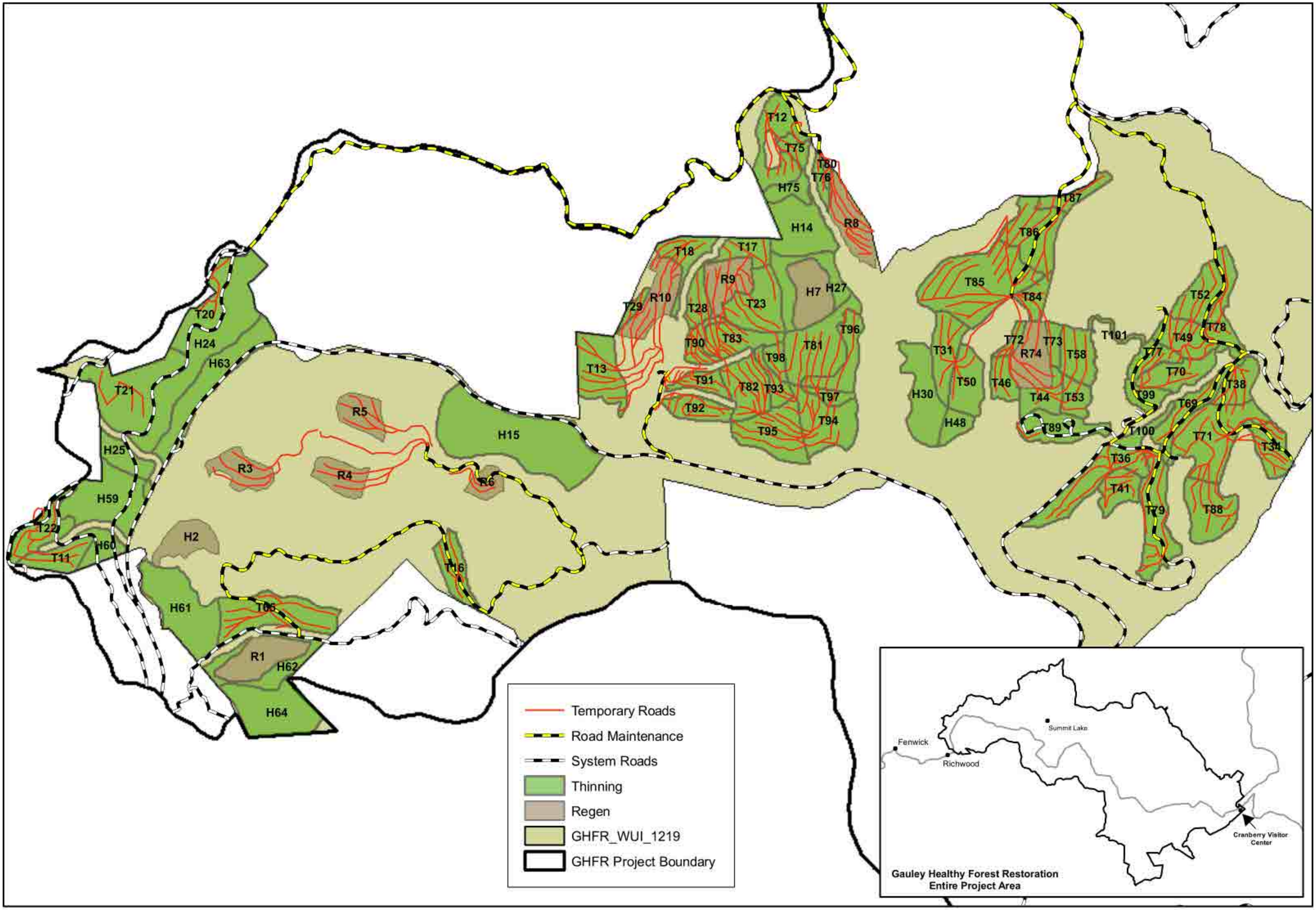

MNF GIS
UTM, Zone 17
NAD 83
TMB
01/27/2020

Gauley Healthy Forest Restoration Project

Original data was compiled from multiple source data and may not meet
the U.S. National Mapping Accuracy Standard of the Office of Management and Budget.
This map has no warranties as to its contents or accuracy.

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February 27, 2020

Gauley Healthy Forests Restoration Project
Summary of Impacts to Wild and Scenic Rivers
Matt Edwards – District Zoned Recreation Manager

Wild and Scenic Rivers
Eligible Wild and Scenic Rivers (WSR) segment in Gauley Healthy Forest Restoration (GHFR) project area:
The GHFR project area includes 5.9 miles of the North Fork of the Cherry River, however only 3.9 miles overlap with proposed management. The Wild and Scenic River Study completed by the Monongahela National Forest in 1995 identified a 10.8 mile segment of the North Fork of the Cherry River as an eligible wild and scenic river. The classification was for a recreational river segment with outstandingly remarkable values (ORV) of scenery and recreation. This segment is listed as eligible for possible inclusion into the wild and scenic river system at a future point. Management actions that retain the free-flowing condition, the highest classification potential, and the outstandingly remarkable values are consistent with the eligible designation. The following table from the Monongahela National Forest Land and Resource Plan p. III-6 identifies the ORVs for each segment of eligible WSR within MP 3.0.

Eligible Wild and Scenic River Segments in MP 3.0			
River Name	**Classification**	**Outstandingly Remarkable Values**	**Miles**
North Fork Cherry River	Recreational	Scenery, Recreation	10.8
Glady Fork	Recreational	Recreation	2.8
Laurel Fork	Scenic	Recreation	4.4
Williams River	Recreational	Scenery, Recreation	7.3

Direction related to management along eligible WSR segments:
For eligible recreational river designations, some management actions may be approved within the one-quarter mile on either side of the eligible river segment. For vegetation management within Scenic and Recreational classifications, the Forest Service Handbook 1909.12 chapter 80, Wild and Scenic Rivers, states that a range of vegetation management and timber harvest practices are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character and prescribed fire and wildfires managed to meet resource objectives may be used to restore or maintain habitat for threatened, endangered, or sensitive species or restore the natural range of variability.

Description of effects to eligible WSR segment from GHFRA project:
The project proposes vegetation thinning actions along 2.2 miles and prescribed fire along 1.7 miles of the eligible segment of the North Fork Cherry River. The thinning and prescribed fire activities will result in healthy forest stands more resilient to insects, disease, and weather disturbances. Therefore, improving the scenic and recreational values of the river. Impacts may be seen by visitors during implementation of treatments. However, these are expected to be short in duration, likely only one growing season. A more resilient forest maintains scenic values and safety. Large scale die-offs or damage to the vegetation will be less likely following these treatment actions. Overall, the project is not expected to have any measurable or lasting impacts on the ORV of scenery and recreation for this river segment.

Gauley Healthy Forest Restoration Project

Background Rationale for Development of WUIs in the Project Area

February 4, 2020

Written by John Fry

The Forest Service manages more than 192 million acres in the National Forest System (NFS). An estimated 58 million acres of this land are at high risk of ecologically destructive wildland fire (Forest Service Wildland Fire Activities – Hazardous Fuels Reduction, July 2016). Excessive amounts of fuel build up is a serious problem that can add wildland fires, which has caused an increasing number of large, intense, and catastrophically destructive wildfires that can be difficult to contain. It has been estimated that these hazardous fuels are accumulating three times as fast as they can be treated (Forest Service Wildland Fire Activities – Hazardous Fuels Reduction, July 2016). Reducing the buildup of hazardous fuels is important in reducing the extent, severity, and cost of wildfires.

Hazardous fuels reduction projects have been proven as a means of mitigating wildfire hazards to lessen catastrophic fire and its threat to public and firefighter safety and property. The objective is to remove enough fuel so that when a wildfire burns it reduces the wildfire severity and can be more easily suppressed making suppression actions safer for fighters. Hazardous fuels reduction treatments can be the most effective way to protect communities, restore forest and grass land health, improve firefighter and public safety (Forest Service Wildland Fire Activities – Hazardous Fuels Reduction, July 2016).

Recognizing the need to reduce the threat of catastrophic wildfires and improve the health of the nation's forest, President Bush announced the Healthy Forest Initiative (HFI) on August 22, 2002. HFI, a combination of administrative initiatives and legislative changes, provided additional tools needed to reduce wildland fire risks, control insects and disease and restore forest health. This included improving procedures for developing and implementing hazardous fuels reduction projects.

On December 3, 2003, President Bush signed the Healthy Forest Restoration Act (HFRA) into law. In passing HFRA, Congress provided additional tools to fully implement HFI. The legislation included a variety of provision aimed at expediting the preparation and implementation of hazardous fuels reduction projects on Federal land and assisting rural communities, States, and landowners in restoring forest conditions on State and private lands. Communities have become increasingly part of at-risk areas known as the wildland-urban interface (WUI), creating a greater challenge for fire protection. HFRA required allocating at least 50 percent of Federal HFI funds to WUI acres. HFRA gives priority to projects and treatment areas identified in a community Wildfire Protection Plan (CWPP) and directs Federal agencies to give specific consideration to fuel reduction projects that implement those plans.

On November 2016, the Great Smoky Mountains National Park near Gatlinburg, TN experienced one of the largest natural disasters in the history of Tennessee. On November 23, 2016 a human-caused wildland fire started in the Chimney Tops area of Great Smokey Mountains National Park. Over the course of the next five days, the fire, known as the Chimney Tops 2 Fire would grow and under extreme weather conditions leave the park boundary on November 28, 2016. High Winds and dry fuels would push the fire from the park and causing numerous new wildfire starts from embers carried far in front of the main fire. The Great Smoky Mountains wildfires claimed the lives of 14 people and damaging 2,545 structures. These fires were the deadliest wildfires in the Eastern U.S since the Great Fires of 1947 which killed 16 people in Maine. In August 2017, U.S Secretary of the Interior Ryan Zinke issued an independent review of the Chimney Tops 2 Fire. The report also provides a summary of findings and recommendations that included implementing the goals of the National Cohesive Wildland Fire management Strategy, which prioritizes healthy and resilient landscapes, fire adapted communities, and safe and effective response. This includes efforts to actively manage vegetation and fuels effectively, removing dead and dying trees (Chimney Tops 2 Fire Review, Individual Fire Review Report).

Changes in wildland fuels resulting from land management practices, climatic change, and decades of fire suppression have all conspired to create a fire exclusion problem. Fire records on the Monongahela National Forest indicate a startling trend in the increase in size and complexity of wildfires on the forest. From 1970 to 2012, there were 4,528 acres or an average of 108 acres per year were consumed in wildfires. Since 2013, there have been a total of 3,969.4 acres or an average of 567 acres per year consumed in wildfires. Creating fuel breaks in identified areas may prevent devastating wildfires similar to what occurred in Gatlinburg, Tennessee from negatively impacting both Forest and privately property.

The Healthy Forest Restoration Act Title I; Hazardous Fuel Reduction on Federal Land Section 101 defines "at-risk community" as an area that is comprised of (i) an interface community as defined in the notice entitled "Wildland Urban Interface communities Within the Vicinity of federal Lands that are at High Risk From Wildfire". This notice provided a list of urban wildland interface communities in the vicinity of Federal lands that are at high risk from wildfire published on January 4, 2001. There are 167 towns located in West Virginia that are identified as "at risk communities".

The Interdisciplinary team (ID) defined the WUI area, "at-risk communities", USFS/privately owned structures and water municipal supply systems within the project boundary based on criteria stated within the HFRA of 2003. The team identify nine areas (Richwood, Summit Lake, Briery Knob, Cranberry Mountain Nature Center, Falls of Hills Creek, South Fork Cherry River, Round Mountain, Cranberry River, and Kennison Mountain) within the project area that met the criteria stated in the HFRA. However, due to the 3000 acre limitations per Section 603 requirements resulted in prioritizing these at risk areas. Notwithstanding the 3,000 limitation, other WUI areas could have been developed for consideration and analysis.

Richwood and Summit Lake areas were selected by the team as locations within the project area to implement this project. Under section 101, an "at-risk-community" is defined as a group of homes and basic infrastructure and services (such as utilities and collectively maintained transportation routes within or adjacent to Federal land, or which conditions are conducive to large-scale wildland fire disturbance event); and for which a significant threat to human life or property exists as a result of a wildland fire disturbance event. We looked at the Federal Register of 2001 to see what communities meet this criterion. The town of Richwood which is located adjacent to the project area was listed in the Federal Register of 2001 as an Urban Wildland Interface Community within the vicinity of federal lands that is at high risk from wildfire.

Summit Lake is a municipal water supply and sole source of drinking water for the town of Richwood (population exceeding 2000). Lands categorized under Section 102 as condition class 2 or condition class 3 within fire regime I, fire regime II, or fire regime III, in close proximity to a municipal water supply system or a stream feeding a municipal watershed creates a significant risk that a fire disturbance event would have adverse effects on the water quality of that municipal water supply or the maintenance of that system. This includes a risk to water quality posed by erosion following such a fire disturbance event. A wildfire that were to threaten the Summit Lake watershed there could be lasting negative effects on the town of Richwood's water quality and its treatment system could be compromised. The HFRA also identifies an "at risk community" as a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) with or adjacent to Federal land. A wildfire that were to occur in this area could negatively impact Forest visitors by compromising egress routes potentially trapping vistors.

The ID team then looked at what would be an adequate "fuel break" to protect communities along the Forest Service Boundary and the Summit Lake Watershed. The HFRA allows natural or manmade changes in fuel characteristics to affect fire behavior such that a fire can be readily controlled. These areas were originally identified theoretically by using a ½ mile radius and later expanded to 1 mile radius based on an Assessment Analysis Area completed on the Francis Marion National Forest.

The International Code Council's (ICC's) International Urban-wildland Interface Code rates WUI into three categories and the distance to create defensible space along urban interface areas.

WILDLAND-URBAN INTERFACE AREA	FUEL MODIFICATION DISTANCE (Feet)
Moderate Hazard	30
High Hazard	50
Extreme Hazard	100

Based on slope, aspect, accessibility, and fuel type, it was determined to use 100-foot fuel modification (fuel break) distances to treat along private property boundaries, forest service infrastructure, and municipal watersheds (Summit Lake). Fuel breaks will consist of removing dead and down trees, pruning limbs of larger trees, and removing brush/vines and some small diameter trees. Slash created from harvest operations will be mechanically or hand piled and burned or pulled away from private property or Forest Service infrastructure by the contractor approximately 100 feet from Forest Service boundary. Fuel breaks will be created and maintained annually as needed. A variety of treatments may be used to maintain effectiveness of fuel breaks that includes broadcast burning, mowing/mulcher, chipper, and burning piles.

Within the project area, the HFRA also allows for prescribed fire to be implemented in areas where vegetation has been moderately altered from those that existed historically. This would include condition classes 2 and 3. We looked at the report "Development of coarse-scale spatial data for wildland fire and fuel management" (Schmidt, Kirsten M., Menakis, James P., Hardy, Colin C., Hann, Wendel J., Bunnell, David L., April 2002) to identify if there were any areas mapped as condition classes 2 or 3 within the project area. A relatively small area less than 250 acres within the project area was identified to implement prescribed fire. A prescribed fire unit that overlaps this area was developed to use natural features (drainages, ridges, rivers) or manmade features (roads) as holding lines that would limit the amount of disturbance on the landscape.

References

Chimney Tops 2 Fire Review, Individual Fire Review Report; National Park Service, U.S Department of the Interior, Division of Fire and Aviation 2017

Forest Service Wildland Fire activities – Hazardous Fuels Reduction, United states Department of Agriculture Office Inspector General, 08601-0004-41, July 2016

Schmidt, Kirsten M., Menakis, James P., Hardy, Colin C., Hann, Wendel J., Bunnell, David L., April 2002. (RMRS – 87) Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management. Missoula, MT: United States Department of Agriculture, Forest Service, Rocky Mountain Research Station

Age class distribution changes as a result of GHFR project
J. Bard 2/7/2020

The Gauley Healthy Forest Restoration project will regenerate 351 acres using the Clearcut with residual method, all within the 3.0 Management Prescription area. This would result in 445 acres of early successional forest, or approximately 6% of the Management Prescription 3.0 area within the project area. This is less than the Forest Plan desired condition which is 12-20% of the Mixed Cove Hardwood Forest Community (Forest Plan p. III – 6.)

Other treatments in the project (thinning, broadcast burn, fuel break, road maintenance) would not impact the age class distribution of the area.

Age Class Distribution in the GHFR Project Area
Prepared by Jane Bard, January 17, 2020

GIS layers were cut to the project area, and the GISR FSVeg 2018 layer was used for the most part, for these calculations. However, the land ownership layer provided the acreage in private lands. An additional layer that was used was the Maintained WL opening layer from 2009.

Private lands	Water*	Non-forest**	Maintained Wildlife Openings***	Early Successional Forest (0-19)****	Early-Mid Successional Forest (20-39)	Mid Successional Forest (40-79)	Mid Successional Forest (80-120)	Late Successional Forest (>120)
2023	187	998	143	94	673	3228	39753	860

*Water includes portions of the North Fork of Cherry and Cranberry River and Summit Lake.

**Non-forest includes stands with data base land classes in the 200 series, which includes a variety of wetlands, mine sites and 777 acres of the Cranberry Glades. The Cranberry Glades includes a substantial amount of forested area, however it is included here. The mine sites could also be considered as forested, since most of them have tree cover, particularly planted pines which are of commercial size.

*** Maintained wildlife openings were taken from a different layer than FSVeg, which includes some small patches of open areas within other stands. Combining the maintained wildlife openings and non-forest lands gives a better picture of small amounts of open or non-forest lands scattered within the project area.

****Early successional forest includes 59 acres of recently regenerated stands in the Desert Branch area, as well as an estimated 35 acres which were blown down by the 2016 tornado, mostly in the Summit Lake area.

The total acreage contained in the FSVeg layer is 47937. The total presented above is approximately 20 acres larger, because of rounding, and the use of the land ownership layer and the maintained opening layer for several of the acreages. While calculating the acreage in each category, I viewed each selection for approximate accuracy, and compared the selections to personal knowledge of the area, but it should not be considered to be accurate to the nearest acre.

Meetings with various groups – specific to the GHFR project
Notes by Jane Bard

December 12, 2019 The National Wild Turkey Federation, Cully McCurdy

This was an in person meeting with Cully at the Gauley RD office. FS staff present: R. Raione, J.Martin, J. Fry (by telephone), J. Bard, K. Tarter.

After and intro by Richard and Jay about the project, describing the 603 category of the 2018 Farm Bill and its relationship to the HFRA, and some of the restrictions of this method of speeding the NEPA analysis for this type of work: 3000 acres, only temporary roads and decommission them within 3 years. John Fry described some recent fire history and the need to treat areas for defensible space. In 2019 we had a fire on Williams R., about 20 acres, started on private and did not burn structures. Fire at Smoke Hole at Thanksgiving. We want to be proactive, and not reactive. We want to harvest trees, similar to a "shelterwood", and use rivers, roads, trails and ridges as natural features to limit spread. Safety of firefighters is at the forefront. John has seen the results of the recent fire in the Gatlinburg area, with the results of increasing runoff. He said that Richwood is a community at risk, and ingress and egress are a factor for fire fighting. Fire season use to be fall and spring, but now fires are occurring at other times. Jane described the existing condition of the area which has been impacted by the Derecho, Hurricane Sandy, EF1 tornado of 2016, and other weather events that have impacted forest health and susceptibility to the many native and non-native insects and diseases that we have, including hemlock wooly adelgid, beech bark disease. She described the timber harvest: thinning, regeneration. Using the thinning cut to remove trees actively impacted by insects, diseases and reducing fuel buildup. Cully mentioned that when you do a timber sale you are creating fuels. We talked about the need for fuel breaks around structures and FS infrastructures. Cully said that herbicides may be needed to curb the spread of NNIS. He said that a savanna would maximize retention of large trees, and they could be cleared of potential fuels under the large trees. He mentioned that the area, as we described it is right next to the city or Richwood, which is working to be a tourist destination. People there have a vested interest in what they see at Summit Lake. He had seen the burned area in the Gatlinburg area after the fire. He mentioned that flying a drone over the Desert Branch area, where NWTF and Boy Scouts were involved in agreement to create WL habitat in the timber harvest area would go a long way towards showing the benefits of that type of work to WL habitat, even though he understood that would only be a by-product, not the purpose, of this project. He discussed how NWTF is now the 11th largest purchaser of NF timber, nationwide, down from #3. They have a feature article in their magazine about woodcock areas and hedgerows. The magazine is called Turkey Country.

January 13, 2020 Richwood Volunteer Fire Department

The Richwood VFD has a regular Monday evening meeting, and J. Bard asked if we could tell them about the project at their regular meeting. See the lists of those present. For the FS were R. Raione, J. Fry, K. Tarter and J. Bard. Richard told about the background of the 603 category of the 2018 Farm Bill to allow faster completion of projects like this. He also gave them a head's up on the forest's plan to do planning for another project in our new order of entry process, a 2 years process for developing projects including timber harvest. John talked about fires in the area, similar to notes for 12/12/19 meeting, about pile burning and mechanical treatment near private land, and about a broadcast burn (a cool burn in spring or fall). He said the burn weather would have to be just right. Jane talked about background on the tornado in 2016, followed by the flood, then followed by a very long dry spell in late summer and early fall that resulted in closure of the Dolly Sodds wilderness because of the outbreak of multiple fires that were finally put out by snow and rain. Jane described the timber harvest treatments that would occur by logging, and verbally described the locations on both sides of the CC road up to private land, the Summit Lake area and she pointed to the area of NF land that adjoins Richwood to the east of the fire house. She said that the harvests near Richwood would have a similar appearance to the harvests that were done several years ago when the helicopter logging was done that was visible from the parking lot of the Cherry R. plaza. She said that about 350 acres of the harvest would be clearcuts, which are probably not visible from this location.

There was some discussion with the fire department about access for emergencies and about increasing communications with the FS. The fire chief mentioned good contacts with K. Perrine and S. Kalna during several emergency rescues, etc. They talked about the situation with the tornado and flood of 2016, with regard to communication, access, during that emergency.

They asked when and how the work would be done. By our normal timber sales process, that layout for the first sales would be started this summer after consultation with USFW was completed, and it would result in several sales over

10 years or so. The timber sale bidding process was briefly describe, that we mark the trees to be cut, and inspect, etc.

They asked about the acreage of the watershed compared to the potential 3000 acres of harvest, and whether that would impact flooding. We mentioned that they could obtain maps of the actual harvest areas, once those were ready, to see that the harvest acreage wasn't contiguous, but would be in several drainages, and that the scheduling would mean that impacts would be spread out over time. The FS would be taking a look at that potential aspect of the project. Jane mentioned that while planning the Desert Branch sale, that topic had been brought up and the percentage of the watershed being harvested in that project had not been expected to result in growing season increases in flow.

They asked if it would be possible to get all of WV 39/55 cleared in the same way that the section in Pocahontas county had been done a couple years ago. This clearing of the road right of way had improved the long term appearance and the accessibility of the road. There was some discussion that the project would include cutting trees that could fall on the roads for FS roads, and at least part of the highway would have such work done, but potentially it would not result in complete clearing.

January 16, 2020 Richwood City Council Meeting

The FS was put on the agenda of the city council meeting by Pete Conard. J. Bard and K.Tarter were present. The mayor, Chris Drennan and a quorum of city council members were present. An estimated 15 people were present in the public section of the room. Jane was asked to speak in front of the group so that she could be video recorded. Jane described the project, as above, starting with background on the 2019 Farm Bill, section 603 and the HFRA, with the need for the project stemming from the aging forest and risk of fire, insect and disease issues. She mentioned the tornado blowdown on Hinkle Mt. and the potential we had that fall for a catastrophic fire, because of the very serious fire season we had that fall and the huge amount of fuel present there. She described the project as involving commercial logging, with some clearcutting and mostly thinning as well as a prescribed burn up by Hacking Run, were vegetation was suitable for oak, and described the fire break as having residual trees with a more open understory, maintained by piling and burning brush and slash from the harvest. She described the area of the project, to include the boundaries of Richwood on the east side, and the Summit Lake area. *(Note that water from Summit Lake flows down Coats Run* *into the North Fork of Cherry River. The water intake for Richwood's city water is located near Richwood from the N. Fork of Cherry. So, the river is a source of local drinking water, but there is no designation of a "municipal watershed").* There were a couple of questions. When would the project occur? The process for marking and selling the timber was described with a start date for marking most likely in June, 2020, and the sale of timber would not be in a single contract. Some of the work would be done by service contracts or by FS staff, for example, parts of the fuel break, work in the Summit Lake campground. One council member asked for good notification for when it would occur, since they don't want to be surprised by smoke, log trucks, etc. as at times has happened with other major projects in the area. Jane described that there would be news releases from our supervisors office to various local papers, especially with regard to the timing of the prescribed burn. They can also receive more info at the FS office once maps, scheduling, etc. were in place. One council member asked if it would create jobs. The work would mostly be done by logging companies, but could also involve other contractors or FS staff in certain areas, such as the fuel break, where commercial logging wasn't practical, etc.

January 17, 2020 Richwood Chamber of Commerce Meeting

Also scheduled by Pete Conard. K. Tarter and J. Bard attended. About 8 board members were present. Several board members were already familiar, since they were also at the council mtg. Project description by j. Bard was similar to above, starting with the aging forest, insects and diseases, increasing fuel, changing complexity of the weather and fire situation in the est, the Black Mt. fire in the 1930's started in August and burned for several months, and effects of that fire are still evident on the landscape. At that time logging slash and RR fires were a factor. Clearing the highway of trees that are falling or could fall was requested. Removing the large amount of dead trees from the river below Summit Lake was discussed as a need.

January 22, 2020 The Nature Conservancy, Benjamin Rhodes

Phone call with B. Rhodes, representing TNC. J. Martin, R. Raione, K. Tarter and J. Bard attended for the FS. Project description basics was as described above, primarily related to fire, insects and disease. Ben had a copy of the 602 and 603 categories. There was a little more specific discussion about red spruce potential east of Summit Lake, with the rest of the area being mostly Appalachian cove hardwoods. Ben mentioned that high elevation spruce forests in the long term create less fire prone conditions. He suggested that retaining spruce, releasing understory and midstory spruce and planting spruce could be done in the area. He indicated that he would check the spruce potential for these activities and get back to us. Jane mentioned that in the fuelbreaks, the fire risk would be the primary consideration on whether implementation would be able to leave spruce, but in the rest of the area spruce could probably be left. The project description for regeneration areas includes planting, and if spruce is suitable in those areas if could be included. Ben mentioned that TNC would like to do more spruce release in this vicinity, even if this project area doesn't turn out to have the most suitable acreage. Their organization is also active in partnering on red spruce planting projects. There was some discussion on details of TNC spruce release procedures received from another project. Jay mentioned that this project is almost completely in the 3.0 management prescription and we would soon be returning to the 4.1 prescription areas in Elk Mt., currently, and in the Cranberry watershed which is coming up next with our new order of entry planning process.

Stevens, Karen L -FS

From: Tolley, Tim -FS
Sent: Wednesday, November 20, 2019 9:53 AM
To: Tarter, Kim - FS; Raione, Richard P -FS
Cc: Conner, Tami -FS; Tolley, Tim -FS; Tanner, Cheryl L -FS; Tasker, Kyle - FS; Coleman, Amy - FS; Nottingham, Adrienne C -FS; Brooks, Gregory - FS
Subject: GHFRP - linear wildlife opening

Good Morning Kim,

One item that was mentioned in last week's meeting but did not really get discussed was a specific linear wildlife opening. Although I'm not familiar with this particular feature, it sounds like something important to the wildlife program and that we periodically maintain. For something like that I'm sure that we can keep it and continue to maintain it as we have been doing.

(b)(5); Deliberative Process Privilege [redacted]

Thanks. I hope you're having a good day.

Tim

Timothy Tolley
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Caring for the land and serving people

Stevens, Karen L -FS

From: Owen, Michael D -FS
Sent: Tuesday, February 18, 2020 10:52 AM
To: Tasker, Kyle - FS
Subject: GHFRP - Comments on Candy Darter BA
Attachments: GHFRP_AquaticsBA_Draft_OwenReview_02.07.20.docx

Hi Kyle,

Nice work on the candy darter BA for GHFRP. Please see the attached document with my comments.

Sorry I wasn't able to get with you last Friday. I am around Tuesday – Thursday of this week. Let's try to touch base as schedules allow.

Thanks.

Michael D. Owen
Aquatic Ecologist
Forest Service
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Caring for the land and serving people

Stevens, Karen L -FS

From: Tasker, Kyle - FS
Sent: Tuesday, January 28, 2020 5:07 PM
To: Morgan, Jonathan R -FS
Cc: Martin, Jay - FS
Subject: GHFRP aquatic Design criteria

Jon and Jay,

I wanted to send you an additional design criteria that would help improve our commitment to reducing potential effects of this project on candy darter habitat. It occurred to me that FWS used this figure as a way to measure downstream potential for habitat disturbance from upstream activities. This was developed on the Williams River, however the North Fork Cherry River has similar geomorphology and pool-riffle habitat sequence potential.

Aquatic Design criteria GHFR

- When temporary roads or road maintenance occurs within one-quarter mile of suitable or proposed candy darter critical habitat, additional sediment and erosion controls will be administered at locations adjacent and surrounding stream crossings creating a barrier surrounding disturbed locations, approximately the width of the riparian buffer zone.
    - *Reasoning*: The Williams River BO (p. 31, 53) that went through FWS consultation last year reached an stating that sources of sediment occurring within one-quarter of a mile from candy darter habitat would have increased potential for affects to candy darter habitat.

Also, listed below are the conservation measures that I have included in the BA, I would like to ask if you would review these and notify me if any of these are not suitable to include in the BA. If there are any questions, we can discuss as needed.

Conservation Measures - The following measures are included as fundamental components of this project.

- Comply with pertinent Forest Plan standards
- Meet or exceed pertinent West Virginia Best Management Practices to help control potential soil erosion and stream sedimentation
- Perform additional BMPs measures when implementing road decommissioning at stream crossings close to suitable candy darter habitat to reduce the potential for sediment delivery to stream channels when restoring stream banks (e.g. silt fence, filter sock, etc.)
- Stream crossing enhancement projects will require stream flow diversion as necessary to maintain relatively dry conditions during in-channel project work and thereby, minimize the potential for increased turbidity downstream
- Continue to monitor aquatic resource conditions in the project area in accordance with established survey methodologies, locations, and schedules associated with the Forest's on-going Aquatic Ecological Unit Inventory efforts

Best,

Kyle Tasker
Fisheries Biologist

Forest Service
Monongahela National Forest

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kyle.tasker@usda.gov

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Marlinton, WV 24954
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Stevens, Karen L -FS

From: Tasker, Kyle - FS
Sent: Wednesday, February 5, 2020 2:27 PM
To: Bard, Jane F -FS
Cc: Martin, Jay - FS; Coleman, Amy - FS; Tanner, Cheryl L -FS
Subject: GHFRP pesticide use
Attachments: Crayton et al 2019 USGS_NPS-FnlRpt-Imidacloprid Aquatic Ecosystems.pdf

Hi Jane,

(b)(5); Deliberative Process Privilege [redacted]

Thanks,

Kyle Tasker
Fisheries Biologist

Forest Service
Monongahela National Forest

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Caring for the land and serving people

T95	0.08	428	New Construction	12	Thinning	Conventional	50.72	0.07925	3.29			T95	In Burn Block
T95	0.38	2,020	Reconstruction	12	Thinning	Conventional	50.72					T95	In Burn Block
T95	0.26	1,371	Reconstruction	12	Thinning	Conventional	50.72					T95	In Burn Block
T95	0.05	266	Reconstruction	12	Thinning	Conventional	50.72					T95	In Burn Block
T95	0.15	817	Reconstruction	12	Thinning	Conventional	50.72					T95	In Burn Block
T95	0.39	2,057	Reconstruction	12	Thinning	Conventional	50.72					T95	In Burn Block
T95	0.01	38	Reconstruction	12	Thinning	Conventional	50.72					T95	In Burn Block
T95	0.24	1,287	Reconstruction	25	Thinning	Conventional	50.72	0.07925	3.29	18.77	22.07	T95	In Burn Block
T96	0.43	2,247	Reconstruction	12	Thinning	Conventional	30.00					T96	
T96	0.21	1,085	Reconstruction	12	Thinning	Conventional	30.00					T96	
T96	0.06	324	Reconstruction	12	Thinning	Conventional	30.00					T96	
T96	0.05	259	Reconstruction	12	Thinning	Conventional	30.00					T96	
T96	0.06	329	Reconstruction	12	Thinning	Conventional	30.00	0.04688		17.14	17.14	T96	
T97	0.01	40	Reconstruction	12	Thinning	Conventional	8.61					T97	In Burn Block
T97	0.08	437	Reconstruction	12	Thinning	Conventional	8.61					T97	In Burn Block
T97	0.08	435	Reconstruction	12	Thinning	Conventional	8.61					T97	In Burn Block
T97	0.06	302	Reconstruction	12	Thinning	Conventional	8.61					T97	In Burn Block
T97	0.03	155	Reconstruction	12	Thinning	Conventional	8.61					T97	In Burn Block
T97	0.04	210	Reconstruction	12	Thinning	Conventional	8.61	0.01346		22.22	22.22	T97	In Burn Block
T98	0.16	842	New Construction	12	Thinning	Conventional	10.43					T98	
T98	0.09	450	New Construction	12	Thinning	Conventional	10.43	0.0163	15.02			T98	
T98	0.03	147	Reconstruction	12	Thinning	Conventional	10.43	0.0163	15.02	1.71	16.72	T98	
T99	0.04	231	New Construction	12	Thinning	Conventional	14.55					T99	
T99	0.01	68	New Construction	12	Thinning	Conventional	14.55	0.02274	2.49			T99	
T99	0.10	514	Reconstruction	12	Thinning	Conventional	14.55	0.02274	2.49	4.28	6.77	T99	

Temp. Road Totals	
27.55	Total, new (miles)
26.90	Total, re-const (miles)

Total Treatment Unit Area (mi^2)	
2.65129	mi^2
2.2095	mi^2

Gauley Healthy Forest Restoration Project
Harvest - Regeneration and Thinning

FID	Method	Cut_Type	GIS_Acres	ID	COMENTS		FID	Method	Cut_Type	GIS_Acres	ID	OMENTS
2	Conventional	Regen	29.1	R3	-	0	2	onvention	Regen	29.1	R3	
3	Conventional	Regen	25.4	R4	-	0	3	onvention	Regen	25.4	R4	
4	Conventional	Regen	25.6	R5	-	0	4	onvention	Regen	25.6	R5	
5	Conventional	Regen	15.5	R6	-	0	5	onvention	Regen	15.5	R6	
7	Conventional	Regen	37.6	R8	-	0	7	onvention	Regen	37.6	R8	
8	Conventional	Regen	34.3	R9	-	0	8	onvention	Regen	34.3	R9	
9	Conventional	Regen	38.7	R10	-	0	9	onvention	Regen	38.7	R10	
52	Conventional	Regen	35.8	R74	-	0	52	onvention	Regen	35.8	R74	
10	Conventional	Thinning	24.3	T11	-	0	10	onvention	Thinning	24.3	T11	
11	Conventional	Thinning	44.4	T12	-	0	11	onvention	Thinning	44.4	T12	
12	Conventional	Thinning	48.3	T13	-	0	12	onvention	Thinning	48.3	T13	
15	Conventional	Thinning	28.0	T16	-	0	15	onvention	Thinning	28.0	T16	
16	Conventional	Thinning	20.0	T17	-	0	16	onvention	Thinning	20.0	T17	
17	Conventional	Thinning	25.4	T18	-	0	17	onvention	Thinning	25.4	T18	
18	Conventional	Thinning	33.0	T20	-	0	18	onvention	Thinning	33.0	T20	
19	Conventional	Thinning	74.8	T21	-	0	19	onvention	Thinning	74.8	T21	
20	Conventional	Thinning	34.2	T22	-	0	20	onvention	Thinning	34.2	T22	
21	Conventional	Thinning	45.2	T23	-	0	21	onvention	Thinning	45.2	T23	
25	Conventional	Thinning	17.4	T28	-	0	25	onvention	Thinning	17.4	T28	
26	Conventional	Thinning	6.2	T29	-	0	26	onvention	Thinning	6.2	T29	
28	Conventional	Thinning	33.6	T31	-	0	28	onvention	Thinning	33.6	T31	
29	Conventional	Thinning	27.2	T34	-	0	29	onvention	Thinning	27.2	T34	
30	Conventional	Thinning	50.2	T36	-	0	30	onvention	Thinning	50.2	T36	
31	Conventional	Thinning	23.0	T38	-	0	31	onvention	Thinning	23.0	T38	
32	Conventional	Thinning	23.0	T41	-	0	32	onvention	Thinning	23.0	T41	
33	Conventional	Thinning	21.9	T44	-	0	33	onvention	Thinning	21.9	T44	
34	Conventional	Thinning	16.9	T46	-	0	34	onvention	Thinning	16.9	T46	
35	Conventional	Thinning	29.5	T49	-	0	35	onvention	Thinning	29.5	T49	
36	Conventional	Thinning	33.4	T50	-	0	36	onvention	Thinning	33.4	T50	
37	Conventional	Thinning	31.4	T52	-	0	37	onvention	Thinning	31.4	T52	
38	Conventional	Thinning	16.9	T53	-	0	38	onvention	Thinning	16.9	T53	
39	Conventional	Thinning	30.4	T58	-	0	39	onvention	Thinning	30.4	T58	
46	Conventional	Thinning	48.9	T65	-	0	46	onvention	Thinning	48.9	T65	
47	Conventional	Thinning	31.4	T69	-	0	47	onvention	Thinning	31.4	T69	
48	Conventional	Thinning	32.7	T70	-	0	48	onvention	Thinning	32.7	T70	
49	Conventional	Thinning	72.9	T71	-	0	49	onvention	Thinning	72.9	T71	
50	Conventional	Thinning	7.5	T72	-	0	50	onvention	Thinning	7.5	T72	
51	Conventional	Thinning	9.4	T73	-	0	51	onvention	Thinning	9.4	T73	
54	Conventional	Thinning	18.5	T77	-	0	54	onvention	Thinning	18.5	T77	
55	Conventional	Thinning	29.6	T78	-	0	55	onvention	Thinning	29.6	T78	
56	Conventional	Thinning	52.9	T79	-	0	56	onvention	Thinning	52.9	T79	
57	Conventional	Thinning	59.9	T81	-	0	57	onvention	Thinning	59.9	T81	
58	Conventional	Thinning	39.2	T82	In Burn Block	0	58	onvention	Thinning	39.2	T82	Burn Block
59	Conventional	Thinning	30.3	T83	-	0	59	onvention	Thinning	30.3	T83	
60	Conventional	Thinning	101.9	T85	-	0	60	onvention	Thinning	101.9	T85	
61	Conventional	Thinning	50.1	T86	-	0	61	onvention	Thinning	50.1	T86	
62	Conventional	Thinning	42.8	T88	-	0	62	onvention	Thinning	42.8	T88	
63	Conventional	Thinning	8.0	T76	-	0	63	onvention	Thinning	8.0	T76	
64	Conventional	Thinning	2.2	T80	-	0	64	onvention	Thinning	2.2	T80	
65	Conventional	Thinning	16.4	T87	-	0	65	onvention	Thinning	16.4	T87	
66	Conventional	Thinning	15.7	T90	-	0	66	onvention	Thinning	15.7	T90	
67	Conventional	Thinning	16.5	T91	In Burn Block	0	67	onvention	Thinning	16.5	T91	Burn Block
68	Conventional	Thinning	22.5	T92	In Burn Block	0	68	onvention	Thinning	22.5	T92	Burn Block
69	Conventional	Thinning	13.2	T93	In Burn Block	0	69	onvention	Thinning	13.2	T93	Burn Block
70	Conventional	Thinning	30.0	T96	-	0	70	onvention	Thinning	30.0	T96	
71	Conventional	Thinning	49.1	T94	In Burn Block	0	71	onvention	Thinning	49.1	T94	Burn Block
72	Conventional	Thinning	50.7	T95	In Burn Block	0	72	onvention	Thinning	50.7	T95	Burn Block
73	Conventional	Thinning	8.6	T97	In Burn Block	0	73	onvention	Thinning	8.6	T97	Burn Block
74	Conventional	Thinning	10.4	T98	-	0	74	onvention	Thinning	10.4	T98	
75	Conventional	Thinning	15.4	T84	-	0	75	onvention	Thinning	15.4	T84	
76	Conventional	Thinning	32.1	T89	-	-3	76	onvention	Thinning	34.9	T89	
77	Conventional	Thinning	14.6	T99	-	0	77	onvention	Thinning	14.6	T99	
78	Conventional	Thinning	11.9	T100	-	0	78	onvention	Thinning	11.9	T100	
80	Conventional	Thinning	5.1	T101	Fuel Break	0	80	onvention	Thinning	5.6	T101	Fuel Break
0	Helicopter	Regen	40.7	R1	-	0	0	Helicopter	Regen	40.7	R1	
1	Helicopter	Regen	29.0	H2	-	0	1	Helicopter	Regen	29.0	H2	
6	Helicopter	Regen	39.3	H7	-	0	6	Helicopter	Regen	39.3	H7	
13	Helicopter	Thinning	50.8	H14	-	0	13	Helicopter	Thinning	50.8	H14	
14	Helicopter	Thinning	144.8	H15	-	0	14	Helicopter	Thinning	144.8	H15	
22	Helicopter	Thinning	97.0	H24	-	0	22	Helicopter	Thinning	97.0	H24	
23	Helicopter	Thinning	24.1	H25	-	0	23	Helicopter	Thinning	24.1	H25	
24	Helicopter	Thinning	34.7	H27	-	0	24	Helicopter	Thinning	34.7	H27	
27	Helicopter	Thinning	49.0	H30	-	0	27	Helicopter	Thinning	49.0	H30	
40	Helicopter	Thinning	64.4	H59	-	0	40	Helicopter	Thinning	64.4	H59	
41	Helicopter	Thinning	19.4	H60	-	0	41	Helicopter	Thinning	19.4	H60	
42	Helicopter	Thinning	92.6	H61	-	0	42	Helicopter	Thinning	92.6	H61	
43	Helicopter	Thinning	30.5	H62	-	0	43	Helicopter	Thinning	30.5	H62	
44	Helicopter	Thinning	62.7	H63	-	0	44	Helicopter	Thinning	62.7	H63	
45	Helicopter	Thinning	63.2	H64	-	0	45	Helicopter	Thinning	63.2	H64	
53	Helicopter	Thinning	24.5	H75	-	0	53	Helicopter	Thinning	24.5	H75	
79	Helicopter	Thinning	13.3	H48	-	0	79	Helicopter	Thinning	13.3	H48	

Data from *GHFR_ProposedTimberUnits_011620*.

2,043 3.19

771

Conventional, Regeneration	242	acres
Conventional, Thinning	1,689	acres
Helicopter, Regeneration	109	acres
Helicopter, Thinning	771	acres
	2,811	Total acres harvested

Data from *GHFR_ProposedTimberUnits_011620*.

Method	Cut_Type	GIS_Acres	ID	Name	Total Acres	Comments
Conventional Thinning. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_01132*						
Conventional	Regen	13.6	R3	NF Cherry R		
Conventional	Regen	25.6	R5	NF Cherry R		
Conventional	Regen	0.0	R6	NF Cherry R	39.2	
-	-	240.0	-	Big Lick		
Conventional	Regen	30.4	R74	Big Lick	30.4	
-	-	0.0	-	Big Lick		
-	-	178.5	-	Cherry River North		
-	-	115.9	-	Cherry River South		
-	-	990.1	-	Coats Run		
Conventional	Regen	5.4	R74	Coats Run	5.4	
-	-	0.0	-	Coats Run		
-	-	376.8	-	Cranberry		
-	-	0.0	-	Cranberry		
-	-	910.9	-	Desert Branch		
Conventional	Regen	15.5	R3	Desert Branch		
Conventional	Regen	25.4	R4	Desert Branch		
Conventional	Regen	15.5	R6	Desert Branch	56.4	
-	-	0.0	-	Desert Branch		
-	-	343.6	-	Goose Hollow		
-	-	0.0	-	Goose Hollow		
-	-	0.0	-	Goose Hollow		
-	-	467.4	-	Hacking Run		
Conventional	Regen	34.3	R9	Hacking Run		
Conventional	Regen	38.7	R10	Hacking Run	73.0	
-	-	2,129.6	-	Hunters Run		
Conventional	Regen	37.6	R8	Hunters Run	37.6	
-	-	0.0	-	Hunters Run		
-	-	863.2	-	Little Lick		
-	-	547.6	-	Spencer Run		
-	-	0.0	-	Spencer Run		

Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*

Conventional Thinning. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_01132*

Method	Cut_Type	GIS_Acres	ID	Name	Total Acres	COMENTS
Conventional	Thinning	1.7	T11	-		-
Conventional	Thinning	2.3	T12	-		-
Conventional	Thinning	48.1	T13	-		-
Conventional	Thinning	33.0	T20	-		-
Conventional	Thinning	27.7	T21	-		-
Conventional	Thinning	0.2	T22	-		-
Conventional	Thinning	1.4	T41	-		-
Conventional	Thinning	1.4	T82	-		In Burn Block
Conventional	Thinning	0.0	T85	-		-
Conventional	Thinning	2.9	T92	-		In Burn Block
Conventional	Thinning	0.6	T93	-		In Burn Block
Conventional	Thinning	12.1	T94	-		In Burn Block
Conventional	Thinning	50.2	T95	181.6		In Burn Block
-	-	180.8	-	Big Lick		-
-	-	0.0	-	Big Lick		-
Conventional	Thinning	0.2	T31	Big Lick		-
Conventional	Thinning	12.5	T44	Big Lick		-
Conventional	Thinning	16.9	T46	Big Lick		-
Conventional	Thinning	33.0	T50	Big Lick		-
Conventional	Thinning	7.5	T72	Big Lick		-
Conventional	Thinning	0.0	T73	Big Lick		-
Conventional	Thinning	14.8	T84	Big Lick		-
Conventional	Thinning	0.0	T84	Big Lick		-
Conventional	Thinning	1.1	T85	Big Lick		-
Conventional	Thinning	0.0	T85	Big Lick		-
Conventional	Thinning	3.6	T89	Big Lick	89.6	-
-	-	131.3	-	Cherry River North		-
Conventional	Thinning	47.2	T21	Cherry River North	47.2	-
-	-	59.3	-	Cherry River South		-
Conventional	Thinning	22.6	T11	Cherry River South		-
Conventional	Thinning	34.0	T22	Cherry River South	56.6	-
-	-	589.5	-	Coats Run		-
-	-	0.0	-	Coats Run		-
Conventional	Thinning	11.9	T100	Coats Run		-
Conventional	Thinning	0.0	T100	Coats Run		-
Conventional	Thinning	5.1	T101	Coats Run		Fuel Break
Conventional	Thinning	0.0	T101	Coats Run		Fuel Break
Conventional	Thinning	0.0	T101	Coats Run		Fuel Break
Conventional	Thinning	49.4	T36	Coats Run		-
Conventional	Thinning	18.2	T38	Coats Run		-
Conventional	Thinning	19.7	T41	Coats Run		-
Conventional	Thinning	9.4	T44	Coats Run		-
Conventional	Thinning	29.5	T49	Coats Run		-
Conventional	Thinning	31.4	T52	Coats Run		-
Conventional	Thinning	16.9	T53	Coats Run		-
Conventional	Thinning	30.4	T58	Coats Run		-
Conventional	Thinning	0.0	T58	Coats Run		-
Conventional	Thinning	30.4	T69	Coats Run		-
Conventional	Thinning	0.0	T69	Coats Run		-
Conventional	Thinning	32.7	T70	Coats Run		-
Conventional	Thinning	19.9	T71	Coats Run		-
Conventional	Thinning	9.4	T73	Coats Run		-
Conventional	Thinning	18.4	T77	Coats Run		-
Conventional	Thinning	0.0	T77	Coats Run		-
Conventional	Thinning	27.8	T78	Coats Run		-
Conventional	Thinning	0.0	T78	Coats Run		-
Conventional	Thinning	2.4	T79	Coats Run		-
Conventional	Thinning	28.6	T89	Coats Run		-
Conventional	Thinning	14.6	T99	Coats Run	406.1	-
-	-	370.1	-	Cranberry		-
-	-	0.0	-	Cranberry		-
Conventional	Thinning	4.8	T38	Cranberry		-
Conventional	Thinning	0.7	T71	Cranberry		-
Conventional	Thinning	1.2	T78	Cranberry	6.7	-
-	-	939.4	-	Desert Branch		-
-	-	0.0	-	Desert Branch		-
Conventional	Thinning	28.0	T16	Desert Branch	28.0	-
-	-	343.0	-	Goose Hollow		-
-	-	0.0	-	Goose Hollow		-
-	-	0.0	-	Goose Hollow		-
Conventional	Thinning	0.5	T78	Goose Hollow		-
Conventional	Thinning	0.0	T78	Goose Hollow	0.5	-
-	-	285.5	-	Hacking Run		-
Conventional	Thinning	0.2	T13	Hacking Run		-
Conventional	Thinning	19.9	T17	Hacking Run		-
Conventional	Thinning	25.4	T18	Hacking Run		-
Conventional	Thinning	44.1	T23	Hacking Run		-
Conventional	Thinning	0.0	T23	Hacking Run		-
Conventional	Thinning	17.4	T28	Hacking Run		-
Conventional	Thinning	6.2	T29	Hacking Run		-
Conventional	Thinning	0.0	T81	Hacking Run		-
Conventional	Thinning	37.8	T82	Hacking Run		In Burn Block
Conventional	Thinning	30.2	T83	Hacking Run		-
Conventional	Thinning	0.0	T83	Hacking Run		-
Conventional	Thinning	15.7	T90	Hacking Run		-
Conventional	Thinning	16.5	T91	Hacking Run		In Burn Block
Conventional	Thinning	19.7	T92	Hacking Run		In Burn Block
Conventional	Thinning	11.7	T93	Hacking Run		In Burn Block
Conventional	Thinning	0.0	T95	Hacking Run		In Burn Block
Conventional	Thinning	10.2	T98	Hacking Run	255.0	-
-	-	1,775.1	-	Hunters Run		-
-	-	0.0	-	Hunters Run		-
Conventional	Thinning	42.0	T12	Hunters Run		-
Conventional	Thinning	0.1	T17	Hunters Run		-
Conventional	Thinning	1.1	T23	Hunters Run		-
Conventional	Thinning	33.4	T31	Hunters Run		-
Conventional	Thinning	0.4	T50	Hunters Run		-
Conventional	Thinning	8.0	T76	Hunters Run		-
Conventional	Thinning	2.2	T80	Hunters Run		-
Conventional	Thinning	59.9	T81	Hunters Run		-
Conventional	Thinning	0.1	T83	Hunters Run		-
Conventional	Thinning	0.5	T84	Hunters Run		-
Conventional	Thinning	0.0	T84	Hunters Run		-
Conventional	Thinning	100.8	T85	Hunters Run		-
Conventional	Thinning	0.0	T85	Hunters Run		-
Conventional	Thinning	50.1	T86	Hunters Run		-
Conventional	Thinning	16.4	T87	Hunters Run		-
Conventional	Thinning	0.8	T93	Hunters Run		In Burn Block
Conventional	Thinning	37.0	T94	Hunters Run		In Burn Block
Conventional	Thinning	0.5	T95	Hunters Run		In Burn Block
Conventional	Thinning	30.0	T96	Hunters Run		-
Conventional	Thinning	8.6	T97	Hunters Run		In Burn Block
Conventional	Thinning	0.3	T98	Hunters Run	392.2	-
-	-	686.7	-	Little Lick		-
Conventional	Thinning	27.2	T34	Little Lick		-
Conventional	Thinning	0.8	T36	Little Lick		-
Conventional	Thinning	0.0	T36	Little Lick		-
Conventional	Thinning	2.0	T41	Little Lick		-

~~Conventional~~	~~Thinning~~	~~1.0~~	~~T69~~	~~Little Lick~~		-
~~Conventional~~	~~Thinning~~	~~52.3~~	~~T71~~	~~Little Lick~~		-
~~Conventional~~	~~Thinning~~	~~50.6~~	~~T79~~	~~Little Lick~~		-
~~Conventional~~	~~Thinning~~	~~0.0~~	~~T79~~	~~Little Lick~~		-
~~Conventional~~	~~Thinning~~	~~42.8~~	~~T88~~	~~Little Lick~~	~~**176.7**~~	-
-	-	~~498.7~~	-	~~Spencer Run~~		-
-	-	~~0.0~~	-	~~Spencer Run~~		-
~~Conventional~~	~~Thinning~~	~~48.9~~	~~T65~~	~~Spencer Run~~	~~**48.9**~~	-

~~**Helicopter Regeneration**. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_0113*~~

~~Method~~	~~Cut_Type~~	~~GIS_Acres~~	~~ID~~	~~Name~~	~~Total Acres~~	~~Comments~~
~~Helicopter~~	~~Regen~~	~~7.9~~	~~H2~~	-	~~**7.9**~~	-
~~Helicopter~~	~~Regen~~	~~40.7~~	~~R1~~	~~Spencer Run~~	~~**40.7**~~	-
~~Helicopter~~	~~Regen~~	~~21.1~~	~~H2~~	~~Desert Branch~~	~~**21.1**~~	-
~~Helicopter~~	~~Regen~~	~~39.3~~	~~H7~~	~~Hunters Run~~	~~**39.3**~~	-
-	-	~~540.4~~	-	~~Hacking Run~~	-	-
-	-	~~2,128.0~~	-	~~Hunters Run~~	-	-
-	-	~~863.2~~	-	~~Little Lick~~	-	-
-	-	~~507.0~~	-	~~Spencer Run~~	-	-
-	-	~~946.2~~	-	~~Desert Branch~~	-	-
-	-	~~270.4~~	-	~~Big Lick~~	-	-
-	-	~~995.5~~	-	~~Coats Run~~	-	-
-	-	~~376.8~~	-	~~Cranberry~~	-	-
-	-	~~115.9~~	-	~~Cherry River South~~	-	-
-	-	~~178.5~~	-	~~Cherry River North~~	-	-
-	-	~~343.6~~	-	~~Goose Hollow~~	-	-
-	-	~~0.0~~	-	~~Hunters Run~~	-	-
-	-	~~0.0~~	-	~~Big Lick~~	-	-
-	-	~~0.0~~	-	~~Spencer Run~~	-	-
-	-	~~0.0~~	-	~~Desert Branch~~	-	-
-	-	~~0.0~~	-	~~Coats Run~~	-	-
-	-	~~0.0~~	-	~~Goose Hollow~~	-	-
-	-	~~0.0~~	-	~~Cranberry~~	-	-
-	-	~~0.0~~	-	~~Goose Hollow~~	-	-

~~**Helicopter Thinning**. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*~~

~~Method~~	~~Cut_Type~~	~~GIS_Acres~~	~~ID~~	~~Name~~	~~Total Acres~~	~~COMENTS~~
~~Helicopter~~	~~Thinning~~	~~144.8~~	~~H15~~	-		-
~~Helicopter~~	~~Thinning~~	~~92.1~~	~~H24~~	-		-
~~Helicopter~~	~~Thinning~~	~~1.0~~	~~H25~~	-		-
~~Helicopter~~	~~Thinning~~	~~0.8~~	~~H30~~	-		-
~~Helicopter~~	~~Thinning~~	~~34.4~~	~~H59~~	-		-
~~Helicopter~~	~~Thinning~~	~~5.3~~	~~H60~~	-		-
~~Helicopter~~	~~Thinning~~	~~57.7~~	~~H61~~	-		-
~~Helicopter~~	~~Thinning~~	~~1.6~~	~~H62~~	-		-
~~Helicopter~~	~~Thinning~~	~~60.5~~	~~H63~~	-		-
~~Helicopter~~	~~Thinning~~	~~61.0~~	~~H64~~	-	~~**459.2**~~	-
-	-	~~257.1~~	-	~~Big Lick~~		-
-	-	~~0.0~~	-	~~Big Lick~~		-
~~Helicopter~~	~~Thinning~~	~~0.1~~	~~H30~~	~~Big Lick~~		-
~~Helicopter~~	~~Thinning~~	~~13.2~~	~~H48~~	~~Big Lick~~	~~**13.2**~~	-
-	-	~~141.2~~	-	~~Cherry River North~~		-
~~Helicopter~~	~~Thinning~~	~~4.9~~	~~H24~~	~~Cherry River North~~		-
~~Helicopter~~	~~Thinning~~	~~23.1~~	~~H25~~	~~Cherry River North~~		-
~~Helicopter~~	~~Thinning~~	~~7.1~~	~~H59~~	~~Cherry River North~~		-
~~Helicopter~~	~~Thinning~~	~~2.2~~	~~H63~~	~~Cherry River North~~	~~**37.3**~~	-
-	-	~~79.0~~	-	~~Cherry River South~~		-
~~Helicopter~~	~~Thinning~~	~~22.9~~	~~H59~~	~~Cherry River South~~		-
~~Helicopter~~	~~Thinning~~	~~14.1~~	~~H60~~	~~Cherry River South~~	~~**37.0**~~	-
-	-	~~995.5~~	-	~~Coats Run~~		-
-	-	~~0.0~~	-	~~Coats Run~~		-
-	-	~~376.8~~	-	~~Cranberry~~		-
-	-	~~0.0~~	-	~~Cranberry~~		-
-	-	~~967.3~~	-	~~Desert Branch~~		-
-	-	~~0.0~~	-	~~Desert Branch~~		-
-	-	~~343.6~~	-	~~Goose Hollow~~		-
-	-	~~0.0~~	-	~~Goose Hollow~~		-
-	-	~~0.0~~	-	~~Goose Hollow~~		-
-	-	~~539.9~~	-	~~Hacking Run~~		-
~~Helicopter~~	~~Thinning~~	~~0.1~~	~~H14~~	~~Hacking Run~~		-
~~Helicopter~~	~~Thinning~~	~~0.4~~	~~H27~~	~~Hacking Run~~	~~**0.5**~~	-
-	-	~~2,009.5~~	-	~~Hunters Run~~		-
-	-	~~0.0~~	-	~~Hunters Run~~		-
~~Helicopter~~	~~Thinning~~	~~50.7~~	~~H14~~	~~Hunters Run~~		-
~~Helicopter~~	~~Thinning~~	~~34.3~~	~~H27~~	~~Hunters Run~~		-
~~Helicopter~~	~~Thinning~~	~~48.2~~	~~H30~~	~~Hunters Run~~		-
~~Helicopter~~	~~Thinning~~	~~0.1~~	~~H48~~	~~Hunters Run~~		-
~~Helicopter~~	~~Thinning~~	~~24.5~~	~~H75~~	~~Hunters Run~~	~~**157.8**~~	-
-	-	~~863.2~~	-	~~Little Lick~~		-
-	-	~~481.6~~	-	~~Spencer Run~~		-
-	-	~~0.0~~	-	~~Spencer Run~~		-
~~Helicopter~~	~~Thinning~~	~~34.9~~	~~H61~~	~~Spencer Run~~		-
~~Helicopter~~	~~Thinning~~	~~28.9~~	~~H62~~	~~Spencer Run~~		-
~~Helicopter~~	~~Thinning~~	~~2.2~~	~~H64~~	~~Spencer Run~~	~~**66.1**~~	-

FID	Method	Cut_Type	GIS_Acres	ID	COMENTS
9	Conventional	Regen	38.7	R10	
2	Conventional	Regen	29.1	R3	
3	Conventional	Regen	25.4	R4	
4	Conventional	Regen	25.6	R5	
5	Conventional	Regen	15.5	R6	
52	Conventional	Regen	35.8	R74	
7	Conventional	Regen	37.6	R8	
8	Conventional	Regen	34.3	R9	
78	Conventional	Thinning	11.9	T100	
80	Conventional	Thinning	5.1	T101	Fuel Break
10	Conventional	Thinning	24.3	T11	
11	Conventional	Thinning	44.4	T12	
12	Conventional	Thinning	48.3	T13	
15	Conventional	Thinning	28.0	T16	
16	Conventional	Thinning	20.0	T17	
17	Conventional	Thinning	25.4	T18	
18	Conventional	Thinning	33.0	T20	
19	Conventional	Thinning	74.8	T21	
20	Conventional	Thinning	34.2	T22	
21	Conventional	Thinning	45.2	T23	
25	Conventional	Thinning	17.4	T28	
26	Conventional	Thinning	6.2	T29	
28	Conventional	Thinning	33.6	T31	
29	Conventional	Thinning	27.2	T34	
30	Conventional	Thinning	50.2	T36	
31	Conventional	Thinning	23.0	T38	
32	Conventional	Thinning	23.0	T41	
33	Conventional	Thinning	21.9	T44	
34	Conventional	Thinning	16.9	T46	
35	Conventional	Thinning	29.5	T49	
36	Conventional	Thinning	33.4	T50	
37	Conventional	Thinning	31.4	T52	
38	Conventional	Thinning	16.9	T53	
39	Conventional	Thinning	30.4	T58	
46	Conventional	Thinning	48.9	T65	
47	Conventional	Thinning	31.4	T69	
48	Conventional	Thinning	32.7	T70	
49	Conventional	Thinning	72.9	T71	
50	Conventional	Thinning	7.5	T72	
51	Conventional	Thinning	9.4	T73	
63	Conventional	Thinning	8.0	T76	
54	Conventional	Thinning	18.5	T77	
55	Conventional	Thinning	29.6	T78	
56	Conventional	Thinning	52.9	T79	
64	Conventional	Thinning	2.2	T80	
57	Conventional	Thinning	59.9	T81	
58	Conventional	Thinning	39.2	T82	In Burn Block
59	Conventional	Thinning	30.3	T83	
75	Conventional	Thinning	15.4	T84	
60	Conventional	Thinning	101.9	T85	
61	Conventional	Thinning	50.1	T86	
65	Conventional	Thinning	16.4	T87	
62	Conventional	Thinning	42.8	T88	
76	Conventional	Thinning	32.1	T89	
66	Conventional	Thinning	15.7	T90	
67	Conventional	Thinning	16.5	T91	In Burn Block
68	Conventional	Thinning	22.5	T92	In Burn Block
69	Conventional	Thinning	13.2	T93	In Burn Block
71	Conventional	Thinning	49.1	T94	In Burn Block
72	Conventional	Thinning	50.7	T95	In Burn Block
70	Conventional	Thinning	30.0	T96	
73	Conventional	Thinning	8.6	T97	In Burn Block
74	Conventional	Thinning	10.4	T98	
77	Conventional	Thinning	14.6	T99	
1	Helicopter	Regen	29.0	H2	
6	Helicopter	Regen	39.3	H7	
0	Helicopter	Regen	40.7	R1	
13	Helicopter	Thinning	50.8	H14	
14	Helicopter	Thinning	144.8	H15	
22	Helicopter	Thinning	97.0	H24	
23	Helicopter	Thinning	24.1	H25	
24	Helicopter	Thinning	34.7	H27	
27	Helicopter	Thinning	49.0	H30	
79	Helicopter	Thinning	13.3	H48	
40	Helicopter	Thinning	64.4	H59	
41	Helicopter	Thinning	19.4	H60	
42	Helicopter	Thinning	92.6	H61	

Gauley Healthy Forest Restoration Project

Harvest - Regeneration and Thinning

Conventional Thinning. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*

Method	Cut_Type	GIS_Acres	ID	Name	Total Acres	Comments
Conventional	Regen	13.6	R3	NF Cherry R		
Conventional	Regen	25.6	R5	NF Cherry R		
Conventional	Regen	0.0	R6	NF Cherry R	**39.2**	
		240.0		Big Lick		
Conventional	Regen	30.4	R74	Big Lick	**30.4**	
		0.0		Big Lick		
		178.5		Cherry River North		
		115.9		Cherry River South		
		990.1		Coats Run		
Conventional	Regen	5.4	R74	Coats Run	**5.4**	
		0.0		Coats Run		
		376.8		Cranberry		
		0.0		Cranberry		
		910.9		Desert Branch		
Conventional	Regen	15.5	R3	Desert Branch		
Conventional	Regen	25.4	R4	Desert Branch		
Conventional	Regen	15.5	R6	Desert Branch	**56.4**	
		0.0		Desert Branch		
		343.6		Goose Hollow		
		0.0		Goose Hollow		
		0.0		Goose Hollow		
		467.4		Hacking Run		
Conventional	Regen	34.3	R9	Hacking Run		
Conventional	Regen	38.7	R10	Hacking Run	**73.0**	
		2,129.6		Hunters Run		
Conventional	Regen	37.6	R8	Hunters Run	**37.6**	
		0.0		Hunters Run		
		863.2		Little Lick		
		547.6		Spencer Run		
		0.0		Spencer Run		

Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*

Conventional Thinning. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*

Method	Cut_Type	GIS_Acres	ID	Name	Total Acres	COMENTS
Conventional	Thinning	1.7	T11			
Conventional	Thinning	2.3	T12			
Conventional	Thinning	48.1	T13			
Conventional	Thinning	33.0	T20			
Conventional	Thinning	27.7	T21			
Conventional	Thinning	0.2	T22			
Conventional	Thinning	1.4	T41			
Conventional	Thinning	1.4	T82			In Burn Block
Conventional	Thinning	0.0	T85			
Conventional	Thinning	2.9	T92			In Burn Block
Conventional	Thinning	0.6	T93			In Burn Block
Conventional	Thinning	12.1	T94			In Burn Block
Conventional	Thinning	50.2	T95	**181.6**		In Burn Block
		180.8		Big Lick		
		0.0		Big Lick		
Conventional	Thinning	0.2	T31	Big Lick		
Conventional	Thinning	12.5	T44	Big Lick		
Conventional	Thinning	16.9	T46	Big Lick		
Conventional	Thinning	33.0	T50	Big Lick		
Conventional	Thinning	7.5	T72	Big Lick		
Conventional	Thinning	0.0	T73	Big Lick		
Conventional	Thinning	14.8	T84	Big Lick		
Conventional	Thinning	0.0	T84	Big Lick		
Conventional	Thinning	1.1	T85	Big Lick		
Conventional	Thinning	0.0	T85	Big Lick		
Conventional	Thinning	3.6	T89	Big Lick	**89.6**	
		131.3		Cherry River North		
Conventional	Thinning	47.2	T21	Cherry River North	**47.2**	
		59.3		Cherry River South		
Conventional	Thinning	22.6	T11	Cherry River South		
Conventional	Thinning	34.0	T22	Cherry River South	**56.6**	
		589.5		Coats Run		
		0.0		Coats Run		
Conventional	Thinning	11.9	T100	Coats Run		
Conventional	Thinning	0.0	T100	Coats Run		
Conventional	Thinning	5.1	T101	Coats Run		Fuel Break
Conventional	Thinning	0.0	T101	Coats Run		Fuel Break
Conventional	Thinning	0.0	T101	Coats Run		Fuel Break
Conventional	Thinning	49.4	T36	Coats Run		
Conventional	Thinning	18.2	T38	Coats Run		
Conventional	Thinning	19.7	T41	Coats Run		

43	Helicopter	Thinning	30.5	H62
44	Helicopter	Thinning	62.7	H63
45	Helicopter	Thinning	63.2	H64
53	Helicopter	Thinning	24.5	H75

Conventional, Regeneration	242	acres
Conventional, Thinning	1,689	acres
Helicopter, Regeneration	109	acres
Helicopter, Thinning	771	acres
	2,811	Total acres harvested

Data from *GHFR_ProposedTimberUnits_011620* .

Gauley Healthy Forest Restoration Project
Harvest - Regeneration and Thinning

Conventional	Thinning	9.4	T44	Coats Run		
Conventional	Thinning	29.5	T49	Coats Run		
Conventional	Thinning	31.4	T52	Coats Run		
Conventional	Thinning	16.9	T53	Coats Run		
Conventional	Thinning	30.4	T58	Coats Run		
Conventional	Thinning	0.0	T58	Coats Run		
Conventional	Thinning	30.4	T69	Coats Run		
Conventional	Thinning	0.0	T69	Coats Run		
Conventional	Thinning	32.7	T70	Coats Run		
Conventional	Thinning	19.9	T71	Coats Run		
Conventional	Thinning	9.4	T73	Coats Run		
Conventional	Thinning	18.4	T77	Coats Run		
Conventional	Thinning	0.0	T77	Coats Run		
Conventional	Thinning	27.8	T78	Coats Run		
Conventional	Thinning	0.0	T78	Coats Run		
Conventional	Thinning	2.4	T79	Coats Run		
Conventional	Thinning	28.6	T89	Coats Run		
Conventional	Thinning	14.6	T99	Coats Run	**406.1**	
		370.1		Cranberry		
		0.0		Cranberry		
Conventional	Thinning	4.8	T38	Cranberry		
Conventional	Thinning	0.7	T71	Cranberry		
Conventional	Thinning	1.2	T78	Cranberry	**6.7**	
		939.4		Desert Branch		
		0.0		Desert Branch		
Conventional	Thinning	28.0	T16	Desert Branch	**28.0**	
		343.0		Goose Hollow		
		0.0		Goose Hollow		
		0.0		Goose Hollow		
Conventional	Thinning	0.5	T78	Goose Hollow		
Conventional	Thinning	0.0	T78	Goose Hollow	**0.5**	
		285.5		Hacking Run		
Conventional	Thinning	0.2	T13	Hacking Run		
Conventional	Thinning	19.9	T17	Hacking Run		
Conventional	Thinning	25.4	T18	Hacking Run		
Conventional	Thinning	44.1	T23	Hacking Run		
Conventional	Thinning	0.0	T23	Hacking Run		
Conventional	Thinning	17.4	T28	Hacking Run		
Conventional	Thinning	6.2	T29	Hacking Run		
Conventional	Thinning	0.0	T81	Hacking Run		
Conventional	Thinning	37.8	T82	Hacking Run		In Burn Block
Conventional	Thinning	30.2	T83	Hacking Run		
Conventional	Thinning	0.0	T83	Hacking Run		
Conventional	Thinning	15.7	T90	Hacking Run		
Conventional	Thinning	16.5	T91	Hacking Run		In Burn Block
Conventional	Thinning	19.7	T92	Hacking Run		In Burn Block
Conventional	Thinning	11.7	T93	Hacking Run		In Burn Block
Conventional	Thinning	0.0	T95	Hacking Run		In Burn Block
Conventional	Thinning	10.2	T98	Hacking Run	**255.0**	
		1,775.1		Hunters Run		
		0.0		Hunters Run		
Conventional	Thinning	42.0	T12	Hunters Run		
Conventional	Thinning	0.1	T17	Hunters Run		
Conventional	Thinning	1.1	T23	Hunters Run		
Conventional	Thinning	33.4	T31	Hunters Run		
Conventional	Thinning	0.4	T50	Hunters Run		
Conventional	Thinning	8.0	T76	Hunters Run		
Conventional	Thinning	2.2	T80	Hunters Run		
Conventional	Thinning	59.9	T81	Hunters Run		
Conventional	Thinning	0.1	T83	Hunters Run		
Conventional	Thinning	0.5	T84	Hunters Run		
Conventional	Thinning	0.0	T84	Hunters Run		
Conventional	Thinning	100.8	T85	Hunters Run		
Conventional	Thinning	0.0	T85	Hunters Run		
Conventional	Thinning	50.1	T86	Hunters Run		
Conventional	Thinning	16.4	T87	Hunters Run		
Conventional	Thinning	0.8	T93	Hunters Run		In Burn Block
Conventional	Thinning	37.0	T94	Hunters Run		In Burn Block
Conventional	Thinning	0.5	T95	Hunters Run		In Burn Block
Conventional	Thinning	30.0	T96	Hunters Run		
Conventional	Thinning	8.6	T97	Hunters Run		In Burn Block
Conventional	Thinning	0.3	T98	Hunters Run	**392.2**	
		686.7		Little Lick		
Conventional	Thinning	27.2	T34	Little Lick		
Conventional	Thinning	0.8	T36	Little Lick		
Conventional	Thinning	0.0	T36	Little Lick		
Conventional	Thinning	2.0	T41	Little Lick		
Conventional	Thinning	1.0	T69	Little Lick		

Conventional	Thinning	52.3	T71	Little Lick		
Conventional	Thinning	50.6	T79	Little Lick		
Conventional	Thinning	0.0	T79	Little Lick		
Conventional	Thinning	42.8	T88	Little Lick	**176.7**	
		498.7		Spencer Run		
		0.0		Spencer Run		
Conventional	Thinning	48.9	T65	Spencer Run	**48.9**	

Helicopter Regeneration. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*

Method	Cut_Type	GIS_Acres	ID	Name	Total Acres	Comments
Helicopter	Regen	7.9	H2		**7.9**	
Helicopter	Regen	40.7	R1	Spencer Run	**40.7**	
Helicopter	Regen	21.1	H2	Desert Branch	**21.1**	
Helicopter	Regen	39.3	H7	Hunters Run	**39.3**	
		540.4		Hacking Run		
		2,128.0		Hunters Run		
		863.2		Little Lick		
		507.0		Spencer Run		
		946.2		Desert Branch		
		270.4		Big Lick		
		995.5		Coats Run		
		376.8		Cranberry		
		115.9		Cherry River South		
		178.5		Cherry River North		
		343.6		Goose Hollow		
		0.0		Hunters Run		
		0.0		Big Lick		
		0.0		Spencer Run		
		0.0		Desert Branch		
		0.0		Coats Run		
		0.0		Goose Hollow		
		0.0		Cranberry		
		0.0		Goose Hollow		

Helicopter Thinning. Data from *GHFR_ProposedTimberUnits_011620* and *GHFR_Catchments_011320*

Method	Cut_Type	GIS_Acres	ID	Name	Total Acres	COMENTS
Helicopter	Thinning	144.8	H15			
Helicopter	Thinning	92.1	H24			
Helicopter	Thinning	1.0	H25			
Helicopter	Thinning	0.8	H30			
Helicopter	Thinning	34.4	H59			
Helicopter	Thinning	5.3	H60			
Helicopter	Thinning	57.7	H61			
Helicopter	Thinning	1.6	H62			
Helicopter	Thinning	60.5	H63			
Helicopter	Thinning	61.0	H64		**459.2**	
		257.1		Big Lick		
		0.0		Big Lick		
Helicopter	Thinning	0.1	H30	Big Lick		
Helicopter	Thinning	13.2	H48	Big Lick	**13.2**	
		141.2		Cherry River North		
Helicopter	Thinning	4.9	H24	Cherry River North		
Helicopter	Thinning	23.1	H25	Cherry River North		
Helicopter	Thinning	7.1	H59	Cherry River North		
Helicopter	Thinning	2.2	H63	Cherry River North	**37.3**	
		79.0		Cherry River South		
Helicopter	Thinning	22.9	H59	Cherry River South		
Helicopter	Thinning	14.1	H60	Cherry River South	**37.0**	
		995.5		Coats Run		
		0.0		Coats Run		
		376.8		Cranberry		
		0.0		Cranberry		
		967.3		Desert Branch		
		0.0		Desert Branch		
		343.6		Goose Hollow		
		0.0		Goose Hollow		
		0.0		Goose Hollow		
		539.9		Hacking Run		
Helicopter	Thinning	0.1	H14	Hacking Run		
Helicopter	Thinning	0.4	H27	Hacking Run	**0.5**	
		2,009.5		Hunters Run		
		0.0		Hunters Run		
Helicopter	Thinning	50.7	H14	Hunters Run		
Helicopter	Thinning	34.3	H27	Hunters Run		

Helicopter	Thinning	48.2	H30	Hunters Run	
Helicopter	Thinning	0.1	H48	Hunters Run	
Helicopter	Thinning	24.5	H75	Hunters Run	**157.8**
		863.2		Little Lick	
		481.6		Spencer Run	
		0.0		Spencer Run	
Helicopter	Thinning	34.9	H61	Spencer Run	
Helicopter	Thinning	28.9	H62	Spencer Run	
Helicopter	Thinning	2.2	H64	Spencer Run	**66.1**

Gauley Healthy Forest Restoration Project
Hydrology Effects

Methodology

This analysis considers the existing condition of the project area and the potential for changes to these conditions as a result of proposed project activities. Sources of data include databases (e.g. GIS/LiDAR), Forest monitoring and surveying, field visits to project or general Forest (individual or with project Interdisciplinary Team (IDT)), literature review, and data/determinations from other specialists. Information used in the analysis includes such factors as miles of temporary road (reconstruction on existing features or new construction), size of area impacted, amount of fine sediment, proximity of activity to streams or other features, etc. Using these factors, an assessment of the impacts is made in terms of likelihood of impacts to occur (low, medium, or high), level of impact (minor or substantial), and duration (short-term or long-term). Minor impacts would tend to be of little or no consequence to existing resource conditions (relative to size of treated area, etc.) and trends but substantial impacts would likely cause material changes to existing resource conditions or trends. Short-term would mean lasting weeks to a few years. The spatial scale of the analysis ranges from sub-watershed (HUC-12) scale to smaller tributary catchments and treatment area.

Assumptions

- Temporary roads created on previously undisturbed land ("new construction") will have different impacts than temporary roads created on existing "legacy" road features ("reconstruction").
- "Decommissioning" of temporary roads, in most cases for this project, will consist of the following activities.
    - Removing stream crossing structures and fill material
    - Removing all culverts
    - Installing water bars or other water diversion structures
    - Revegetating exposed soil adequate to address erosion
- "*… returned to productivity*" (RF15) means

Existing Conditions

The project area contains portions of six 6th level (HUC-12) sub-watersheds although project activities will occur in only in the western portion of the 23,756-acre North Fork Cherry River sub-watershed. The proposed project activities are mostly contained within nine catchments ("watersheds") of streams that are tributary to the North Fork Cherry River. The remaining project activities occur in areas that drain directly to the North Fork Cherry River and not via one of its tributary streams.

The project area contains an estimated (from GIS LiDAR) 472 miles of non-system (i.e. legacy) roads, of which approximately 32 miles will be reconstructed for use by this project. These are of various ages and have undergone varying degrees of recovery in the years or decades since their original use. They have mostly become covered with duff and other organic material over this time and thus erosion and sedimentation are generally minimal. Although mitigated to some degree by the accumulation of duff and organic material, compacted and in-sloped road surfaces continue to reduce infiltration and capture intercepted groundwater and upslope overland surface flow. Road surface and cut-slopes have minimal or no tree growth compared to areas on either side of the road. This is likely due to the diminished soil productivity conditions from having top soil and organic matter removed in the creation of the road, as well as from shading by the forest canopy on either side of the road.

Three sites monitored as part of the AEUI (Aquatic Ecological Unit Inventory) monitoring are within the North Fork Cherry River sub-watershed, one of which (Bear Run) is located upstream of the proposed project activities. Fine sediment data measurement is part of this monitoring. Two size classes (4mm and 1mm) are used because they have been shown to be significant threshold levels for effects on aquatic organisms. For instance, brook trout biomass starts to decline when the percentage of fine sediment <1mm exceeds approximately 5% (Edwards et al. 2007). All of the sites in this sub-watershed have levels of fine sediment (<1mm) that exceed this 5% level at which brook trout biomass starts to decline. A summary of the fine sediment, both 1mm and 4mm grain sizes, are shown in Table 1 below.

Stream Site	Sample Date	Smaller than 4mm (%)	Smaller than 1mm (%)
Bear Run (Cherry R.)	08/01/2011	24.73	11.48
Bear Run (Cherry R.)	07/25/2016	34.80	16.84
Desert Branch	08/03/2010	27.10	12.73
Desert Branch	08/01/2016	15.82	9.86
Hunter’s Run	05/18/2009	27.70	12.94
Hunter’s Run	08/11/2015	37.63	12.42
Hunter’s Run	07/17/2019	33.28	14.33

Table 1. Percentage of stream bed material with a grain size smaller than 4mm or 1mm. When the percentage of bed material smaller than 1mm (last column) exceeds approximately 5%, brook trout biomass begins to decline

Effects:

Impacts Associated with Timber Harvesting.

The activities associated with timber harvesting that have the greatest potential for impacts to hydrologic resources are those that involve the disturbance or removal of ground cover, thus exposing bare soil. The largest source of sediment in forested systems is from skid roads, haul roads, and landings associated with forest harvesting. In particular, the effects are generally associated with landings and road system rather than on areas disturbed by tree cutting and dispersed skidding (Ketcheson et al (1999) and Swift (1988)). Roads and landings associated with timber harvesting produce effects that generally fall into the following three categories: 1) sedimentation and erosion, 2) altered natural hydrologic flow regimes of hillslopes, and 3) diminished resource productivity.

The GHFR project proposes no new permanent system roads so the impacts from roads will be limited to those from temporary roads, including temporary roads used to skid trees to landings. The temporary roads and their respective impacts are grouped into those that are created on existing features on the landscape (i.e. reconstructed on existing "legacy" road features), and those created on previously undisturbed ground (i.e. "new" temporary roads).

The GHFR project proposes creating a total of 61.9 miles of temporary roads, 32.3 miles of which will be created on existing features and 29.6 miles created on undisturbed ground. Most temporary roads (54.5 miles) will be created within the 1,961 acres (3.06 mi^2) of conventional harvest units. 27.6 miles of these will be created on undisturbed ground and 26.9 miles on existing features. The remaining 7.4 miles are outside of any harvest units. Helicopter units contain no temporary roads. This results in a density of temporary roads within harvest units of 17.8 miles of temporary roads per square mile of conventional harvest area (mile/mi^2), and is divided among temporary roads reconstructed on existing features and those created on undisturbed ground as summarized in Table 2 below.

	Length (miles) or Area (mi^2)	Density (miles/mi^2)
Temporary roads, new disturbance	27.6	9.0
Temporary roads, on existing features	26.9	8.8
Temporary roads, total	54.5	17.8
Conventional harvest units (total area)	3.06	N/A

Table 2. Summary of temporary roads within conventional harvest units. No temporary roads in helicopter harvest units.

The creation of temporary roads, especially on hillslopes, generally consists of using a bulldozer to excavate a road prism into the hillside, thus creating a cut-slope on the uphill side of the road bed, and a fill-slope on the downhill side. This process effectively removes the topsoil and organic material from the cut-slope and road surface and deposits it in the fill-slope on the downhill side.

Temporary roads reconstructed on existing features don't involve creating new road prisms, as one already exists, and thus reconstruction of these temporary roads generally entails bulldozing any accumulated soil and organic material from an existing road bed to create a firm travel surface. The potential hydrologic impacts of this project resulting from the reconstruction of temporary roads on existing features is generally expected to involve erosion and sedimentation due to the removal or disturbance of the ground cover.

Impacts of temporary roads created on previously undisturbed ground involve not only the erosion and sedimentation described above, but also alterations to natural hillslope hydrologic flow patterns, and diminished resource productivity. The creation of a new road prism, including a cut slope and a fill slope, on previously undisturbed ground alters the morphology of the hillside such that the in-sloped road surface may capture and divert water down the new road. Captured water may include precipitation that falls directly onto the road prism, overland flow from the area upslope of the road, and/or shallow groundwater intercepted during excavation of the road prism. The compacted road surface inhibits infiltration of the captured water and, in essence, acts as an artificial extension to the natural stream drainage system of the watershed, and thus more rapidly and efficiently exports water from the watershed. Compaction of the road surface during its use combined with the removal of is top soil and organic matter during construction diminish the resource productivity of the road prism in its hydrologic capacity to infiltrate, store, and transport groundwater, and in ability to support vegetation, including vegetation required to protect and stabilize the bare ground from erosion as part of decommissioning measures after the use of the temporary road. Tree volume on temporary road surfaces, for example, has been estimated to be reduced by as much as 80% (Carr, 1987), and results from BMP monitoring on the Forest have shown the difficulty in establishing a vegetation ground cover that is effective at protecting bare ground from erosion.

The CE category under which this project falls requires that all temporary roads constructed or reconstructed for this project be decommissioned within 3 years of project completion. Guidance on road decommissioning is provided by the MNF Land and Resource Management Plan (i.e. Forest Plan), National Core BMP Technical Guide (BMP Tech Guide) FS-990a, and FSM 7734. The Forest Plan (RF15, p. II-55) and the National Core BMP Technical Guide (Road-5, Temporary Roads, p. 114) state that temporary roads are to be decommissioned/rehabilitated and the area returned to resource productivity after the access is no longer needed. FSM 7734.02 states the objective of road decommissioning is to "Stabilize, restore, and revegetate unneeded roads to a more natural state to protect and enhance NFS lands". Temporary road decommissioning treatments proposed by the project include the following: removing culverts and stream channel crossings, installing water bars or other cross drain features, and the establishment of a protective vegetation ground cover. It is expected that these erosion and sedimentation impacts can be effectively addressed with the successful application of these decommissioning steps. The greatest potential for erosion and sedimentation occurs the first year post-harvest and generally decreases each year after that. The application of appropriate BMPs have been shown to be 53 to 94% effective at reducing sediment in the first year after harvesting (Edwards and Williard, 2009). Altered hydrology and diminished productivity which result from the altered morphology of the hill slope during the construction of temporary roads on previously undisturbed ground are anticipated to remain as long-term impacts to the hydrologic resources. The impacts of altered hydrology and site productivity are not specifically addressed by water bars and revegetation alone (Kolka, 2004). The decommissioning activities indicated above do not address the altered hillside morphology or the subsurface soil conditions such as bulk density, hydraulic conductivity, soil organic matter and others that affect hydrologic and other resource properties. In a study on road decommission, even 30-plus years after water bar and revegetation treatment these below-ground soil properties and processes remain in a degraded state (Lloyd, et al., 2013). These properties also impact the water-holding capacity, water absorption (or percolation) and groundwater flow.

The project proposes 17 new landings and 23 existing landings as indicated below.

- New, helicopter (4), approximately 8 acres
- New, conventional (13), approximately 6.5 acres
- Existing, helicopter (3), approximately 6 acres
- Existing, conventional (20), approximately 10 acres

As with road construction/reconstruction, landings pose a risk of erosion and sedimentation due to the bare ground that results from their creation and use. BMPs applied to landings are expected to adequately address erosion and sedimentation risks. Landings incorporate drainage along the upslope perimeter to prevent water from flowing on to the landing, thus the only water on a landing is what has fallen directly on to it from precipitation. Additionally, landings do not present a linear, connected flow path for water, they generally seeded, and generally include logging slash at the toe of the landing slope to help arrest sediment movement. Landings are normally located no closer than 100 feet from a perennial, intermittent, or ephemeral stream (Forest Plan Standard SW40, p. II-13).

Impacts Associated with Prescribed Fire and Fuels Reduction Treatments.

The prescribed low to moderate burn is expected to produce a mosaic of burn areas on the forest floor. This mosaic burn pattern will produce some parts of the forest floor that have burned more intensively than others but overall it is expected to retain a ground cover of duff and organic matter sufficient to protect the underlying soil from erosion. The mosaic pattern will also not be expected to produce the long, linear flow paths that are conducive to concentrated flow and erosion.

Suppression activities have a greater potential to create the extended linear flow paths, primarily in the form of dozer lines and hand lines. To address this potential, the Forest proposes using natural features such as streams or rivers whenever possible, and to use the Minimum Impact Suppression Tactics (MIST) when the natural features are not available. The Proposed Action describes these in more detail. Features created to control the prescribed burn such as hand or dozer lines will be rehabilitated after use. By implementing the prescribed burn in the manner described in the Proposed Action, the impacts to hydrologic resources resulting from prescribed burn are expected to be minimal and of short duration.

A summary of the anticipated impacts to hydrologic resources is shown in Table 3.

Impact/Issue	Activity	Likelihood of Impact (Low, Med, High)	Level of Impact (Minor, Mod, Substantial)	Duration (short- or Long-term)
Erosion and Sedimentation	Temporary roads, reconstruct (32.3 miles)	High	Moderate	Short
	Temporary road, new construction (29.6 miles)	High	Moderate	Short
	Timber harvest, conventional (1,961 acres)	High	Minor	Short
	Timber harvest, helicopter (850 acres)	Low	Minor	Short
	Landings, new (17)	High	Minor	Short
	Landings, existing (23)	High	Minor	Short
	Prescribed burn (357 acres)	Med	Minor	Short
Altered Hydrology and Diminished Productivity	Temporary roads, reconstruct (32.3 miles)	Low*	N/A	N/A
	Temporary road, new construction (29.6 miles)	High	Substantial	Long
	Timber harvest, conventional (1,961 acres)	Low	Minor	Short
	Timber harvest, helicopter (850 acres)	N/A	N/A	N/A
	Landings, new (17)	High	Minor	Long
	Landings, existing (23)	Low	Minor	Short
	Prescribed burn (357 acres)	N/A	N/A	N/A

Table 3. Estimation of probable impacts in terms of likelihood of impact, level of impact, and duration. Minor impacts would tend to be of little or no consequence to existing resource conditions (relative to size of treated area, etc.) and trends but substantial impacts would likely cause material changes to existing resource conditions or trends. Short-term would mean lasting weeks to a few years.
*Altered hydrology and diminished productivity of legacy road features are existing features of legacy roads features.

Impacts Associated with System Road Maintenance

Maintenance of roads has been shown to reduce erosion and sedimentation input that these roads pose to water bodies of the watershed in which the roads are located. While they may produce some minor short-term erosion and sedimentation effects during and immediately after maintenance, an overall reduction in erosion and sedimentation is anticipated.

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Edwards, P. J., T. C. Cain, and C. J. Cagen. 2007. Using Multiple Fine-sediment Size Classes to Evaluate the Condition of Trout Spawning Habitat. In Advancing the Sciences: Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, 18-20 October 2004, PNWGRT-689, Portland, OR: U. S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Ketcheson, G. L., W. F. Megahan, and J. G. King. 1999. R1-R4 and BOISED Sediment Prediction Model Test using Forest Roads in Granitics. Journal of the American Water Resources Association, 35(1): 83-98.

Swift Jr., J. W. 1988. Forest access roads: design, maintenance, and soil loss. In: Swank, W. T., Crossley, Jr., D. A. (eds.). Forest Hydrology and Ecology at Coweeta, Springer-Verlag. New York, 313-324

Kolka, R. K., and M. F. 2004. Effects of forest road amelioration techniques on soil bulk density, surface runoff, sediment transport, soil moisture, and seedling growth. Forest Ecology and Management, 202: 313-323

*******START HERE*******

Stevens, Karen L -FS

From: Bard, Jane F -FS
Sent: Thursday, December 19, 2019 3:31 PM
To: Martin, Jay - FS; Mullins, Amelia -FS; Brake, Timothy -FS
Cc: Fry, John - FS
Subject: Potential unit changes for GHFR
Attachments: AddCampgrd.cpg; AddCampgrd.dbf; AddCampgrd.prj; AddCampgrd.sbn; AddCampgrd.sbx; AddCampgrd.shp; AddCampgrd.shp.xml; AddCampgrd.shx; DropUnitsasNeeded.sbn; DropUnitsasNeeded.sbx; DropUnitsasNeeded.cpg; DropUnitsasNeeded.dbf; DropUnitsasNeeded.shp; DropUnitsasNeeded.shp.xml; DropUnitsasNeeded.shx; NewThinsInBurn.cpg; NewThinsInBurn.dbf; NewThinsInBurn.prj; NewThinsInBurn.sbn; NewThinsInBurn.sbx; NewThinsInBurn.shp; NewThinsInBurn.shp.xml; NewThinsInBurn.shx

Here are the units to drop or add, as needed based on acres once Tim is able to calculate the burn acres for us. I used operability/merchantability as a criteria for choosing the ones to drop depending on how many acres we need to drop. Only the portions of stands that fall into the burn block should be added.

Jane Bard
Silviculturist

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Caring for the land and serving people

Stevens, Karen L -FS

From:	Tolley, Tim -FS
Sent:	Thursday, January 30, 2020 5:12 PM
To:	Tasker, Kyle - FS
Cc:	Tolley, Tim -FS
Subject:	RE: GHFR -
Attachments:	GHFRP_Effects_Hydro_Excerpt.docx

Hey Kyle,

I'm still slowly (very slowly) plugging away at the report. I don't expect this report to be too long. We'll just see how it goes.

The WV (silvacultural) BMPs (p. 12) states that skid roads are to be retired and that "... *should be done by first removing the outer berm, then outsloping and smoothing the skid road*.

(b)(5); Deliberative Process Privilege [redacted]

I just wanted to let you know what I was thinking. I've also attached my latest version of what I've written about the temporary roads. I think it says the same thing we were talking about earlier, but maybe a little clearer (hopefully).

Sorry for any confusion.

(b)(6) [redacted]

Tim

From: Tasker, Kyle - FS
Sent: Wednesday, January 29, 2020 9:59 AM
To: Tolley, Tim -FS <tim.tolley@usda.gov>
Subject: RE: GHFR -

Hey Tim,

Thanks for checking in. I'm still plugging along, working mostly on the BA/BE portion of it. I'm definitely glad we have an extra week to work on things after proposed actions and design criteria are approved, this Friday.

Sure, if you want to send me the files you created or store them on the T: drive somewhere I would appreciate it. I haven't created any shapefiles for the temp roads and that is something I have been waiting to dive into. Saving the best for last!

Kyle Tasker
Fisheries Biologist

Forest Service
Monongahela National Forest

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Caring for the land and serving people

From: Tolley, Tim -FS
Sent: Wednesday, January 29, 2020 9:28 AM
To: Tasker, Kyle - FS <kyle.tasker@usda.gov>
Subject: GHFR -

Good Morning Kyle,

I'm just touching base to see how it's going with your specialist's report, specifically to see if you need anything from me. The catchments shapefile is on the T-drive. I've done a little GIS work with temporary roads … miles of new construction and re-construction in catchments and in conventional harvest units. If you need or want any of that I'll send it to you. Also just want to make sure we don't have conflicting numbers, if we're both doing the same things independently.

Really nothing else going on with me on that … just trying to get something written up now.

Tim

Timothy Tolley
Hydrologist

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Elkins, WV 26241
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Caring for the land and serving people

Stevens, Karen L -FS

From: Tasker, Kyle - FS
Sent: Monday, August 31, 2020 10:34 AM
To: Brooks, Gregory - FS
Subject: RE: GHFR BA

Hi Greg,

(b)(5); Deliberative Process Privilege [redacted]

Thanks,

Kyle Tasker
Fisheries Biologist

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Caring for the land and serving people

From: Brooks, Gregory - FS
Sent: Monday, August 31, 2020 10:20 AM
To: Tasker, Kyle - FS <kyle.tasker@usda.gov>
Subject: GHFR BA

Good morning,

(b)(5); Deliberative Process Privilege [redacted]

Respectfully,

Gregory Brooks (Certified Wildlife Biologist ®)
Forest Wildlife & Ecology Program Manager

Forest Service
Monongahela National Forest

p: 304-635-4456
gregory.brooks@usda.gov

Stevens, Karen L -FS

From:	Martin, Jay - FS
Sent:	Thursday, January 23, 2020 7:17 AM
To:	Bard, Jane F -FS; Tarter, Kim - FS; Raione, Richard P -FS; Nottingham, Adrienne C -FS; Coleman, Amy - FS; Tasker, Kyle - FS; Hale, Gavin -FS; Walter, Terry J -FS; Fry, John - FS; Tolley, Tim -FS; Brake, Timothy -FS; Tanner, Cheryl L -FS; Cober, William J -FS; Wilson, Will -FS; Beer, Louis - FS; Torres, Amy S -FS; Stevens, Karen L -FS; Tupis, Pete Jr. - FS; Ash, Jeremy - FS; Artale, Diane -FS; Mullins, Amelia -FS; Conner, Tami -FS; Edwards, Matthew J -FS; Whetsell, Carol L -FS
Cc:	Morgan, Jonathan R -FS
Subject:	RE: GHFR GIS files are locked

GHFR Team,
If you happened to jump in and grab the shapes yesterday after I sent the below message out, you will want to replace the GHFR ProposedTimberUnits_012220. It did not get overwritten yesterday after we made some slight but important changes.

Thanks and let me know if you have any questions.

Jay Martin
South Zone NEPA Planner

Forest Service
Monongahela National Forest, Marlinton / White Sulphur Ranger District

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Caring for the land and serving people

From: Martin, Jay - FS
Sent: Wednesday, January 22, 2020 4:53 PM
To: Bard, Jane F -FS <jane.bard@usda.gov>; Tarter, Kim - FS <kim.tarter@usda.gov>; Raione, Richard P -FS <richard.raione@usda.gov>; Nottingham, Adrienne C -FS <adrienne.nottingham@usda.gov>; Coleman, Amy - FS <amy.f.coleman@usda.gov>; Tasker, Kyle - FS <kyle.tasker@usda.gov>; Hale, Gavin -FS <gavin.hale@usda.gov>; Walter, Terry J -FS <terry.walter@usda.gov>; Fry, John - FS <john.fry@usda.gov>; Tolley, Tim -FS <tim.tolley@usda.gov>; Brake, Timothy -FS <timothy.brake@usda.gov>; Tanner, Cheryl L -FS <cheryl.tanner@usda.gov>; Cober, William J -FS <william.cober@usda.gov>; Wilson, Will -FS <will.wilson@usda.gov>; Beer, Louis - FS <louis.beer@usda.gov>; Torres, Amy S -FS <amy.torres@usda.gov>; Stevens, Karen L -FS <karen.stevens@usda.gov>; Tupis, Pete Jr. - FS <pete.tupis@usda.gov>; Ash, Jeremy - FS <jeremy.ash@usda.gov>; Artale, Diane -FS <diane.artale@usda.gov>; Mullins, Amelia -FS <amelia.mullins@usda.gov>; Conner, Tami -FS <tami.conner@usda.gov>; Edwards, Matthew J -FS <matthew.j.edwards@usda.gov>; Whetsell, Carol L -FS <carol.whetsell@usda.gov>
Cc: Morgan, Jonathan R -FS <jonathan.morgan@usda.gov>
Subject: GHFR GIS files are locked

GHFR Team,
Please find the Proposed Action GIS files here:

(b)(4) [redacted]

Thanks

Jay Martin
South Zone NEPA Planner

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