Board of Forestry and Environmental Quality Commission Joint Meeting

Smoke Management Plan Update

March 3, 2021

State of Oregon
DEQ Department of Environmental Quality

Oregon Health Authority

Presenters

Smoke Management Plan Update

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Doug Grafe, Chief of Fire Protection
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Oregon Department of Forestry

Oregon Health Authority

State of Oregon DEQ Department of Environmental Quality

Goals of the 2019 Smoke Management Rules Update

- Create more opportunity for the use of prescribed fire
- Preserve public health protection, including vulnerable populations
- Encourage timely and comprehensive communications

State of Oregon
DEQ Department of Environmental Quality

Oregon Health Authority

Oregon Department of Forestry

Key Changes to Smoke Management Rule

- Intrusion threshold 26 ug^3 PM2.5 24 hr average or 70ug^3 PM2.5 one hour average.
- Develop Statewide Communication Framework. Develop Community Response Plans for smoke-vulnerable SSRAs.
- Burn more efficiently by removing size and thickness restrictions of polyethylene burn pile coverings.

Smoke Management Statistics

2019

Acres burned: 200,629

10-yr average acres burned: 175,942

Smoke incidents: 38

Smoke intrusions: 6

10-yr average intrusions: 9

2020

Acres burned: 129,427*

10-yr average acres burned: 173,162

Smoke incidents: 1

Smoke intrusions: 0

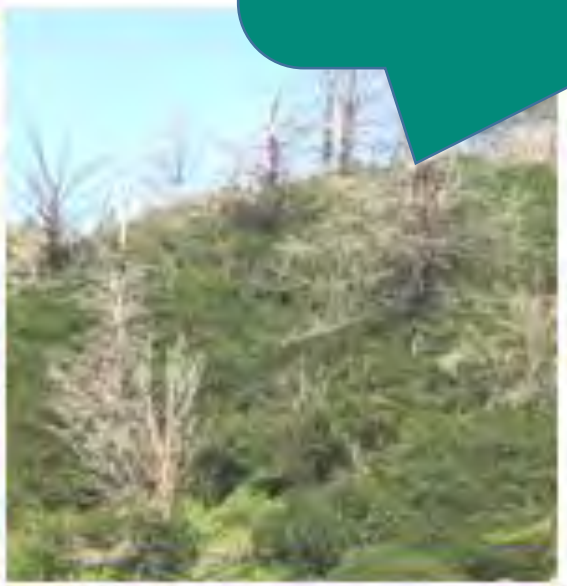
10-yr average intrusions: 8

* COVID, wildfire, and dry fall impacts

Fostering confidence and trust with people in Oregon to ensure the responsible use of prescribed fire in our forested ecosystems

What are the ecological benefits to prescribed fire in the wet season?

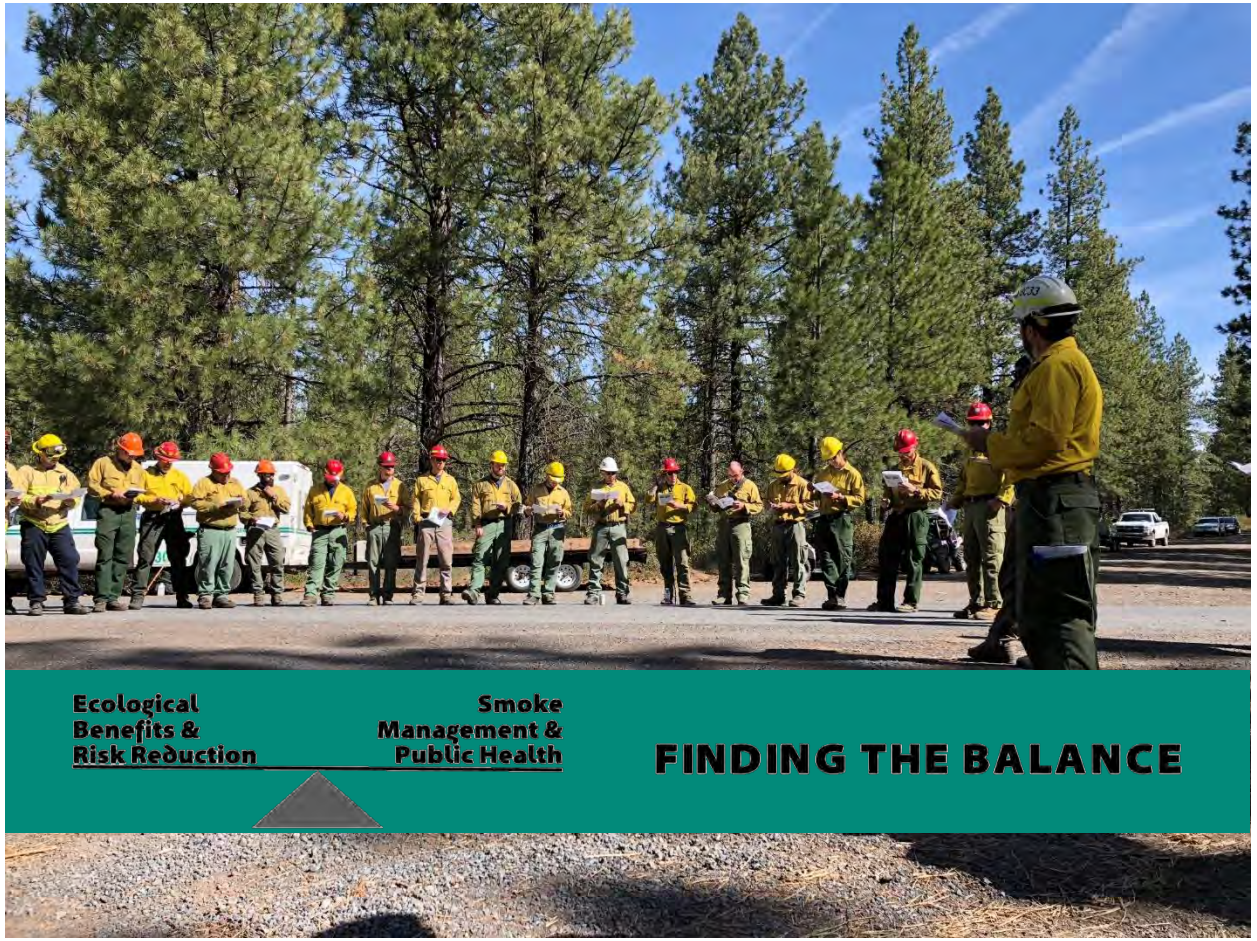


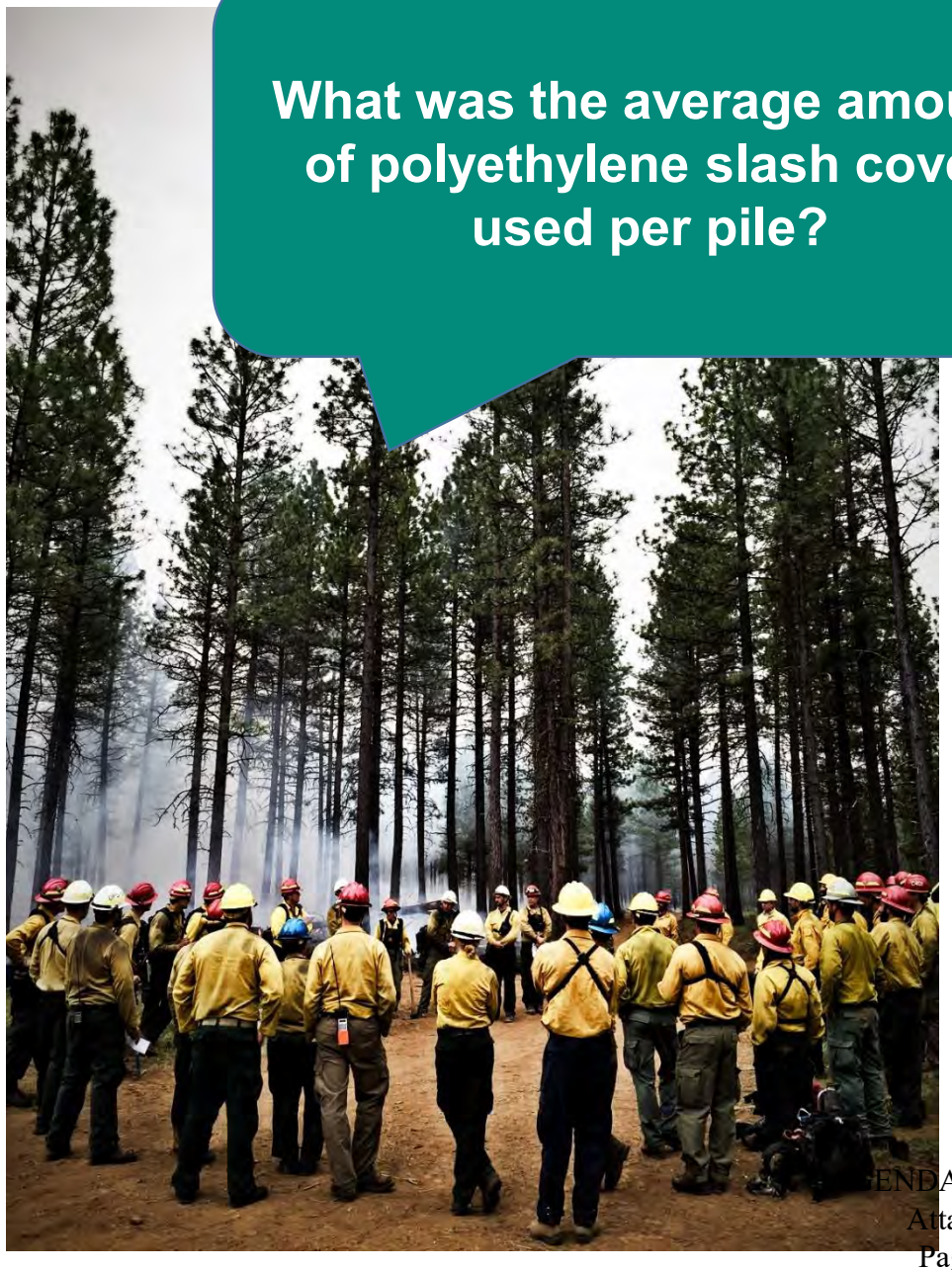





Prescribed Burning Statistics

Best burn practices
Emission reduction techniques



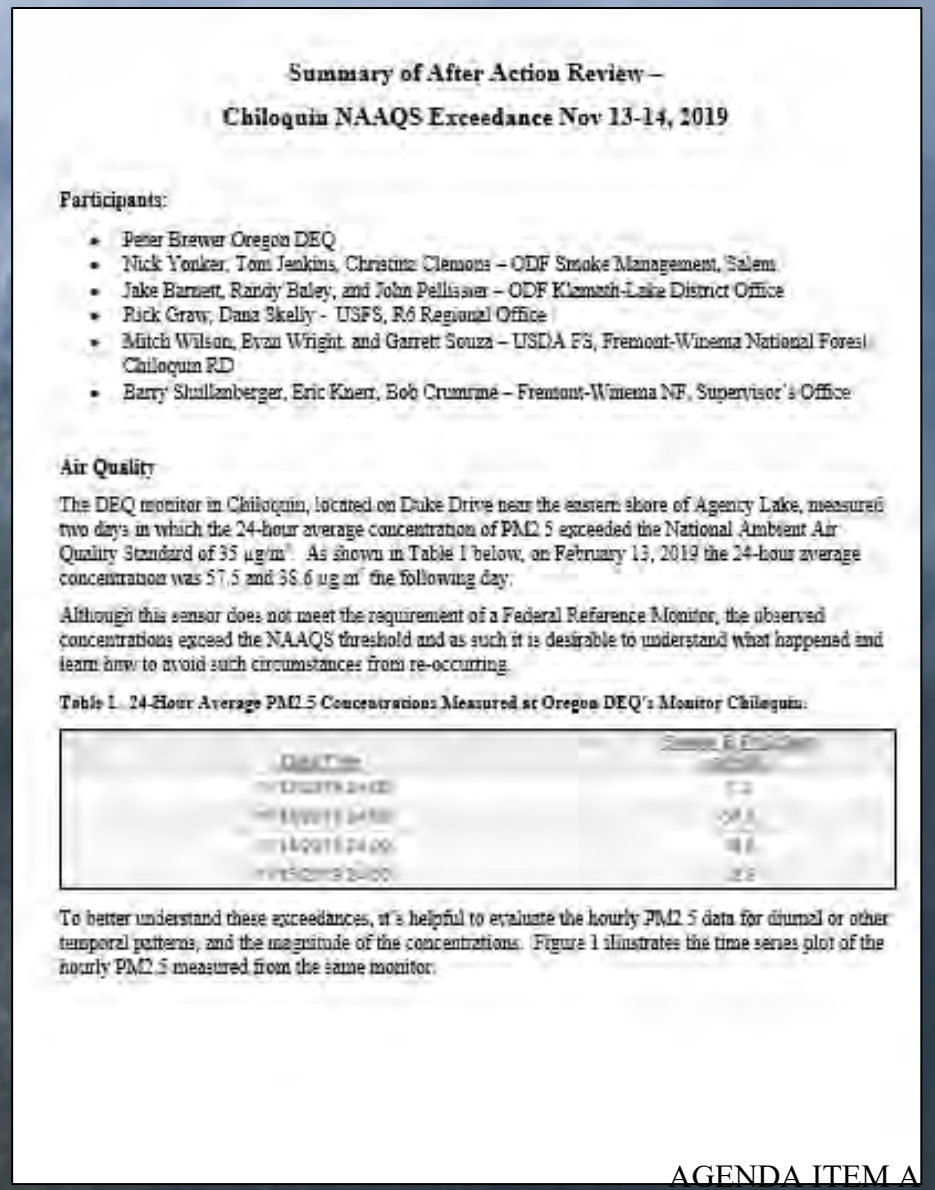


What was the average amount of polyethylene slash cover used per pile?

Alternatives to pile burning

Timely Communication and After Actions Reviews (AAR)

1 – What happened?
2 – What was suppose to happened?
3 – Why did it happen?
4 – What are the lessons learned?



Summary of After Action Review –

Chiloquin NAAQS Exceedance Nov 13-14, 2019

Participants:

- Peter Brewer Oregon DEQ
- Nick Yonker, Tom Jenkins, Christine Clemons – ODF Smoke Management, Salem
- Jake Barnett, Randy Baley, and John Pellissier – ODF Klamath-Lake District Office
- Rick Graw, Dana Skelly - USFS, R6 Regional Office
- Mitch Wilson, Evan Wright, and Garrett Souza – USDA FS, Fremont-Winema National Forest Chiloquin RD
- Barry Stullenberger, Eric Knerr, Bob Crumrine – Fremont-Winema NF, Supervisor's Office

Air Quality

The DEQ monitor in Chiloquin, located on Duke Drive near the eastern shore of Agency Lake, measured two days in which the 24-hour average concentration of PM2.5 exceeded the National Ambient Air Quality Standard of 35 µg/m³. As shown in Table 1 below, on February 13, 2019 the 24-hour average concentration was 57.5 and 38.6 µg/m³ the following day.

Although this sensor does not meet the requirement of a Federal Reference Monitor, the observed concentrations exceed the NAAQS threshold and as such it is desirable to understand what happened and learn how to avoid such circumstances from re-occurring.

Table 1. 24-Hour Average PM2.5 Concentrations Measured at Oregon DEQ's Monitor Chiloquin:

To better understand these exceedances, it's helpful to evaluate the hourly PM2.5 data for diurnal or other temporal patterns, and the magnitude of the concentrations. Figure 1 illustrates the time series plot of the hourly PM2.5 measured from the same monitor.

2020-2021 Smoke Mitigation and Community Response Grants

Lakeview/Lake County

City of Oakridge

City of Ashland

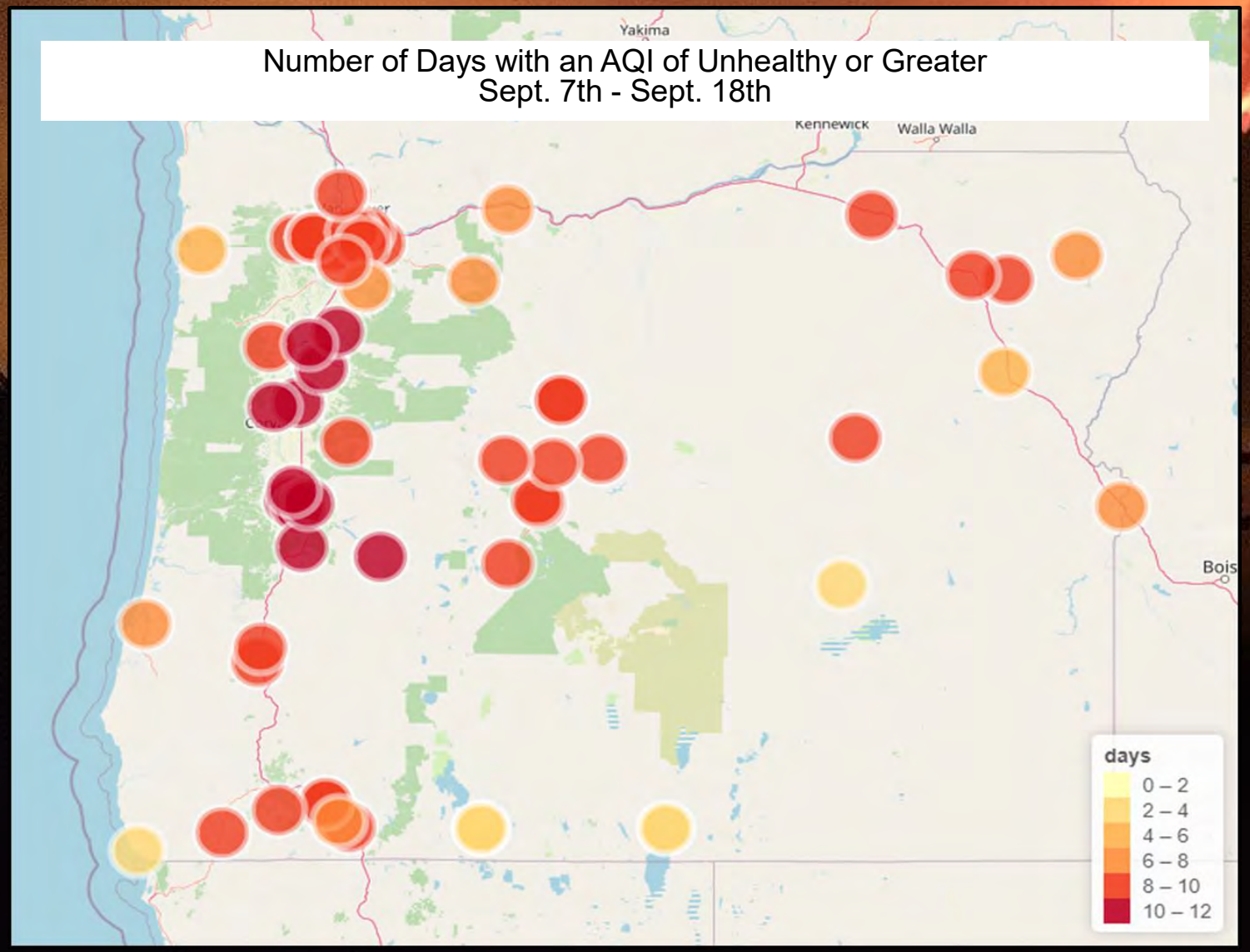
Enterprise/Wallowa County

Baker City/Baker County

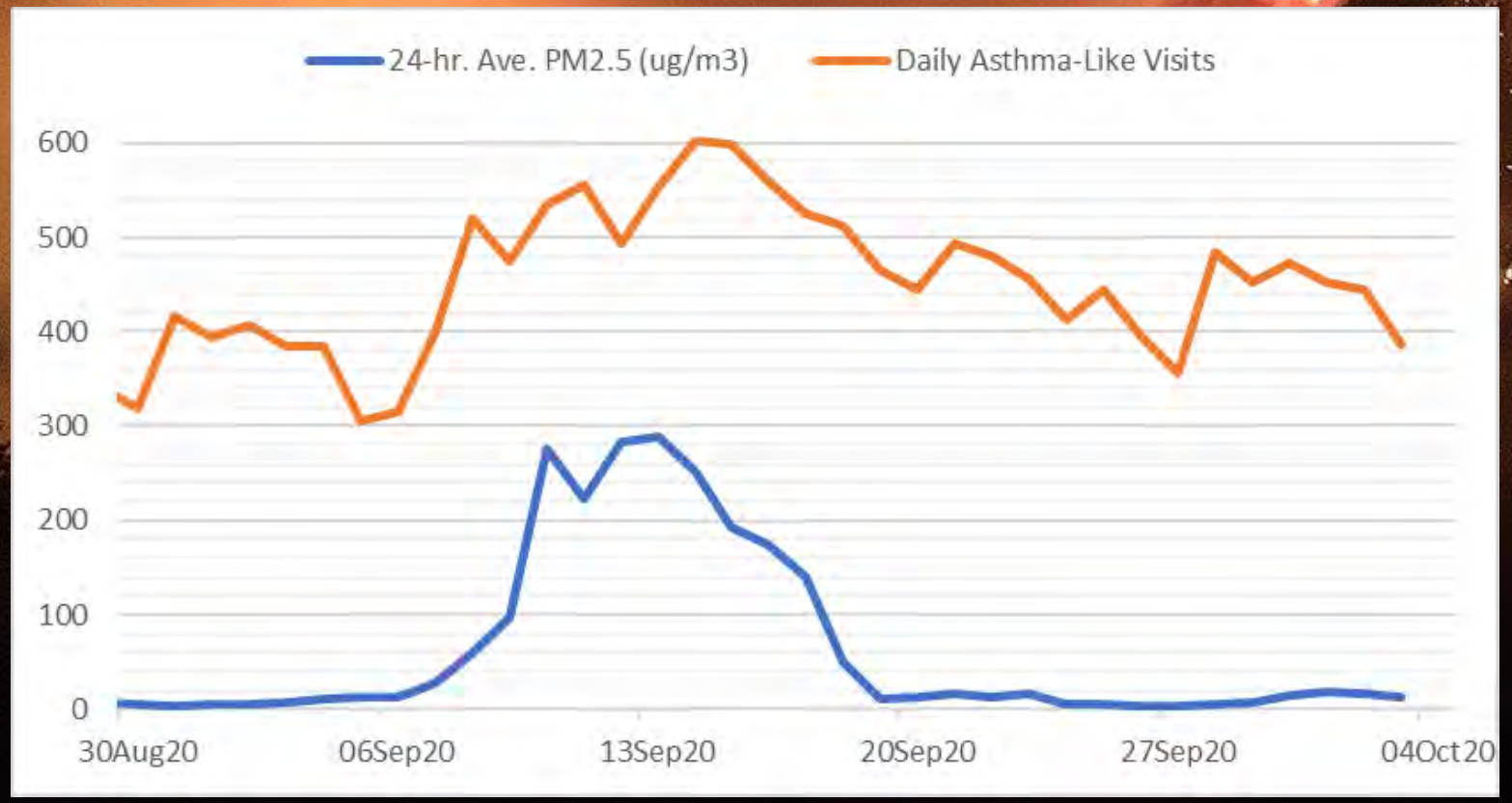
Building Smoke Resilient Communities

- Bend and Ashland have active CRPs
- Bend was approved for the 1-hr exemption in 2019 and Ashland submitted for approval in January of 2021
- Ashland has distributed 400 HEPA air purifiers in 2020 and are distributing another 200 HEPA air purifiers in spring of 2021
- Four other communities working on CRP

PM 2.5 Levels During the September 2020 Wildfire Smoke Event

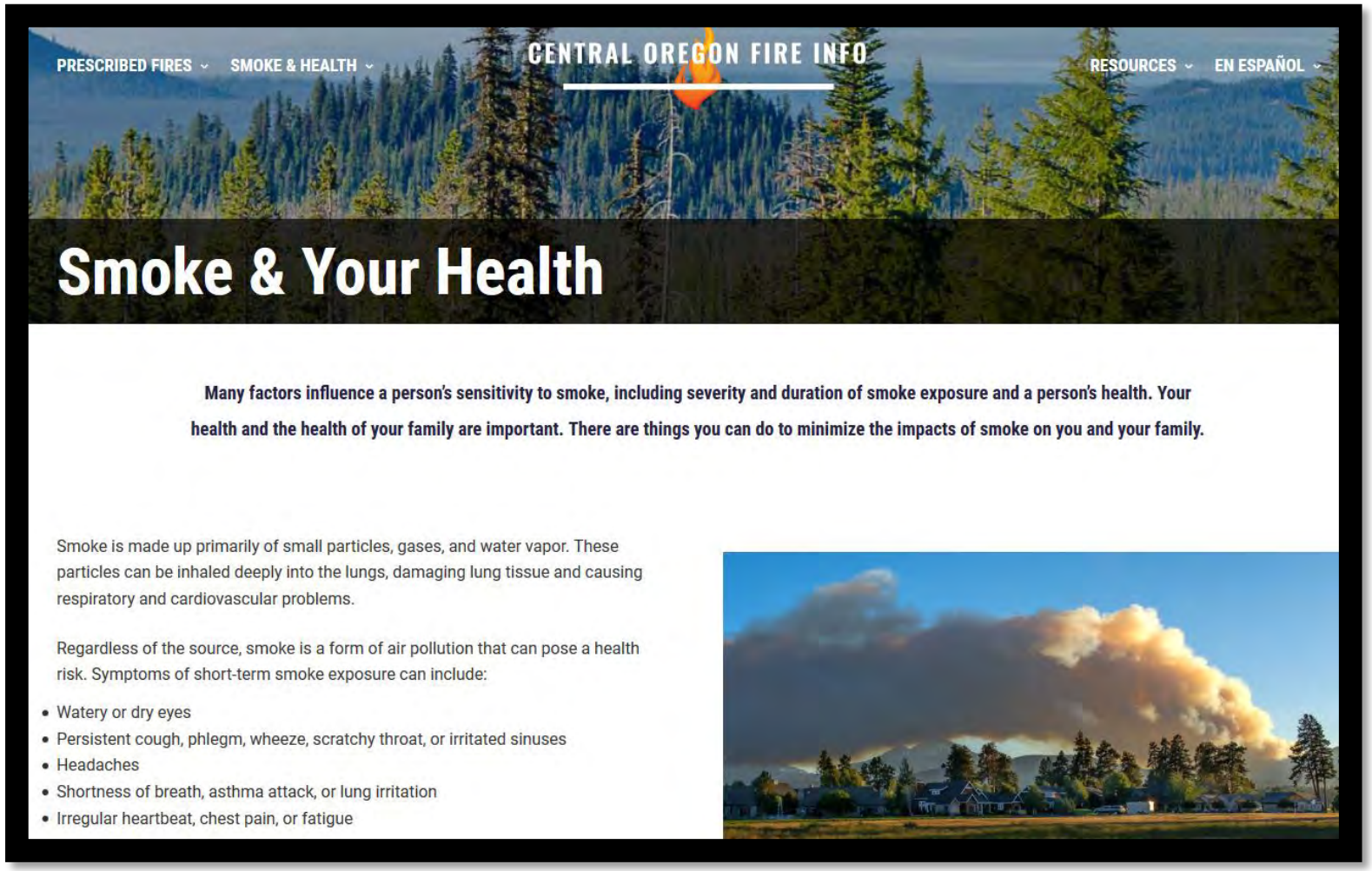


September 2020 Wildfire Health Impacts

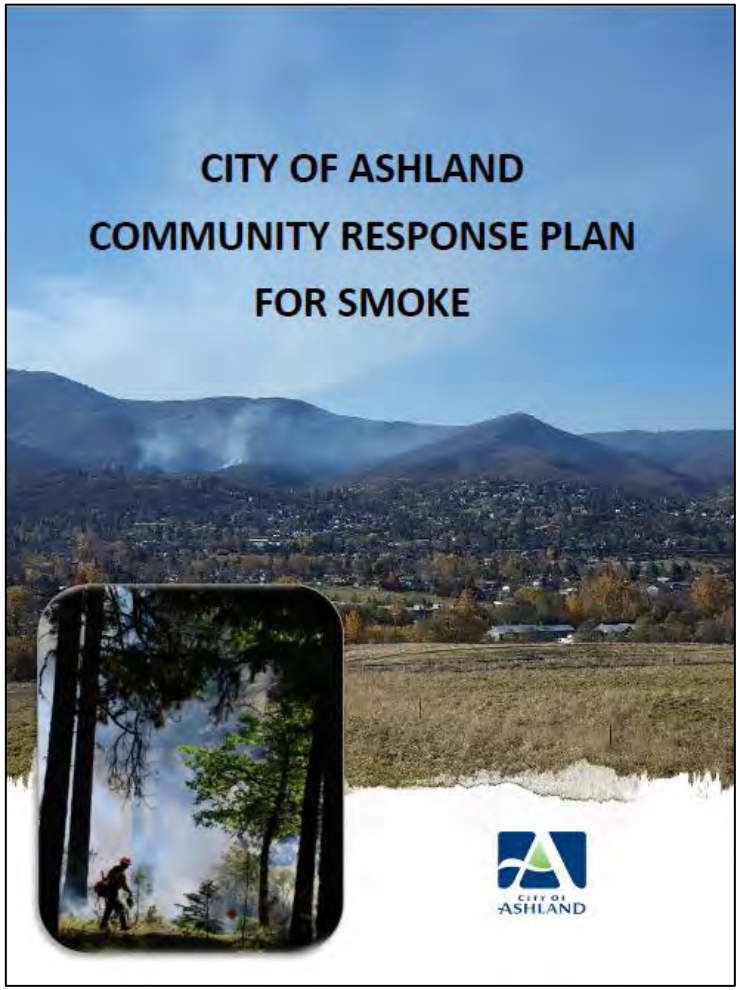


PM2.5 daily 24-hr average concentrations (provisional data from state, regional and tribal air quality monitoring)

Emergency department and urgent care asthma-like visits from near-real-time syndromic surveillance (ESSENCE)

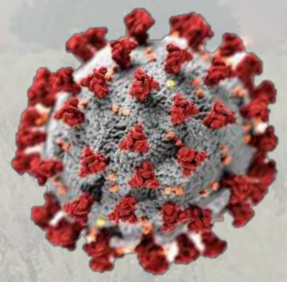


www.centraloregonfire.org



COVID-19 & Smoke Management

- Uniformed messaging
- Volunteer refrain on burning
- Fall and winter prescribed burning guides
  - Uses legacy rules
  - Uses county risk levels



Questions? Thank You!

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Oregon Health Authority

OREGON DEPARTMENT OF FORESTRY

State of Oregon DEQ Department of Environmental Quality

AUTHORITY TO PROTECT WATER QUALITY ON FORESTLANDS

Matt DeVore, Senior Assistant Attorney General
Diane Lloyd, Senior Assistant Attorney General
Oregon Department of Justice
Natural Resources Section

Topics:

- DOJ Advice Memo
  - EQC Authority to Implement the CWA
    - Water Quality Standards
    - TMDL Development
      - Surrogate Measures
      - Reasonable Assurance
  - BOF Authority under Oregon Forest Practices Act
    - Supervise all matters of forest policy and management
    - Establish forest practices that maintain water resources
    - Ensure forest operations do not impair water quality standards
- Coordination

Water Quality Standards

- Designated use or uses for the water body
- Water quality criteria based upon such uses and
- Antidegradation requirements

40 CFR § 131.3(i), 40 CFR § 131.6.

- CWA 305(b) and 303(d) Report

TMDL Formula

$$\mathbf{TMDL} = \Sigma WLA + \Sigma LA + MOS$$

TMDL Development Process

- OAR Chapter 340, Division 42
- Local Advisory Group
- ORS 468B.110 Authority to establish and enforce TMDLs by rule or order

Surrogate Measures

- Where a pollutant is highly variable or difficult to measure directly, surrogate measures may be used as an additional means to express allocations.
- One example, important for nonpoint sources, is the use of riparian shade as a surrogate measure for temperature TMDLs.
- OAR 340-042-0040(5)(b).


Pollutant reduction strategies
Identify relevant Designated Management Agencies
Develop timelines, targets, measurable objectives
DEQ evaluates implementation plans and progress
DEQ action when Designated Management Agencies fail to implement
DEQ tracks water quality status and trends
Reasonable Assurance

TMDL Implementation

- For non-point sources, TMDL allocations are implemented by designated management agencies (DMAs), such as cities, counties and other government agencies (including ODF for non-federal forestlands), as identified by DEQ in the TMDL.
- DMAs develop TMDL implementation plans that may contain regulatory measures, non-regulatory measures, or both, and that are subject to review and approval by DEQ.
- For non-federal forestlands, the Commission has adopted a specific TMDL implementation rule.
  - OAR 340-042-0080(2)

BOF Authority

- The BOF shall supervise all matters of forest policy and management. ORS 526.016(1).

- The BOF has exclusive authority to develop forest practices rules. ORS 527.630(3).

- The BOF shall adopt rules establishing standards for forest practices that ensure the continuous growing and harvesting of forest tree species; and provide for the overall maintenance water resources. ORS 527.710.

BOF Authority

- The BOF shall establish best management practices applying to forest practices as necessary to insure that to the maximum extent practicable nonpoint source discharges of pollutants resulting from forest operations on forestlands do not impair the achievement and maintenance of water quality standards established by the Environmental Quality Commission for the waters of the state. Such best management practices shall consist of forest practices rules adopted to prevent or reduce pollution of waters of the state. ORS 527.765(1).

BOF Authority

- The BOF will coordinate with other state agencies and local governments which are concerned with the forest environment. ORS 527.630(3).

- The BOF shall consult with the EQC in adoption and review of best management practices and other rules to address nonpoint source discharges of pollutants resulting from forest operations on forestlands. Further, the EQC may petition the BOF to require a review of the established best management practices. ORS 527.765.

BOF Authority

- The BOF may adopt rules that set standards for forest practices not specifically addressed in statute, only after determining that certain facts exist and standards are met. ORS 527.714(5)(a) - (f).

- The BOF shall appoint an interdisciplinary task force if forest practices are measurably limiting to water quality achievement. The task force shall analyze conditions within the watershed and recommend watershed-specific practices to ensure water quality achievement. OAR 629-635-0120.

BOF Authority

- Forest operations shall be conducted in full compliance with the rules and standards of the Environmental Quality Commission relating to air and water pollution control. ORS 527.724.

- Operations conducted in accordance with Board's best management practices shall not be considered in violation of any water quality standards. ("BMP Shield"). ORS 527.770.

Coordination

- EQC / DEQ
  - Assess waters and develop water quality standards
  - Develop TMDLs with ODF participation in Local Advisory Group
  - Assess whether reductions are adequate
- BOF / ODF
  - Statutory requirements for findings and criteria for rulemaking
  - Target is achievement of DEQ's determinations of load allocations
  - Flexibility in determining how to achieve the target
- Goal of collaborative process:
  - Commission determines amount of pollution reduction needed
  - Board determines how to achieve those reductions

Temperature TMDL Replacement

- Substantive litigation regarding whether replacement is required is complete
- DEQ and EPA are working together to develop TMDLs
- Schedule in District Court Order

TMDL	Deadline for EPA Approval or Disapproval
Southern Willamette Subbasins	January 15, 2024
Mid-Willamette Subbasins	January 15, 2024
Lower Willamette Subbasins	January 15, 2024
Willamette River Mainstem and Major Tributaries	February 28, 2025
North Umpqua Subbasin	February 28, 2025
South Umpqua and Umpqua Subbasins	February 28, 2025
Applegate, Illinois, Lower Rogue, and Middle Rogue Subbasins	April 17, 2026
John Day Basin	April 17, 2026
Upper Rogue Subbasin	April 17, 2026
Snake River-Hells Canyon	June 4, 2027
Lower Grande Ronde, Imnaha, and Wallowa Basins	June 4, 2027
Middle Columbia-Hood, Miles Creeks Basins	June 4, 2027
Umatilla Basin-Walla Walla Subbasin	May 29, 2028
Willow Creek Subbasin	May 29, 2028
Malheur River Subbasins	May 29, 2028

Thank you

March 3, 2021

Chair Imeson
State Forester Daugherty
Members of the Board of Forestry

For the record, I am Tillamook County Commissioner David Yamamoto, Chair of both the Council of Forest Trust Lands Counties and Forest Trust Lands Advisory Committee. Thank you for the opportunity to address you today.

The 2020 Oregon wildfire season has been one of the most destructive on record. The fires killed at least 9 people, burned more than 1M acres of land, and destroyed over 4000 homes in eight (8) counties with over 40,000 people evacuated.

The Beachie Creek, Lionshead and Riverside fires alone burned over 500K acres, of which roughly 16,600 burned acres belong in the Santiam State Forest. Overall, this was a devastating forest fire year for Oregon and our hearts go out to the families and communities impacted by the fires.

I cannot say enough about the brave men and women of the Oregon Department of Forestry who placed their own lives on the line in order to save the lives of Oregonians and our State's visitors along with their property and livelihoods. Viewing the destruction left behind and looking to the long and laborious process of rebuilding lives and dreams is a testament to the dedication and devotion the men and women of the Oregon Department of Forestry have to Oregon's people, property and way of life.

We cannot prevent forest fires, but I do feel strongly that with proper forest management, we can make great strides in stopping forest fires from turning into conflagrations...but that is a topic for another day. Today, I want to speak to the Department's North Cascade District, Draft Implementation Plan.

While overall, I agree with the concepts presented in the draft implementation plan, there are areas of concern. My primary concern...is ODF doing all it can to capture value as well as finance restoration to the greatest extent possible?

From the public comments received, it is evident that there are many viewpoints pertaining to this draft implementation plan. Allow me to address some of the public comment received. The bulk of comments received pertain to salvage logging. In opposition to salvage logging, critics have raised spurious claims, such as:

- Salvage logging disturbs the "natural reforestation process"
- Climate change the reason to restrain or avoid salvage harvest
- Carbon emissions and lost potential for carbon storage in naturally recovering forests
- Concern about soil erosion and silt in waterways

It must be understood that the trees burned in the fire were either on land when the Counties deeded the land to the State, or were planted with FDF monies derived from ODF harvest. Revenue from these trees was promised to the Counties, and these trees should be salvaged to the greatest extent possible. Salvageable trees should not be left for some other purpose. Similarly, the burned acres should be regenerated in to healthy, productive forests as soon as possible.

The current draft implementation plan considers salvage logging only 4500 acres out of 16,600 acres burned. While ODF is moving faster than ever before to get these sales out, they are behind the industry as a whole. Fortunately, ODF is being more aggressive than BLM or USFS. Salvage timber not harvested by early summer will likely suffer damage from beetles and stain and will bring a lower value the longer it sits.

ODF admits that the amount of charred wood and resulting merchantability is uncertain and is concerned about the private lands salvage harvest driving prices down while constricting available harvest crews. While private timberland owners are quickly salvage harvesting their own lands and sending logs to mills, due to the unprecedented housing boom evident in many parts of the country, timber prices remain at near record levels. It is also important to note the harvest of salvage logs is an inherently dangerous task...even more so than standard logging practices.

All of this begs the question...does ODF have a salvage policy and practice that helps recover value while regenerating state forestlands as quickly as possible to the benefit of both the trust counties and ODF? As we look forward to updating the FMP, we should build these policies in so we can react as quickly as possible when the next conflagration occurs. Trust counties and our special districts rely heavily on continuing timber revenue to finance public safety, fire, schools, healthcare, ports, 911 centers, and many other issues important to our residents, while ODF will soon be scrambling to find additional funding sources to close its own projected budget deficits.

To those that feel that requiring the burned lands to naturally regenerate, I would ask people to take a close look at the Tillamook State Forest. We have people today wanting to stop all logging in the Tillamook State Forest as its an example of a beautiful, pristine forest.

These people have failed to look at the history of this forest and what is referred to as the “Big Burn” which devastated this area in a series of huge conflagrations in the 1930’s until the early 1950’s. Over a period of 20 years, a series of 3 conflagrations burned over 750,000 acres of old growth timber.

While the science of reforestation and young stand management was not well understood at the time, hundreds of school age children, local residents as well a people from across the state were recruited and transported into these burned over areas and replanted huge swaths of what is now the Tillamook State Forest. It is estimated that over 72 million seedlings were replanted which is now mature, working timberland bringing timber revenue and family wage jobs to Tillamook County.

This is perhaps the earliest and largest restoration project ever undertaken in the Pacific NW and when viewed now, some 60 to 70 years later, it is truly a remarkable achievement. Oregon Governor Tom McCall, marking an end to reforestation of the burned-over area, helped to write the closing chapter of the Tillamook Burn story when he visited in June 1973. He told a gathered crowd of tree planters, foresters and dignitaries, that from that point forward, the "Tillamook Burn" was to be known as the Tillamook State Forest.

Additionally, requiring a “natural reforestation process” results in leaving a huge fuel load in the form of partially burned timber while at the same time allowing scrub and undergrowth to outcompete natural seedlings. This leads to a situation where continuous fire danger, due to increased fuel load, remains ever present. From a county health and safety perspective, salvage harvesting to minimize fuel load and replanting and restoration to protect roads and waterways is a primary objective of the trust counties.

I would also like to address the issue of modern forest access road and the danger of erosion and silt in waterways. ODF has done an admirable job of assessing almost 200 miles of road within the fire perimeter. There is much work to be done to address culverts, danger trees, roadbed repair and bank stabilization. Recent studies have shown that modern forest road building does not lead to excess silt and debris in our waterways and lack of roads in our forests does not allow access to fire equipment and manpower needed to quickly knock down the next fire.

I also need to address the questions around carbon sequestration. Oregon is blessed with the worlds premiere carbon sequestration engine…our magnificent forests. A recent publication by the journal Proceedings of the National Academy of Sciences, the study team of USDA Forest Service scientists states "forests and harvested wood products annually offset the equivalent of more than 14% of economy-wide carbon dioxide emissions in the nation".

When we harvest timber to produce wood products, those finished wood products continue to hold sequestered carbon. We then go back and replant which produces a rapid uptake of carbon as the trees reach for the stars. As a forest matures, the uptake of carbon slows and we go in a harvest again, produce finished wood products for our homes and businesses, replant and the carbon sequestration process starts all over again. This process is interrupted when conflagrations burn a forest to the ground releasing carbon into the environment as heat and smoke. Additionally, the USDA Forest Service, in the journal Scientific Reports states "The accumulation of carbon stored in U. S. forests may slow in the future, primarily due to land use change and forest aging".

It goes without saying that the trust counties appreciate the great working relationship we have with ODF and the Board of Forestry. While we may not agree with all aspects of the North Cascade District Draft Implementation Plan, its development needed to occur quickly and now its implementation needs to occur even more rapidly. As I have said before, we will continue to find areas of disagreement, but it is my hope that we will always find ways to remain engaged.

Thank you for this opportunity to address you this afternoon. I would be happy to address any questions you may have.

Respectfully submitted,

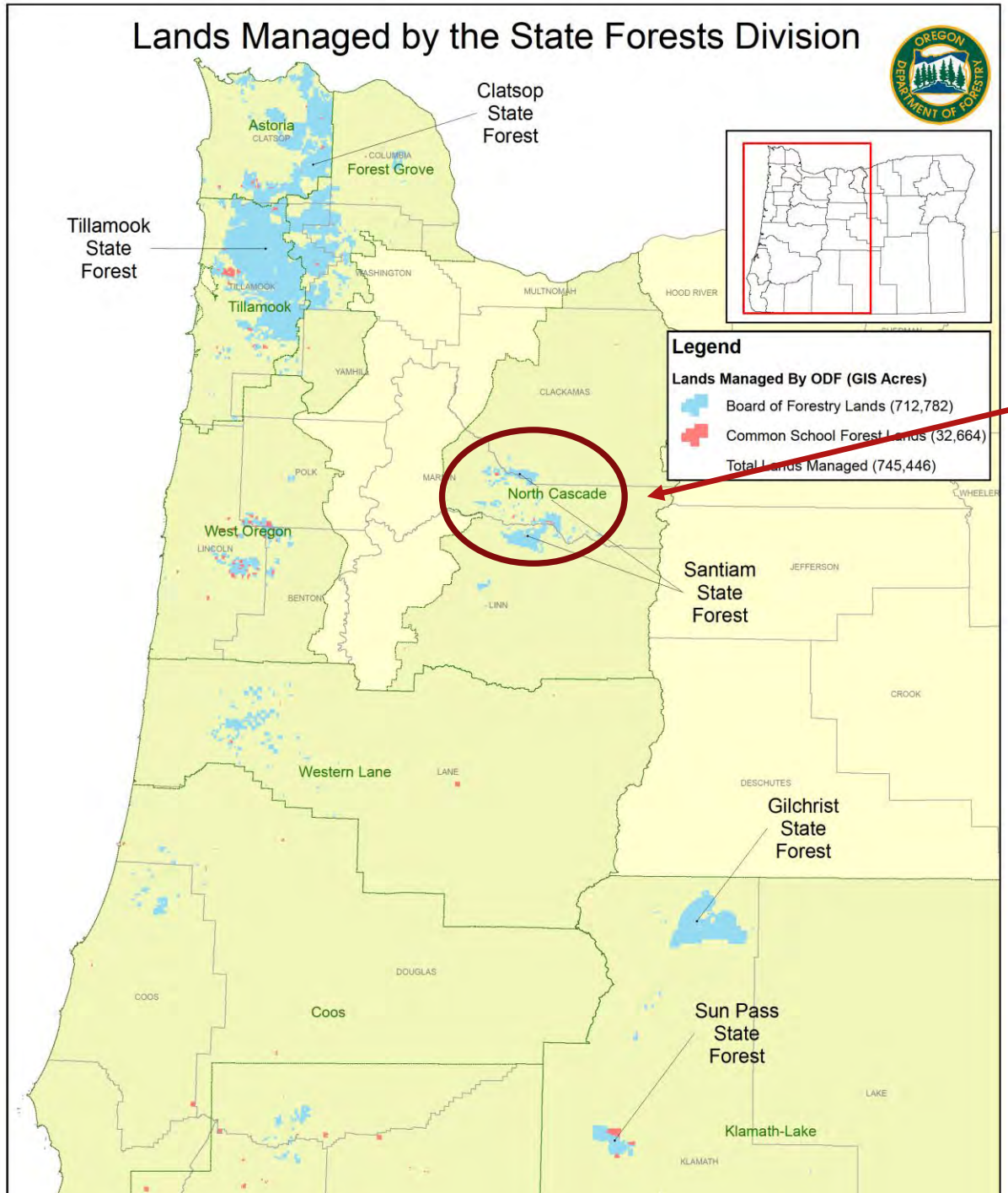
David Yamamoto

Tillamook County Commissioner
Council of Forest Trust Counties, Chair
Forest Trust Lands Advisory Committee, Chair

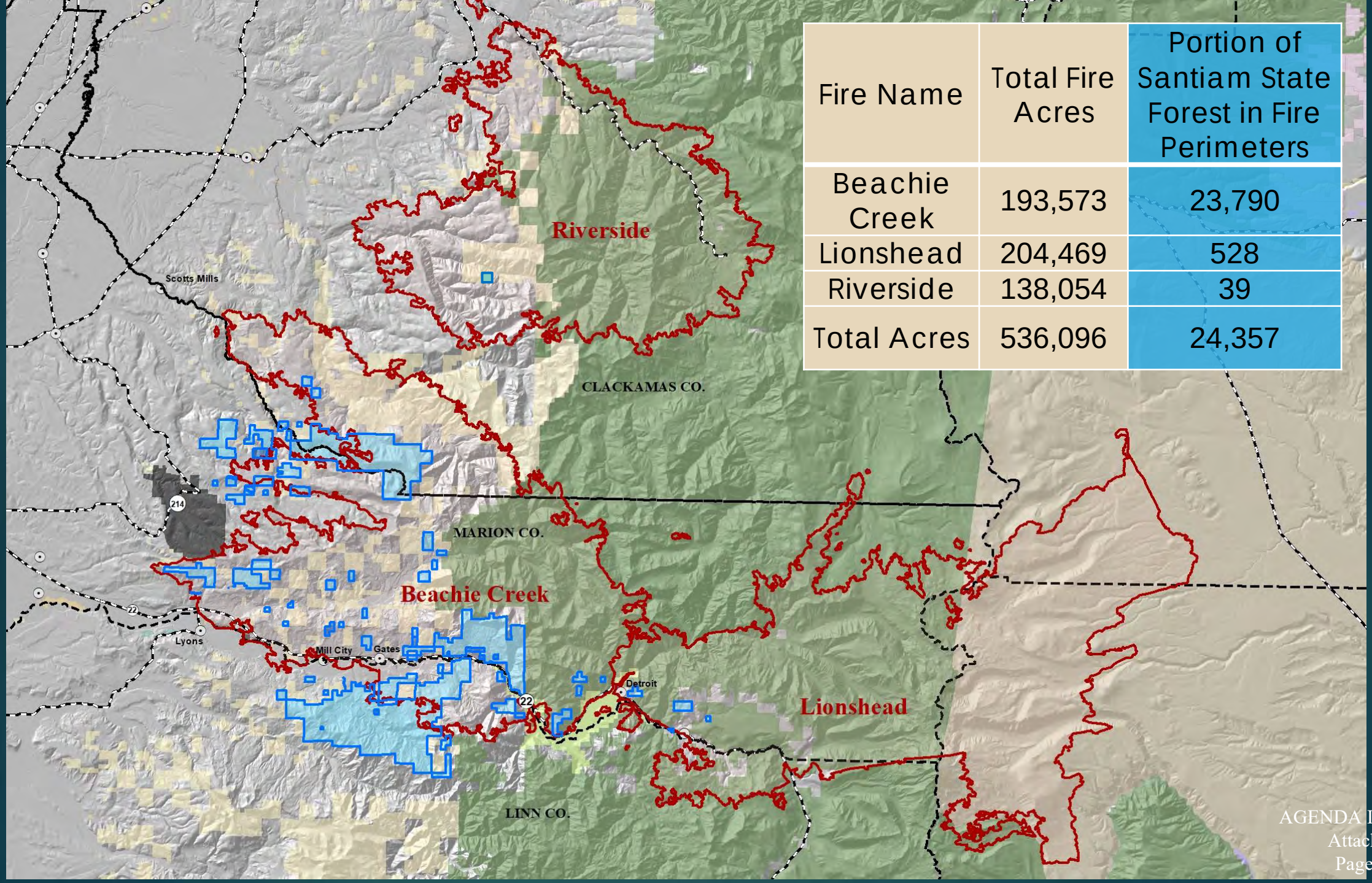
Santiam State Forest

POST-FIRE MANAGEMENT UPDATE MARCH 3, 2021

Liz Dent
Ron Zilli
Jason Cox
Ramona Arechiga

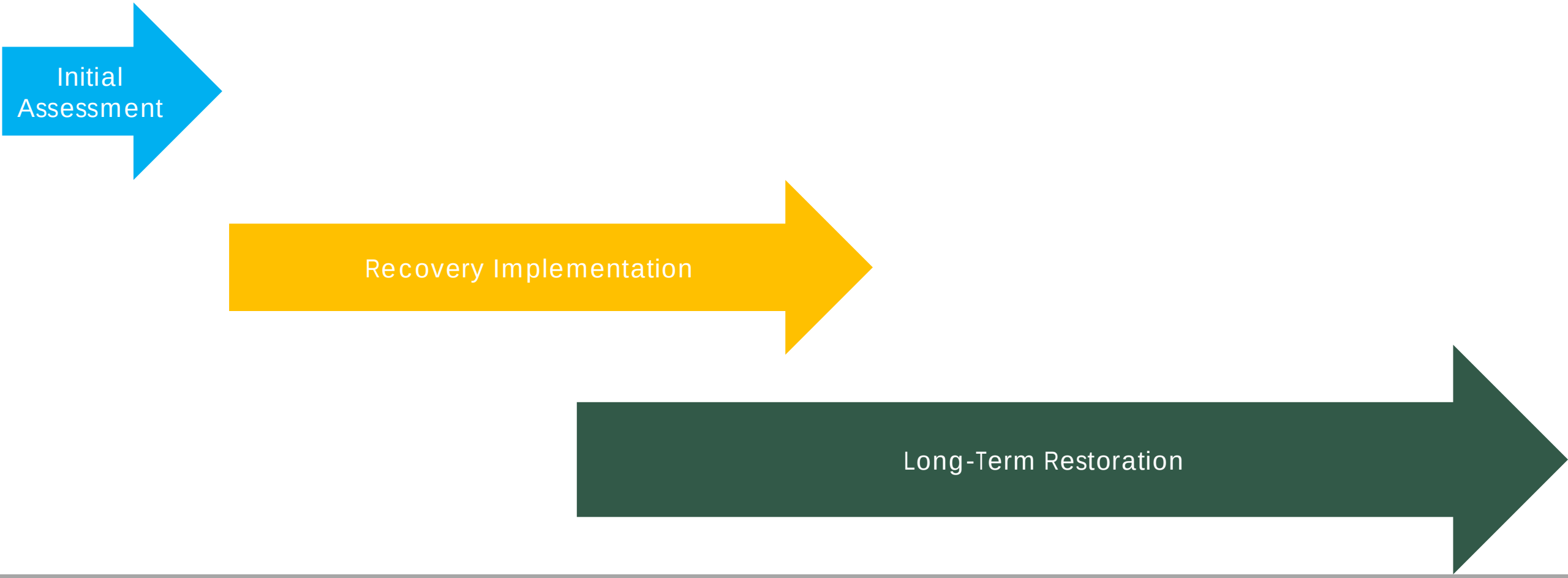


Santiam State Forest Vicinity



Fire Name	Total Fire Acres	Portion of Santiam State Forest in Fire Perimeters
Beachie Creek	193,573	23,790
Lionshead	204,469	528
Riverside	138,054	39
Total Acres	536,096	24,357

Santiam State Forest Fire Response Timeline



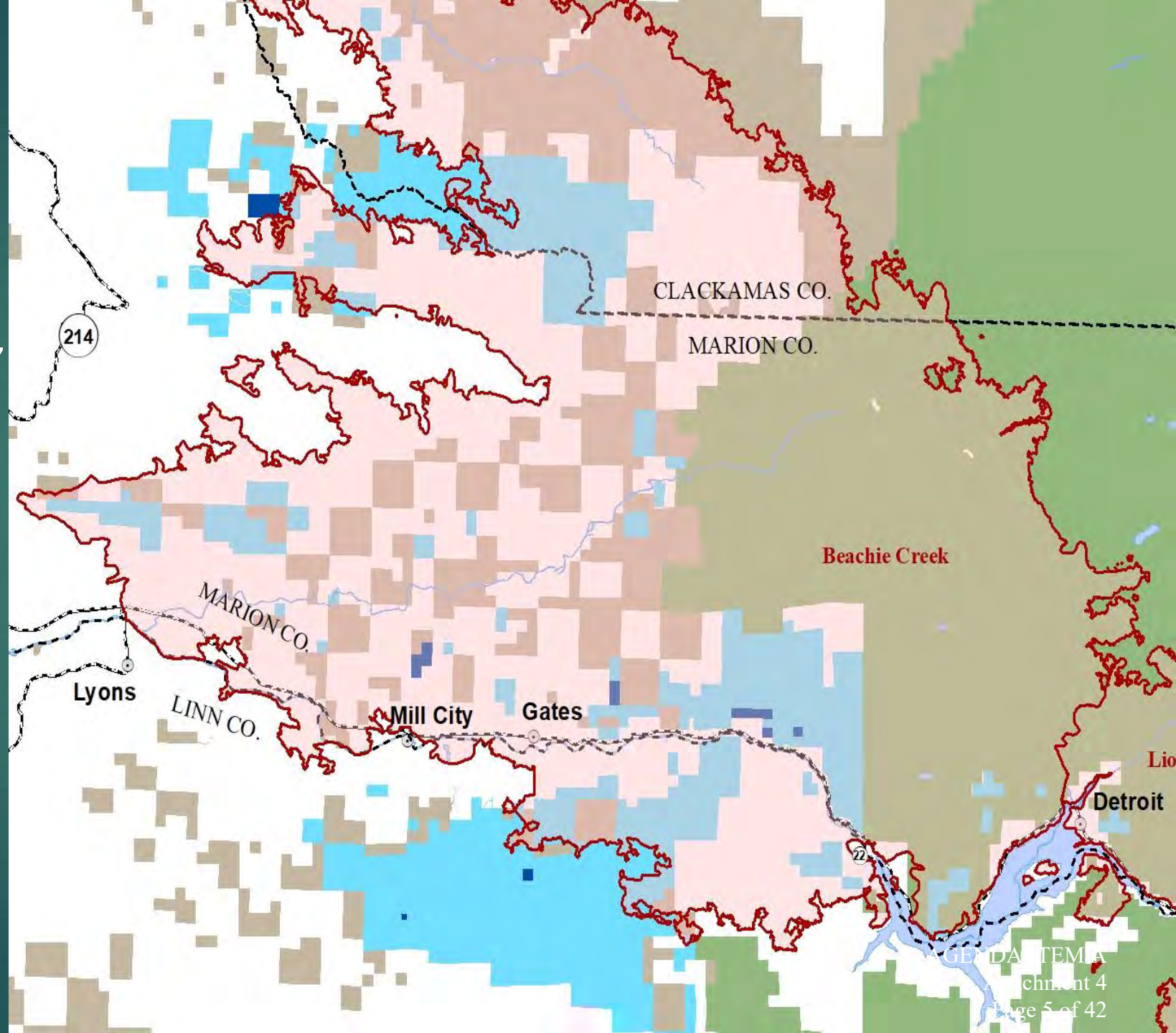
Initial Fire Assessment

Overview

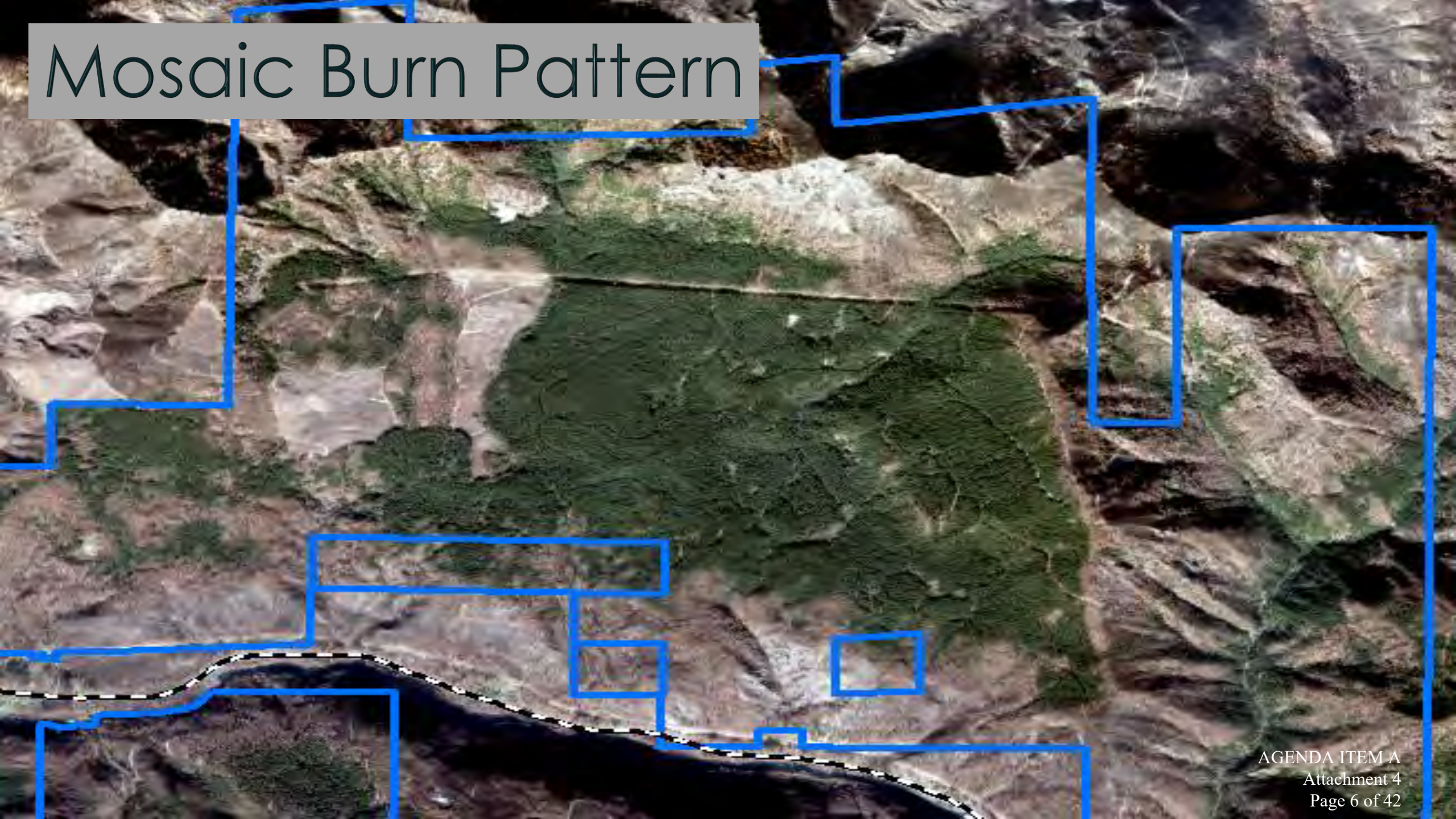
- District Acres = 47,465
- Acres in Fire Perimeters = 24,357
- Acres impacted = 16,614

Resources Impacted

- Public Access / Roads
- Forest Stands burned as a mosaic
- Recreation Facilities and Trails
- Fish & Wildlife Habitat
- Infrastructure



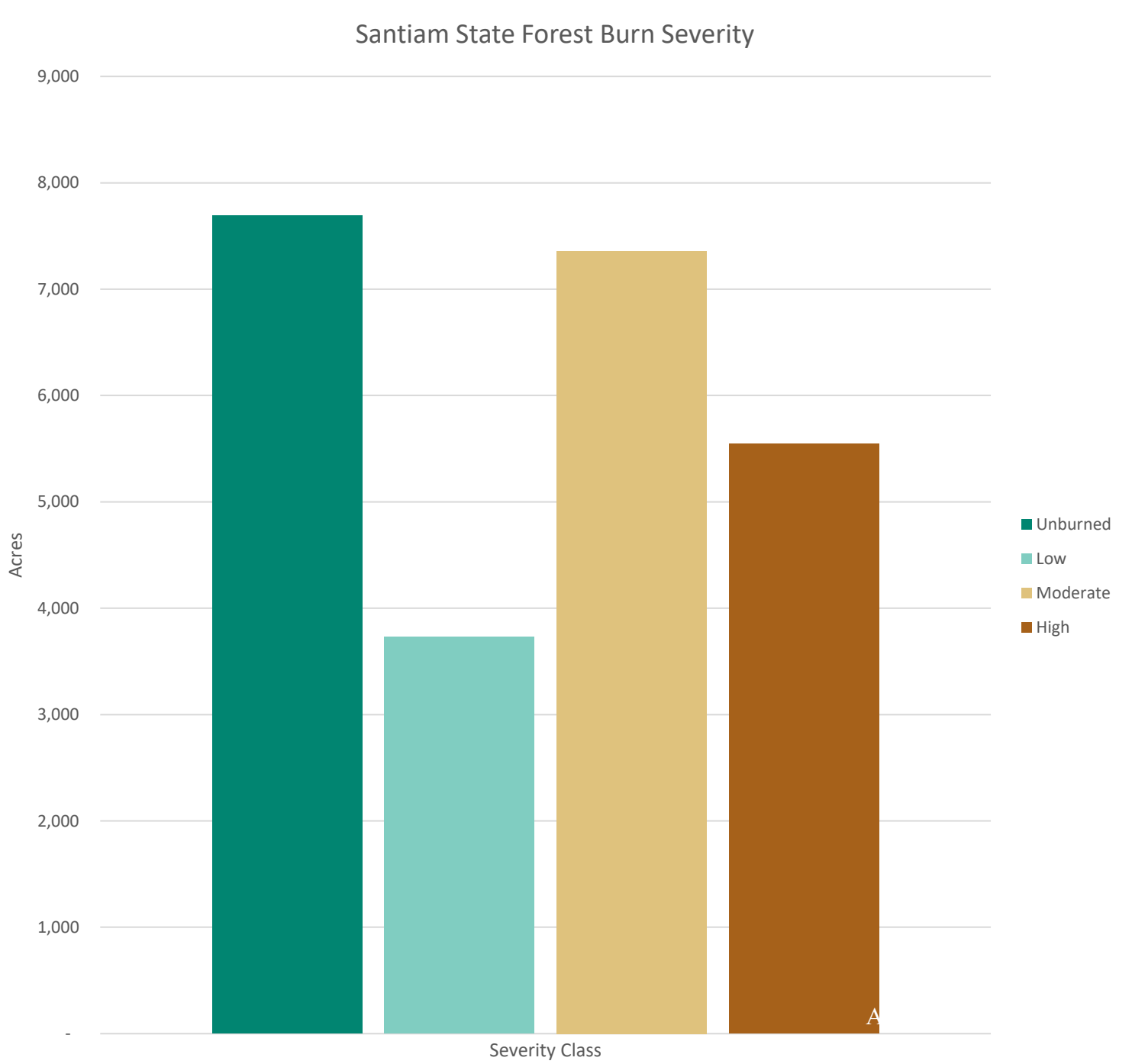
Mosaic Burn Pattern



Burn Severity

Approximately:

- 7,700 Acres - Unburned
- 3,700 Acres - Low Severity
- 7,400 Acres –Moderate Severity
- 5,500 Acres - High Severity



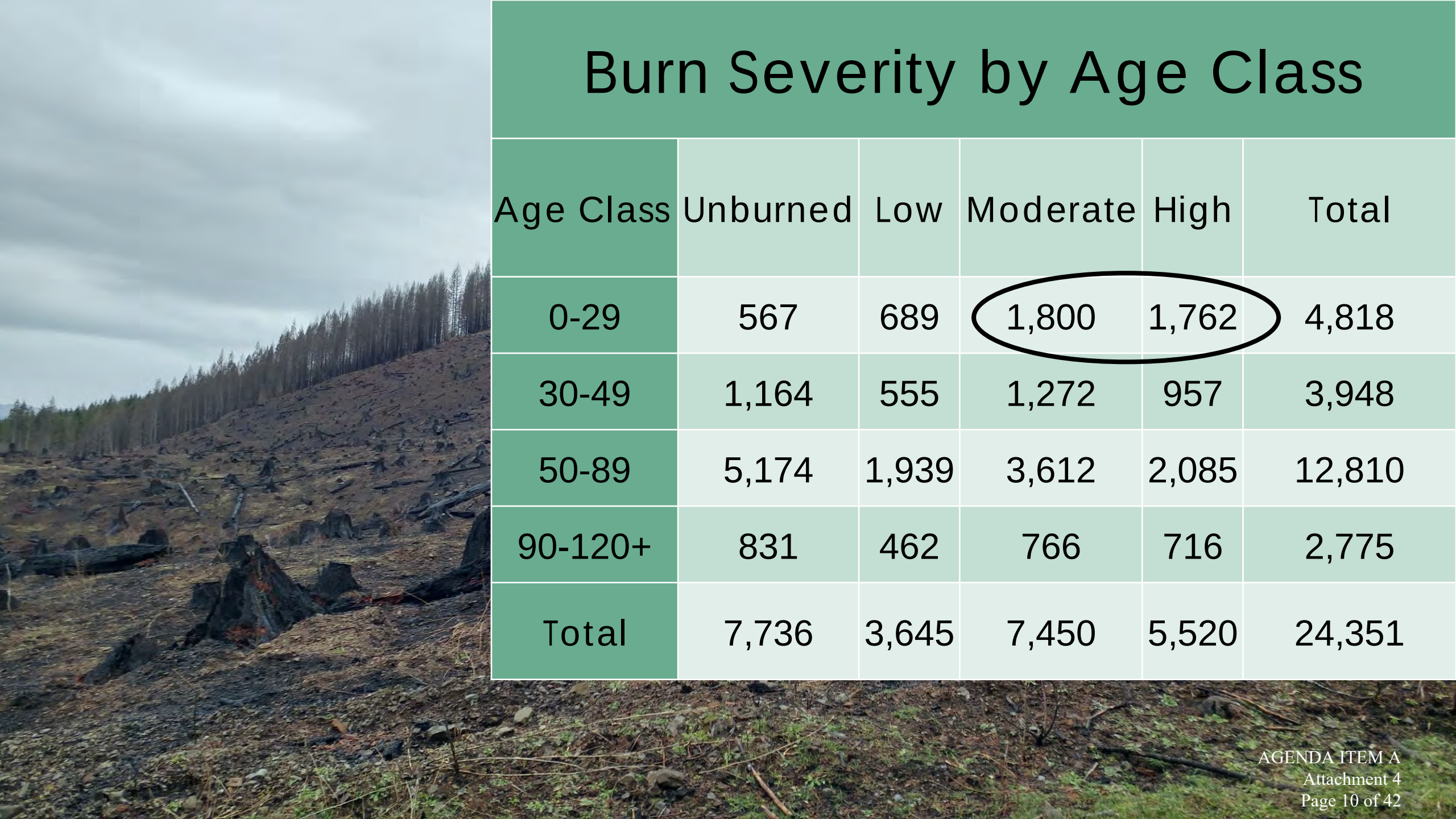

Low Severity


Moderate Severity


High Severity

Fire Impacts By County

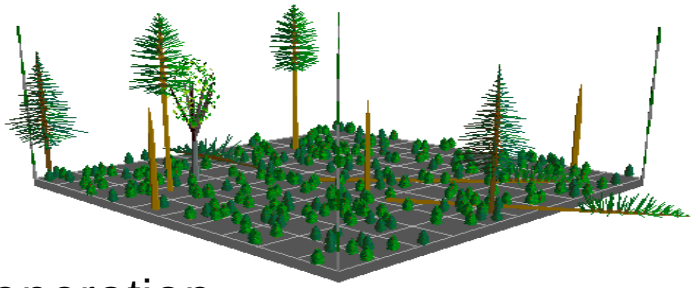
County	Total Acres by County	Acres within Fire Perimeter	**Burned Acres**
Clackamas	7,270	5,239	**3,076**
Linn	21,227	4,753	**2,942**
Marion	18,968	14,362	**10,596**
Total Acres	47,465	24,354	**16,614**



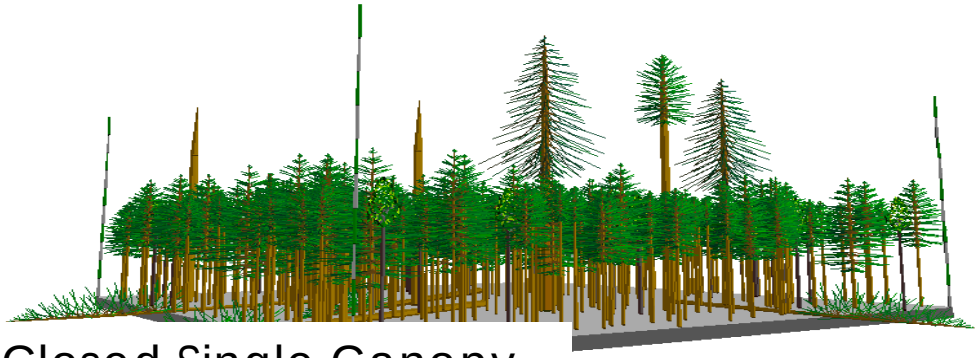
Burn Severity by Age Class

Age Class	Unburned	Low	Moderate	High	Total
0-29	567	689	1,800	1,762	4,818
30-49	1,164	555	1,272	957	3,948
50-89	5,174	1,939	3,612	2,085	12,810
90-120+	831	462	766	716	2,775
Total	7,736	3,645	7,450	5,520	24,351

Managing for a Range of Forest Structures

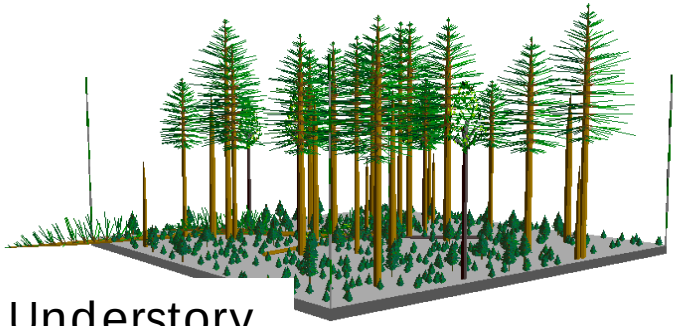


Regeneration

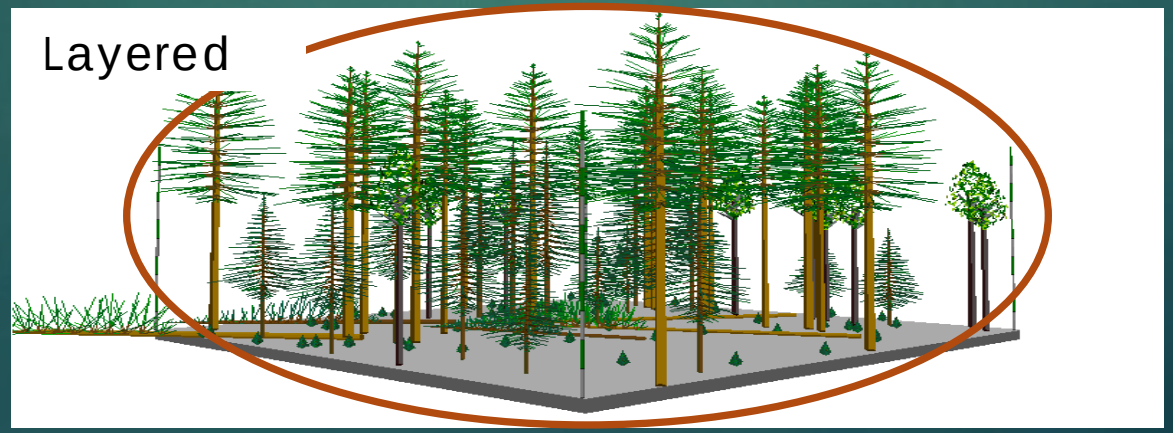


Closed Single Canopy

Older Forest



Understory



Layered

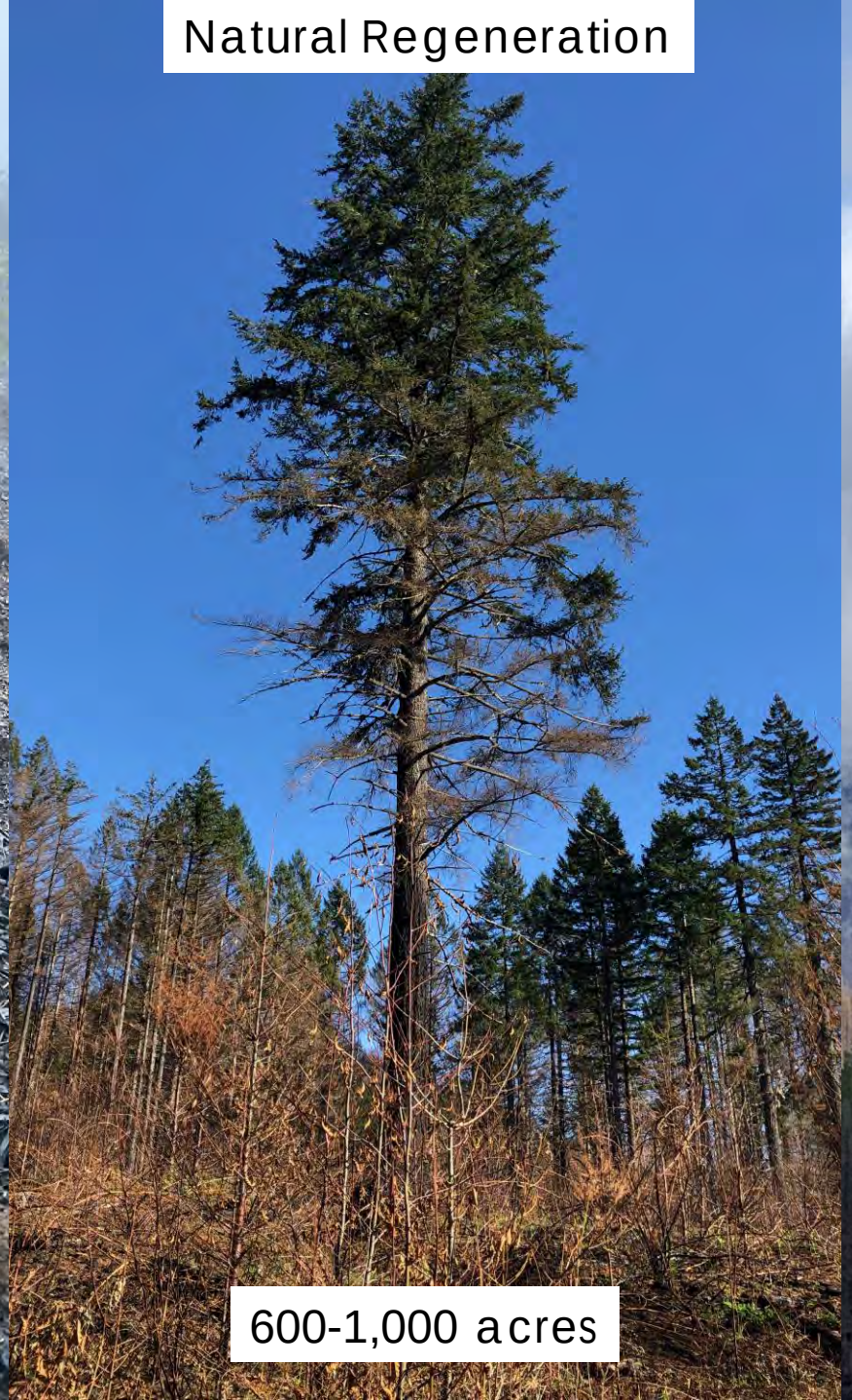
Fire Impacts to Current Forest Stand Structure

	Regeneration	Closed Single Canopy	Understory	Layered	Older Forest Structure	Non-Forest
Pre-Fire Stand Structure Condition (Acres)	4,731	4,021	24,718	8,635	3,831	1,529
Forest Stand Structure Burned (Acres)	1,890 (40%)	1,831 (46%)	9,925 (40%)	1,570 (18%)	916 (24%)	482 (32%)

Fire Impacts within the Desired Future Condition (DFC) Mapped Landscape Design

Mapped Stand Structure	Mapped Acres	Unburned	Burned
Layered	9,376	6,449	2,927
Older Forest Structure	7,078	6,072	1,006
Total DFC Complex	16,454	12,521	3,933


Planting
6,000 – 6,600 acres


Natural Regeneration
600-1,000 acres


Aerial Seeding
4,000 – 4,800 acres

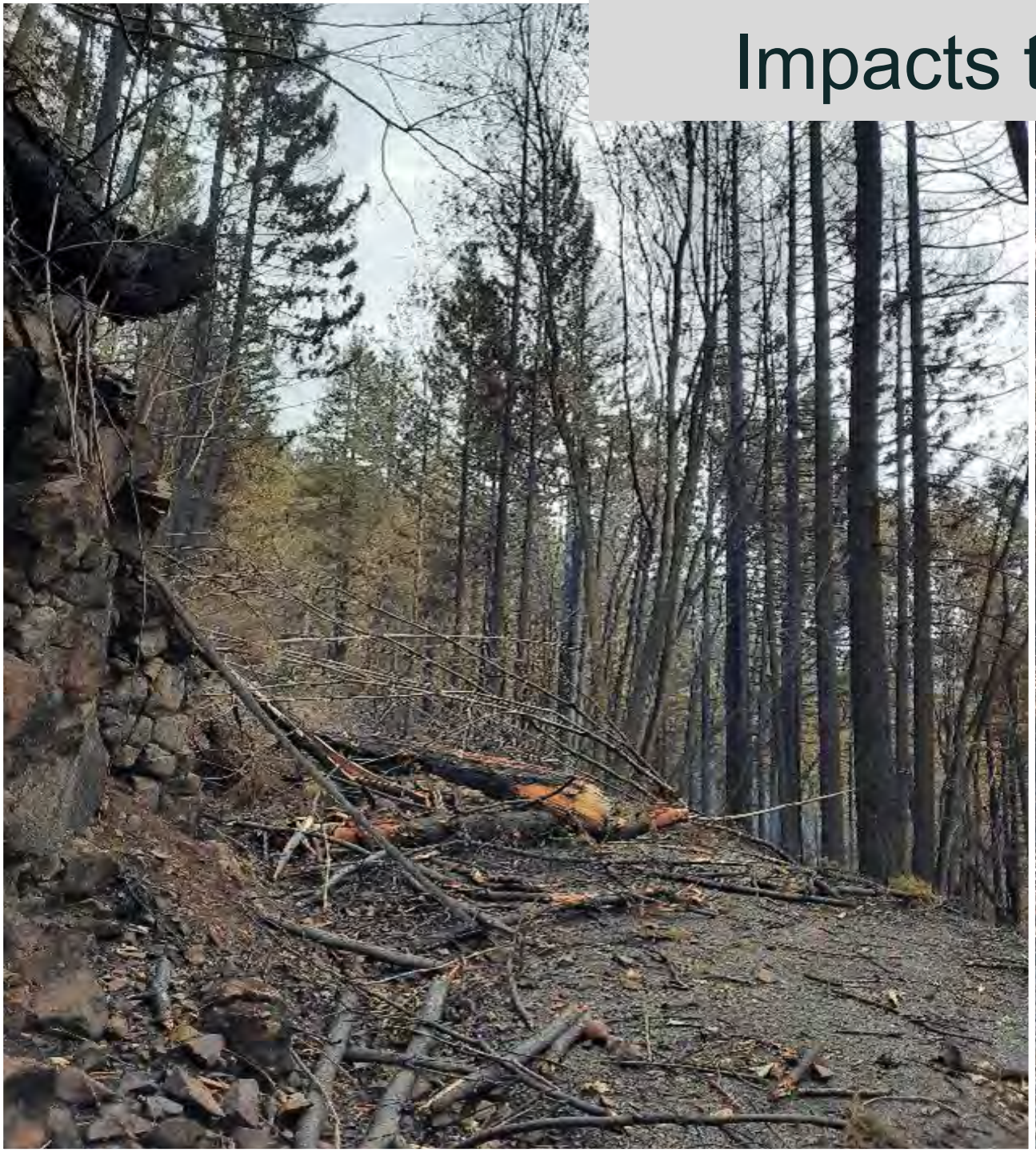
Impacts to Recreation

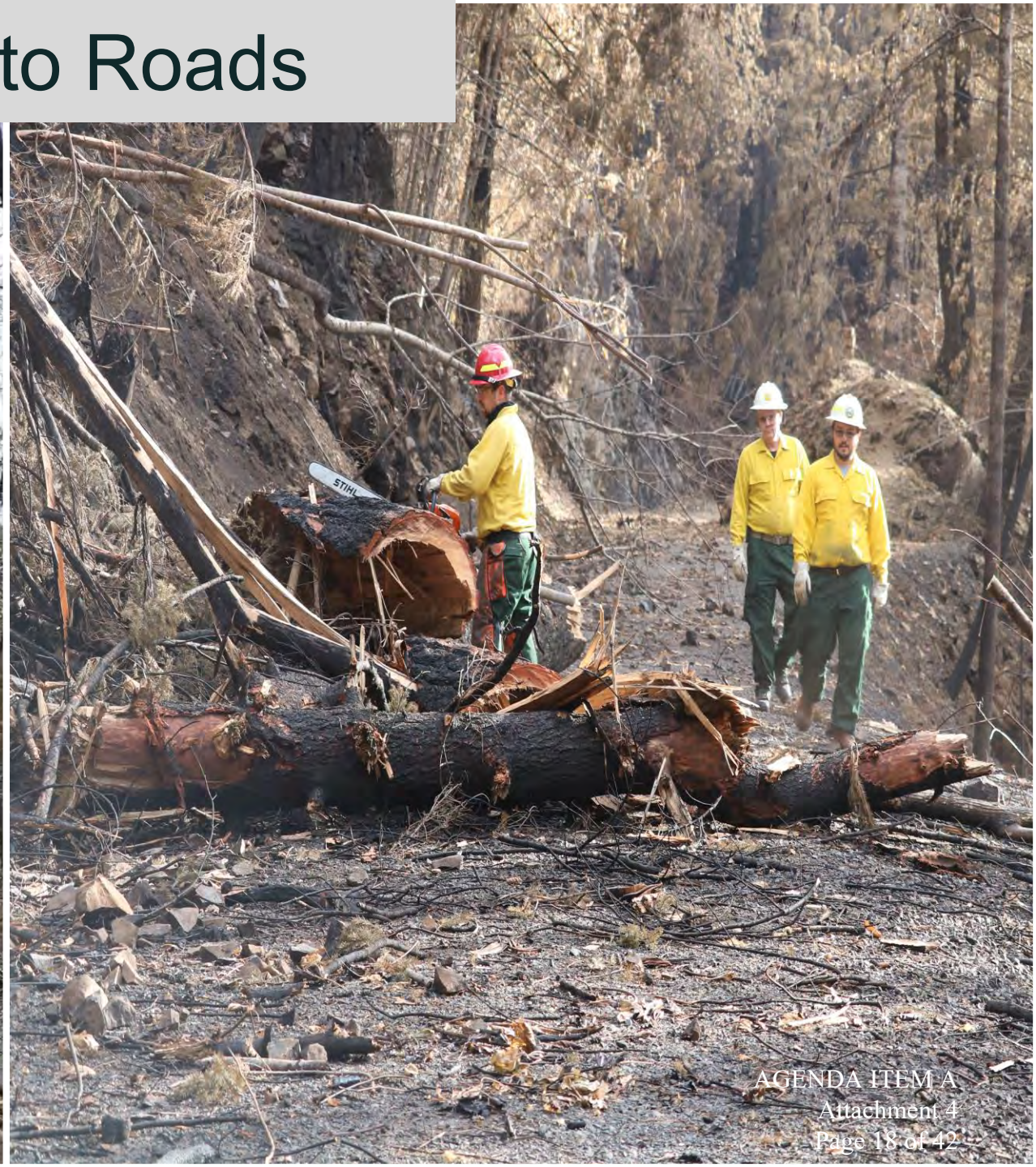
Shellburg Falls

Recreation, Education and Interpretation – Next Steps

- Hazard tree removal around recreation sites and trails
- Initial work on infrastructure repair
- Assessment of potential to relocate and enhance recreation opportunities
- Collecting information for Interpretive opportunities

Impacts to Roads





Roads Recovery Actions

- Hazard tree removal
- Forest road restoration
- Roadbed repair
- Bank stabilization
- Culvert replacement

Range of Burn Severities in Riparian Areas

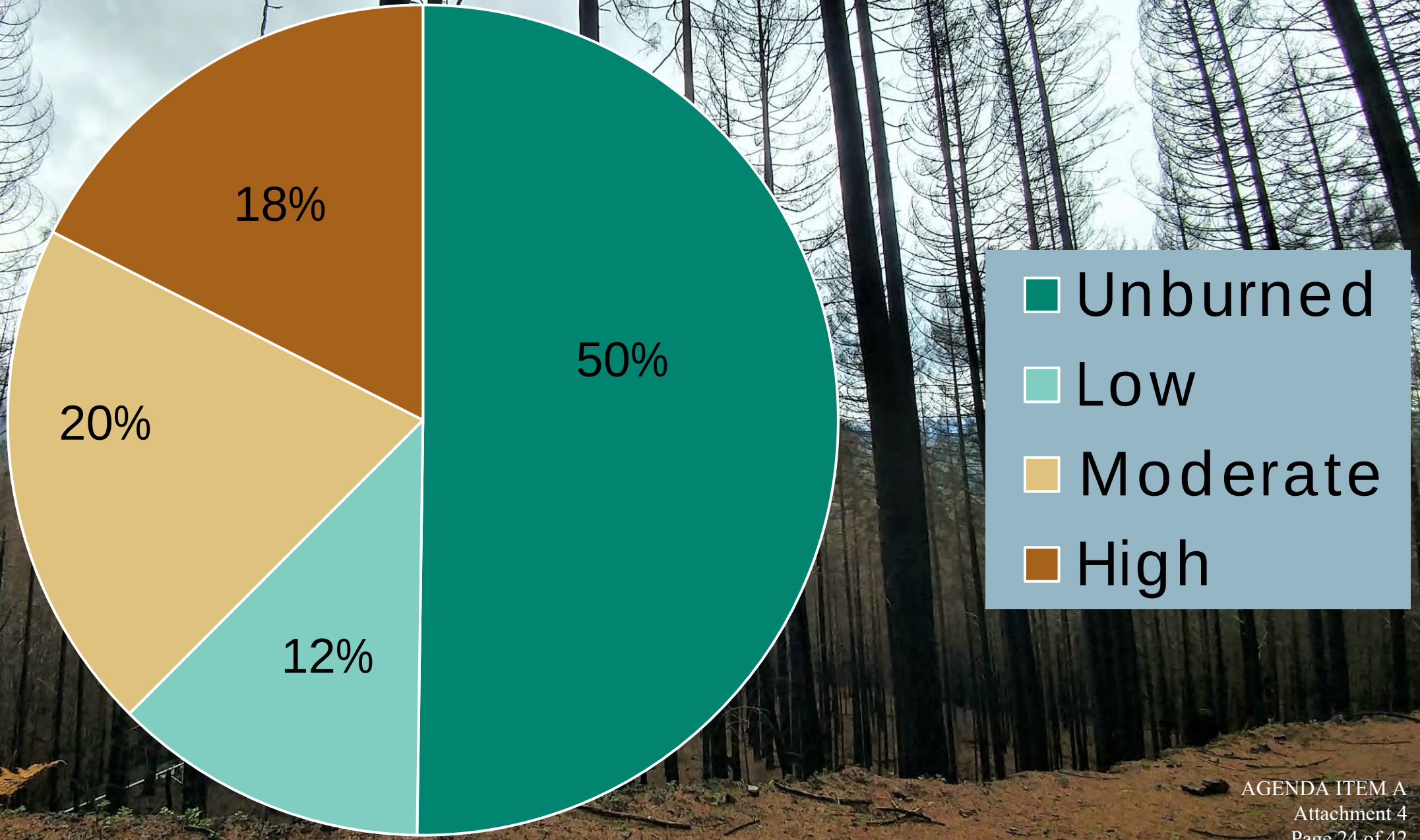
Aquatics Recovery and Restoration Next Steps:

- Working with ODFW & Local Watershed Councils on priority projects
- Opportunistic Large wood placement and planned projects
- Planting heavily burned riparian areas where feasible
- Potentially decommissioning roads along streams

Terrestrial Strategies

- Current ESA compliance methods
- Retaining:
  - Green Trees
  - Snags
  - Down wood
- Mixed approach to reforestation

Burn Severity within Northern Spotted Owl Circles



Post-Fire Harvest Activities Overview

Revised Implementation Plan Harvest Acreage Ranges

	Regeneration Harvest Acres	Partial Cut Harvest Acres	Volume (MMBF)
FY 2021	1,000 – 3,000	500 - 1,200	35-60
FY 2022	0 – 1,150	0 – 1,500	8-25
FY 2023	0 -750	0 - 800	8-15

Post-Fire Harvest Activities Overview

Fire Impacts and Planned Harvest within the Desired Future Condition (DFC) Mapped Landscape Design

	Total Mapped Acres in Mapped Landscape Design	Unburned Acres in Mapped Landscape Design	Burned Acres in Mapped Landscape Design	Planned Post-Fire Harvest Acres in Mapped Landscape Design (As of 3/1/21)
Total Acres	16,453	12,504	3,933	398
Percent of Total	100%	76%	24%	2.4%

Example Post-Fire Harvest

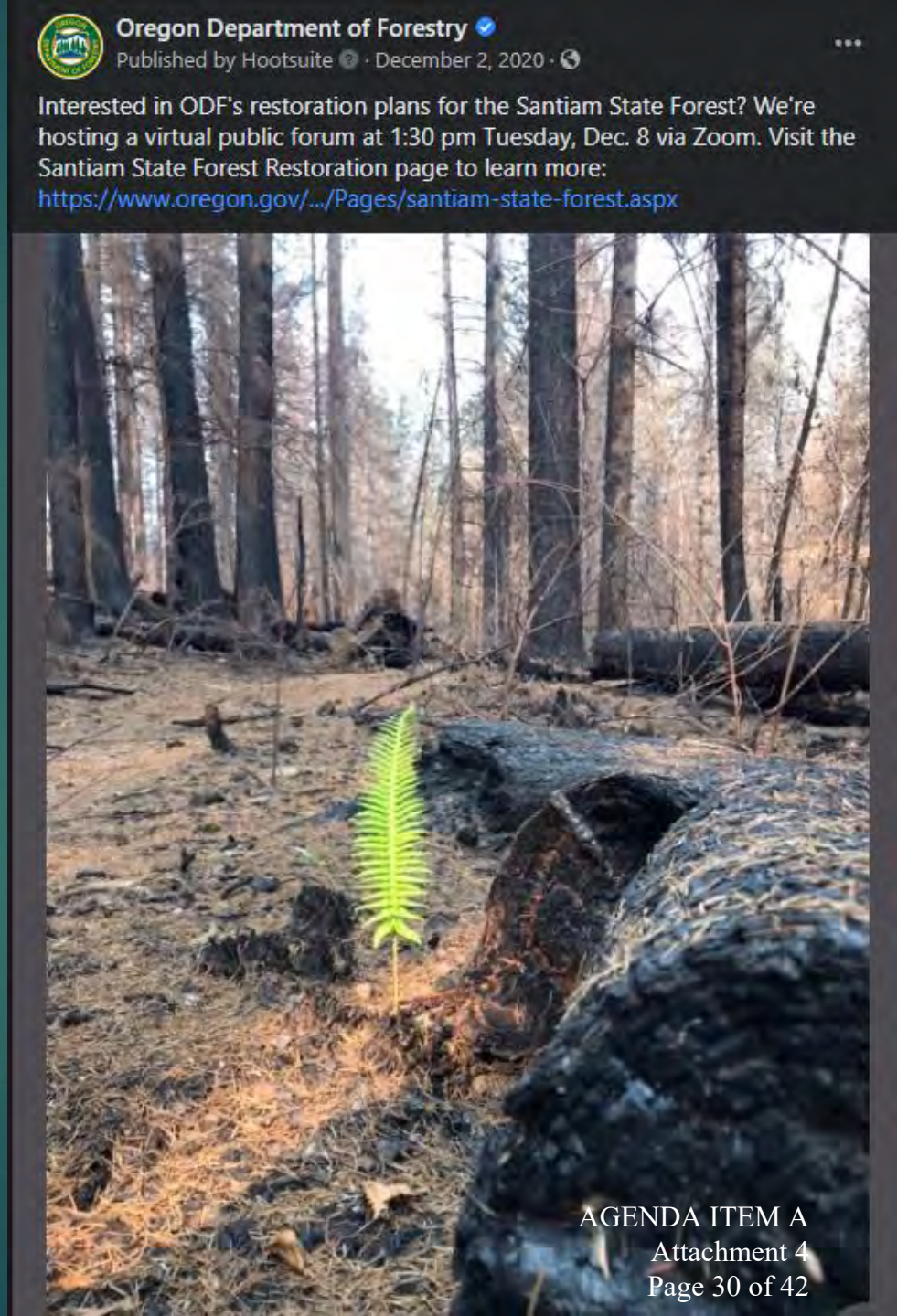

Legend
Partial Harvest
Regen Harvest
DFC Complex
Harvest in DFC Complex
Fish Stream
Nonfish Stream

Public Comment Summary

ODF NORTH CASCADE IMPLEMENTATION PLAN REVISION

Outreach

- 30-day public comment period required for Major Modification to district Implementation Plan
  - Extended 12 days at stakeholder request to Jan. 4
  - Additional 15-day public comment period for specific sales
- Public forum (virtual)
- Forest Trust Land Advisory Committee
- State Forests Advisory Committee
- Partner agencies: ODFW, DEQ



Overview

- 1,155 written comments received
  - 1,091 from organizational email campaigns
- Common topics
  - Post-fire logging
  - Recreation and public access
  - Forest management & replanting

Organizations commenting include:

- Association of Oregon Loggers
- Benton Forest Coalition
- Capitol Chapter, Oregon Hunters Association
- Cascadia Wildlands
- DEQ
- Great Old Broads for Wilderness
- Frank Lumber
- Hampton Lumber
- ODFW
- Oregon Equestrian Trails
- Oregon Forest & Industries Council
- Oregon Hunters Association
- OR Society of American Foresters
- Oregon Wild
- Rocky Mountain Elk Foundation
- Seneca Jones Timber
- Stimson Lumber
- Sustainable Forestry Initiative
- Wild Salmon Center
- Willamette Riverkeepers

Post-fire logging

- Comments in support included:
  - Capturing value while merchantable
  - Supporting rural communities & funding restoration
  - Tillamook Burn as example of active reforestation success
  - Increasing pace of assessment and post-fire logging levels
  - Retaining carbon in wood products and carbon absorption from young trees
  - Water quality
  - Standing dead trees could increase fire risk

Post-fire logging

- Concerns or opposition included:
  - Disturbing natural reforestation & developing early complex seral forests
  - Lost potential for carbon retention in burned forests
    - Governor's Executive Order 20-04
  - Water quality and soil erosion
  - Logging in Older Forest or Layered Condition areas burned in fires
  - Harvesting within Northern Spotted Owl circles impacted by fire
  - Logging slash could increase fire risk

Post-fire logging

- Other related comments included:
  - Strong disagreement over how, or if, draft HCP elements should be incorporated into IP
  - Riparian buffers
    - Exceed Forest Management Plan requirements
    - Re-consider adhering to FMP buffers & allow flexibility

Revisions

- Added new sections and subsections:
  - Climate change
  - Fire mitigation
  - Monitoring
  - Burn severity
  - Forest structure
  - Legacy structures
  - Desired future condition
  - Insect and disease
  - Invasive plants
  - Riparian strategies
  - Aquatic anchors
  - NSO details
  - Reforestation methods and approx. acreage
- Updated for acreage/volume ranges for each fiscal year under the IP

More information

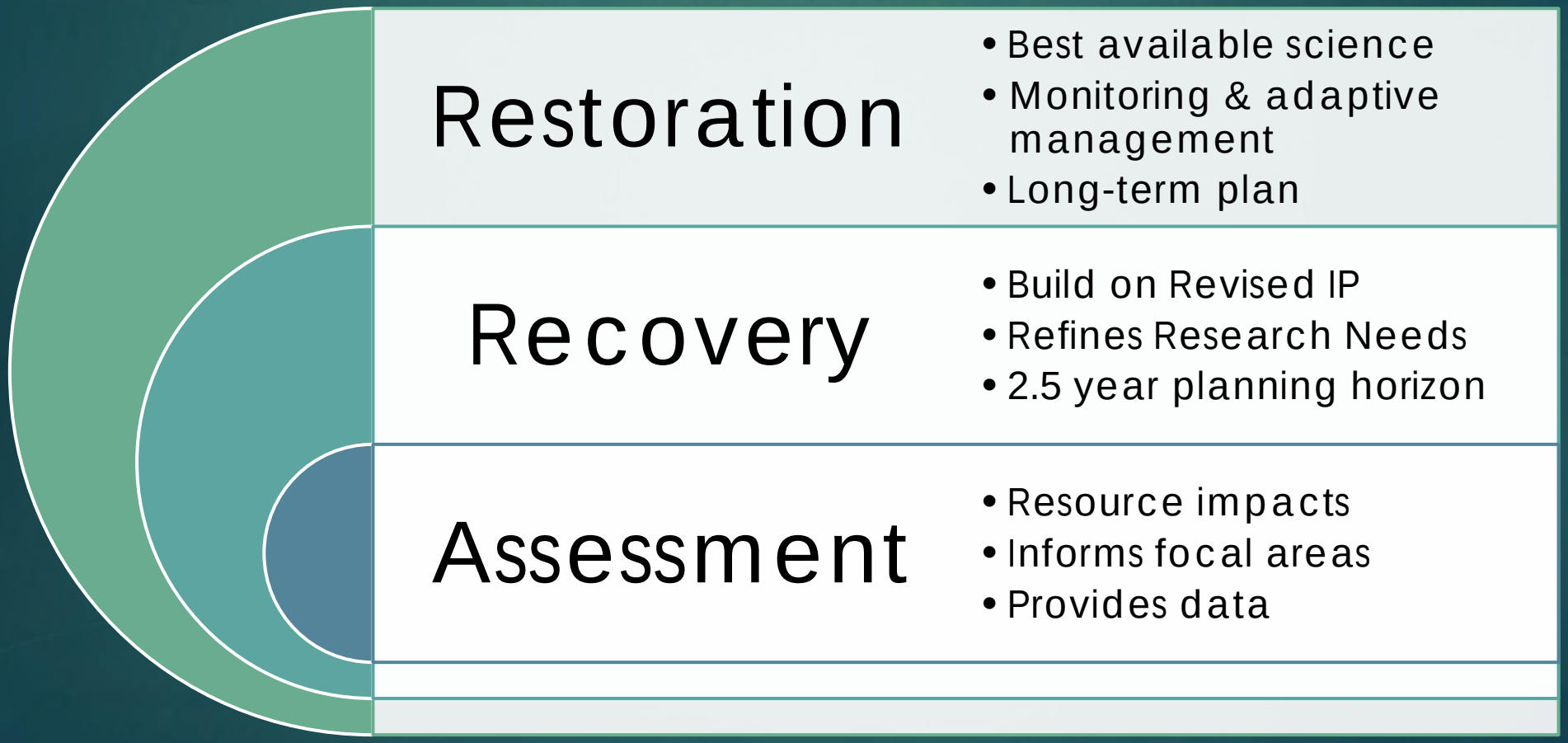
To read all comments and view other information, visit

Oregon.gov/odf/recreation/Pages/santiam-state-forest.aspx

Santiam State Forest Restoration Plan

RESTORATION FOR GREATEST PERMANENT VALUE – *ECONOMIC, ENVIRONMENTAL, AND SOCIAL*

ODF Phase Approach and Restoration Plan Development



Greatest Permanent Value Framework

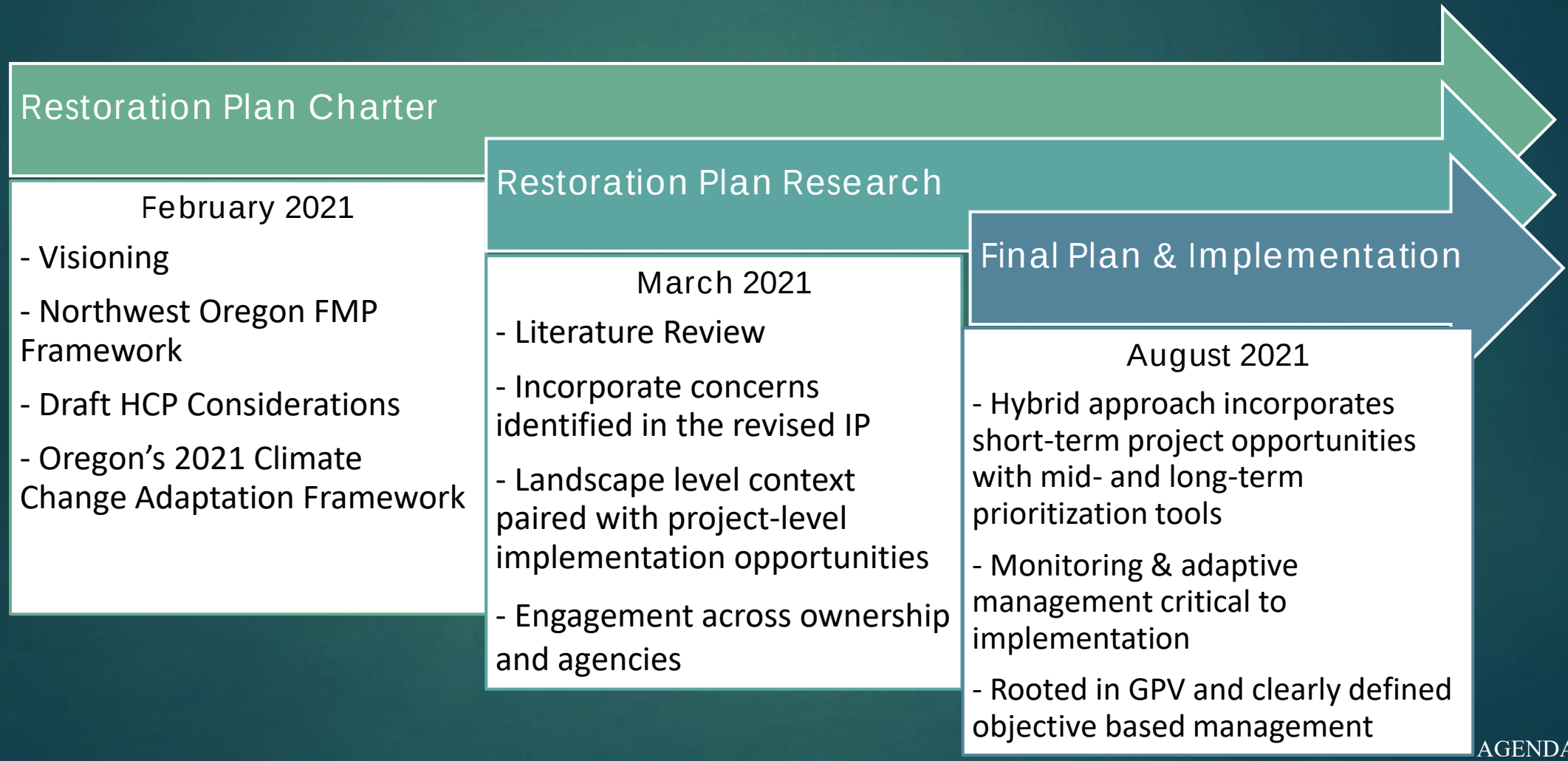
Social

Economic

Environmental

Climate Resilience

Restoration Plan Timeline



Engagement & Partners…

- Oregon Department of Fish & Wildlife
- Oregon Department of Environmental Quality
- Oregon Parks and Recreation Department
- BLM
- Tribal Engagement
- USFS
- OSU

Key Topics…

- Forest Restoration
- Fire Ecology & Fuel Management
- Climate Change & Carbon
- Reforestation & Young Stand Management
- Timber Harvest
- Wildlife & Terrestrial Habitats
- Riparian, Aquatics, & Fisheries
- Recreation, Education, & Interpretation
- Monitoring & Adaptive Management
  - Insect & Disease
  - Invasive species

Questions?

Ramona Arechiga, *Santiam State Forest Restoration Plan Project Lead*

Ramona.T.Arechiga@Oregon.gov

Associated Oregon Loggers, Inc.

PO Box 12339 • Salem, Oregon 97309-0339 • (503) 364-1330 • Fax (503) 364-0836

December 22, 2020

Peter Daugherty
Oregon State Forester
2600 State Street, Building C
Salem, OR 97310

In Response to Action Item: North Cascade District Draft Implementation Plan Major Revision

Dear Mr. Daugherty,

Introduction

Associated Oregon Loggers (AOL) is a local trade association which represents nearly 1,000, family-owned forest contractors. Our members have been involved in the management of the Santiam State Forest for decades. Our members are essential to conduct any activity in the woods, be that road work for access, timber falling for management and restoration, reforestation for sustainability, trucking for product transportation, and many other services. AOL's members provide a diverse array of services that are necessary for Oregon Department of Forestry (ODF) to conduct successful post-fire restoration in the proposed North Cascade District Draft Implementation Plan Major Revision (IP). The best way to ensure economic viability and operational feasibility of salvage and restoration operations is to work with AOL, your partner in the forest contracting sector.

Our Perspective

First, AOL wants to thank ODF for considering a revision to their North Cascade District Implementation Plan. We recognize the difficult task ahead and applaud the state employees working tirelessly to ensure Oregon's state lands remain forested through their post-fire restoration efforts. Without the work prosed in this IP, it is likely the Santiam State Forest would take decades if not longer to regenerate leaving animals without habitat, timber dependent communities without jobs, and Oregon with a large carbon source rather than a carbon sink.

AOL does however have the responsibility to advocate for our members and ensure the work that ODF is proposing is the best option forward. ODF claims that their forests are managed to support rural schools and communities, timber related economies, high quality habitat for fish and wildlife, recreational experiences, and clean air and water. In other words, ODF is supposed to manage its lands for the greatest permanent value.

AOL recognizes the capacity issues that ODF faces in treating the burned areas in the Santiam State Forest. We would like ODF to focus first on those areas that will return value for additional port-fire restoration. Focusing on areas with merchantable timber salvage will allow maximized returns and greater value back to all Oregonians.

AOL has also reviewed the Erosion Threat Assessment and Reduction Team Report (ETART) and the Burned Area Emergency Response Plan (BAER). We assume this is the assessment ODF refers to on page 4 of the IP. If there was a different assessment completed, AOL believes it should be made public in order to get the best feedback from the public.

Post-Fire Restoration

Limiting Factors

ODF identifies four factors on page 9 of the IP that may limit their ability to complete the necessary restoration on the Santiam State Forest:

1) "Variability in burn severity and resulting damage to the trees
2) Limited time to recover marketable burned timber due to decay
3) Timber market conditions
4) Operator availability"

First, all four of these factors coincide with AOL's previous request to prioritize merchantable timber operations prior to any non-merchantable and planting operations. As previously noted, capitalizing on the ability to drive returns back into other restoration projects will benefit all Oregonians.

Second, ODF should not be "playing the market". It is the state's sole job to restore these landscapes as quickly as possible. Recognizing where the market is, may influence the bid rate identified on the contracts developed by ODF, but please also recognize that prices should be low to begin with in order to ensure the work will *at least* be completed and *at best* result in competitive bidding.

Third, operator availability should not drive the quantity of work being proposed on the Santiam State Forest. Rather, it is the state's duty to accurately assess the work to be completed in order to restore the Santiam State Forest in its entirety, with prioritization leaning on other factors that would help drive success. With increased demand for operators, AOL believes capacity will not be a limiting factor in the long term and capacity is being filled quickly in the short term through reshuffling, iron being transported from further locations, and operators moving in from outside of the typical operating circle of each fire location.

Prescriptions

First off, AOL is concerned that there is no standard for identifying risk of mortality in the burned areas of the Santiam State Forest. Multiple factors should be used to identify this risk including crown scorch, bole scorch, and root scorch. Because assessing risk can be very subjective, having a framework for all staff to work off of can create consistency. Please consider these prescriptions for included salvage and/or hazard tree timber taken from the Willamette National Forest:

Associated Oregon Loggers, Inc.

PO Box 12339 • Salem, Oregon 97309-0339 • (503) 364-1330 • Fax (503) 364-0836

DESCRIPTION OF INCLUDED TIMBER
Fire damaged Hardwoods, Douglas-fir and other coniferous species except for Pacific yew within 1½ tree length distance from the road edge and within 300 feet slope distance on the uphill side or 200 feet slope distance on the downhill side of the road, measured from the road edge.
Fire damaged Hardwoods, Douglas-fir and other coniferous species except for Pacific yew with less than 20% live green crown.
Fire damaged Hardwoods, Douglas-fir and other coniferous species except for Pacific yew with half or more of its exposed roots that are burned or scorched.
Fire damaged Hardwoods, Douglas-fir and other coniferous species except for Pacific yew where fire has burned through the bark and penetrated the bole of the tree on two or more panels. Separate areas of burnt bole 1 foot or closer are to be considered the same panel.
Fire damaged Hardwoods, Douglas-fir and other coniferous species except for Pacific yew where fire has burned bole with less than 50% cross-section of sound wood.

Other Requirements:

All physical damage to root system, trunk, stem, or limbs and the direction of lean of the tree shall be evaluated in addition to fire damage for removal. Inspection of the cambium layer will provide an indication of potential tree mortality. Structural stability shall also be considered in evaluation of the Danger trees.

Definitions:

Panel: A panel is defined as one quarter the circumference of a tree.

Operation Locations and Acreage

The IP notes on page three in the description of Figure 1 that burn severity acres were identified using Sentinel 2 imagery. AOL requests that flexible language is used when identifying acres in order to allow ground truthing to drive actual locations and acreages of different restorative operations.

Leaving standing dead trees on the landscape as legacies or skips due to mapping deficiencies or in an effort to diversify the landscape will only create risks in the future for additional fires and safety issues for the fire fighter that have to fight them.

Please treat as many acres as possible by not limiting yourself to the remote sensing and estimates currently presented in this IP, including the limitations on treatments in the riparian management areas (RMAs). The whole point of doing this revision is to address the changed condition and ensure the forest is restored.

The ETART states on page 19, "Leave wider-than-required riparian buffers on all fish-bearing streams (e.g. 100-120ft) and nonfish-bearing streams (e.g.30-50ft). Even if riparian vegetation mortality is high, buffering all streams will reduce near-stream disturbance, allow growth of fast-growing herbaceous plants, and retain the ecological/water quality benefits of dead wood. In severely impacted riparian areas, consider planting trees to aid revegetation."

Rather than continuing to use the Forest Management Plan RMA buffers, AOL believes that ODF should assess and prioritize each situation individually. Let your foresters make individual situations based on risks and needs they see. It is known that RMAs within high severity burns will take more time than we have to reestablish. Please reassess the ability of ground truthing and situational decision making to take precedent over unchanged or even increased RMA buffers.

AOL believes reforesting and restoring all areas, especially the RMAs should be prioritized. When completed promptly, the process will stabilize soils, protect water supplies, provide habitat to wildlife, and ensure a future generation of healthy trees providing climate solutions.

Climate

The inability to remove standing dead and decaying timber will not only contribute to high fuel loads and greater carbon sources in the future but may also complicate both agencies' ability to reforest these areas safely and effectively.

Furthermore, research by the Forest Service's Northern Research Station shows that young trees pull carbon out of the atmosphere at an exponential rate which enhances carbon sequestration and restores the forests' role as carbon sinks.

Recreation

On page 9 of the IP, ODF states that staff should, "maintain or enhance legacy structure retention where possible to provide for and enhance recreation experiences." AOL would like to ensure that this is not synonymous with leaving hazards near recreation areas to provide nesting structure. AOL believes ODF should prioritize public safety before wildlife habitat legacies near any recreation area (trails, trail heads, campsites, etc.).

When ODF is developing interpretive signs to explain what happened during the fires, how the environment was affected, the recovery efforts, and what is to come AOL would like ODF to reach out to groups like our own to develop this teaching tool collaboratively. Many associations, non-

profits, and forest sector companies have public relation specialists and or teachers that can help with this messaging and with specific information that may not be privy to ODF staff.

Roads

AOL finds that roads are vitally important for equity in recreation, available access for sustainable forest management, and options in fire management strategizing. Rather than a wholesale declaration like on page 11 of the IP which states that ODF may vacate legacy roads near streams, AOL would rather see a prioritization metric that ensures benefits are being weighed against the negatives associated with retaining legacy roads. ODF should identify the roads they plan on obliterating and/or decommissioning to allow Oregonians the chance to comment on the usefulness of those roads. For instance, a legacy road may have been used for decades by multiple generations to access a special hunting or fishing locations. By choosing to obliterate that road without an opportunity for comment from the public would be in poor form.

Habitat Conservation Plan

Procedurally, it is inappropriate and illegal to include any language related to ODF's potential Habitat Conservation Plan (HCP) in the guiding documents for any of ODF managed lands until such a plan has been finalized, as identified on page 4 of the IP. Upon finalization and approval by the Board of Forestry (BOF), this IP may then be amended to include the HCP. Including language from an unapproved and draft HCP is illegal according to the National Environmental Policy Act (NEPA) because a "hard look" has not been conducted by the National Oceanic and Atmospheric Administration through ODF as the applicant.

The Tenth Circuit Court noted in Forest Guardians v. United States Fish & Wildlife that "predetermination occurs only when an agency irreversibly and irretrievably commits itself to a plan of action that is dependent upon the NEPA environmental analysis producing a certain outcome, before the agency has completed the environmental analysis…."

The Ninth Circuit Court also ruled in Metcalf v. Daley that it was improper and predeterminant for an agency to sign written agreements binding them to support a proposal under consideration prior to the preparation of a NEPA document. In this case the plaintiff agencies were in violation of NEPA by making an "irreversible and irretrievable commitment of resources" prior to completing the environmental review.

Therefore, AOL believes no inclusion or mention of the potential HCP should be included in this IP prior to finalization of the NEPA process and approval of the HCP by the BOF.

Contextual Questions

According to Table 2, 14,042 acres (29%) of the total District acres were burned. Table 2 goes on to show how the remaining acres are broken into different seral classes. AOL would like to know

how the burned acres were broken into different seral classes. Table 3 does not follow these same seral class definitions.

AOL is also wondering why there are only two identified desired conditions. We recognize that, in total, the layered and older forest desired conditions only make up 35% of the total acres, but it is unclear what proportions of the other seral classes the District is shooting for within the remaining 65% of the acreage. Please make this clear as the District moves forward with this process.

Table 3 also has conflicting information. The first category of "Plantations needing to be replanted" are not differentiated between the next category of "Non-commercial tree removal". It is assumed that the first category is for plantations 0-18 years of age and would require less site prep and work to be able to replant, but this is not clearly identified. To add to the confusion, salvage can be completed on merchantable trees which are typically over 30 years old. So, why are the "Non-commercial trees" identified as 18-40 years old. If these older stands are really just low volume, why aren't they identified in the third category of operability and access issues.

Table 3 is not referenced in the document anywhere, so there is no explanation of the information that is provided in the table. Page 6 seems to have some clarifying information, but does not reference back to Table 3. Please include an explanation of Table 3 in future documents.

Conclusion

Overall, AOL is happy to see ODF consider a revision of the North Cascade District Implementation Plan as a result of the devastating Labor Day Fires. We understand the colossal task ahead and want to help advise the actions taken by ODF in any way we can in order to create ethe best outcome possible. We hope ODF take our comments presented here seriously and reach out to AOL with any questions regarding what you have read. We would like to see a stronger message of the need to restore the fire-killed forest landscape by salvage restoration in a thoughtful and prioritized way, but are reassured to see ODF commit to conduct restoration harvest soon.

Thank you for the opportunity to provide written comment on this IP for AOL's member companies who rely on a sustainable and predictable supply of timber across Oregon.

Sincerely,

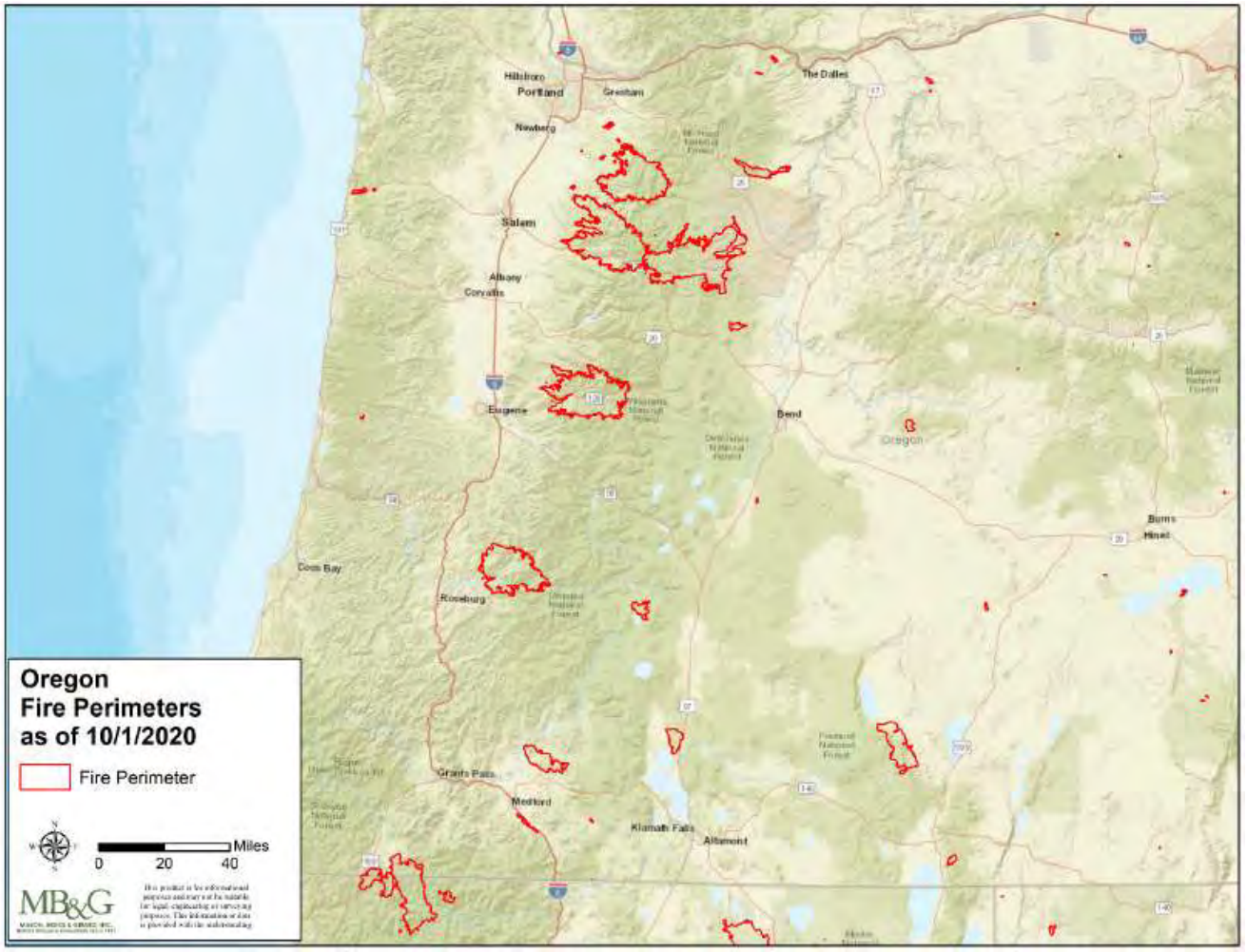
Amanda Astor
Associated Oregon Loggers
Forest Policy Manager
aastor@oregonloggers.org

Santiam State Forest Post-Fire Restoration

Amanda Astor

Forest Policy Manager – Associated Oregon Loggers

Wildfire Area



- 828,900 acres within fire perimeters in western Oregon
- 9 counties in western Oregon impacted

Fire boundaries from 10/1/2020 NIFC
Ownership from public sources and BLM data layer

Public Post-Fire Restoration

Public Agency	Acres in Fire Perimeter	Proposed Post-Fire Restoration (As of February 22nd)	Percent of Fire Area Proposed for Restoration
U.S. Forest Service	377,025 acres	7,566 acres	*1.6%* *(less than 3% of moderate to high severity)*
Bureau of Land Management	110,370 acres		
Oregon Department of Forestry (Santiam State Forest)	24,357 acres	1,500 - 3,000 acres	6.2% - 12.3% *(At most, less than 23% of moderate to high severity)*
Total	**511,752 acres**	**9,066 - 10,566 acres**	**1.8% - 2.1%**

Needs For Treatment

- Hazards
- Re-burn Potential
- Slope Stabilization
- Carbon Sequestration
- Restoration of Habitat
- Stability in Contracted Work

How the Fires Burned

- First 24-48 hours burned quickly with high intensity and severity pushed by strong winds
- Much of the fire did not burn into cambium
  - Pro – sap wood will last longer
  - Con – more attractive to bugs

AOL's Members Are Ready and Willing to Aid in Restoration of the Santiam State Forest

Questions?

Amanda Astor – aastor@oregonloggers.org 503-983-4017

Associated Oregon Loggers, Inc.

PO Box 12339 • Salem, Oregon 97309-0339 • (503) 364-1330 • Fax (503) 364-0836

Date: March 3. 2021

To: Board of Forestry

From: Amanda Astor, Forest Policy Manager
Associated Oregon Loggers

Chair Imeson, State Forester Daugherty, and members of the Board,

Thank you for the opportunity to present on the Santiam State Forest post-fire restoration needs. My name is Amanda Astor and I am the Forest Policy Manager at Associated Oregon Loggers.

I submitted extensive written comments on the North Cascade District Implementation Plan Revisions and thus would urge you to read those if you have further questions or concerns.

Today I want to provide a broader context to this conversation.

As you know, the Labor Day fires burned over 800,000 acres in Oregon contributing substantially to the over 1 million acres burned in the 2020 fire season. Unlike the majority of fires in Oregon's recent past, these fires burned significantly on non-federal lands.

Over half a million acres burned on public lands in Oregon and at most 2.1% of these lands have been proposed for post-fire restoration. As you can see in the table, the Santiam State Forest is at most, harvesting on less than 23% of the moderate to high severity burned acres in the Forest.

ODF is on track and in a much better place than their federal partners and as heard from Mr. Barnes, the public is in favor of this restoration work. Survey results even indicated that the public was unaware of the lack of salvage and restoration that occurred on public lands. We should be re-greening our forests and regenerating forest stands after fires.

The inability to remove standing dead and decaying timber will not only contribute to high fuel loads and greater carbon sources in the future but may also complicate ODF's ability to reforest these areas safely and effectively.

Furthermore, research presented by Mr. Barnes completed by the Forest Service's Northern Research Station shows that young trees pull carbon out of the atmosphere at an exponential rate which enhances carbon sequestration and restores the forests' role as carbon sinks.

Taking common sense and climate-friendly action like removing dead timber from our public lands to reduce future safety and fire risks; processing that wood at local mills to create jobs and lumber to rebuild our communities; and replanting our public lands to avoid fire-caused deforestation and enhance carbon sequestration are all steps in the right direction.

Because the fires burned quickly being driven by strong winds, ODF has been given time to offset other restoration costs with salvaged timber. The cambium did not get damaged in all trees and this the sap wood will last longer. Bugs could be more attracted to the wood, but so far, it looks like much of the timber is recoverable.

In closing, I would like to point out that AOL's members are already out on private lands helping in these efforts. The importance of keeping our small businesses moving forward is critical. Many of AOL's members were out on the front lines with ODF staff and contribute undervalued in-kind contributions every year to the firefighting efforts of the state. As the members of these communities seek to rebuild their lives please keep these small family-owned businesses in your hearts and minds. Many of AOL's forest contracting members live and work in these communities and have been personally impacted by the fires too.

USDA
United States Department of Agriculture

RESOURCE UPDATE FS-227

Greenhouse Gas Emissions and Removals from Forest Land, Woodlands, and Urban Trees in the United States, 1990-2018

Introduction

As a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), the United States has been reporting an economy-wide Inventory of greenhouse gas (GHG) emissions and removals since the mid-1990s (US EPA 2020). Forest land, harvested wood products (HWPs), and urban trees within the land sector collectively represent the largest net carbon (C) sink in the United States, offsetting more than 11 percent of total GHG emissions annually (US EPA 2020). Estimates of GHG emissions and removals are compiled by U.S. Department of Agriculture (USDA) Forest Service researchers and are based primarily on National Forest Inventory (NFI) data collected and maintained by the Forest Inventory and Analysis (FIA) program within the USDA Forest Service. This report—the second in a new series of annual updates—provides an overview of the status and trends of GHG emissions and removals from forest land, woodlands in the grassland category, HWPs, and urban trees in settlements in the United States from 1990 to 2018. The estimates for the United States summarized here are based on the compilation reported in the *Land Use, Land-Use Change, and Forestry* chapter of the US EPA (2020) submission to the UNFCCC. New in this report, most of the national scale estimates are also reported by individual U.S. state (Fig. 1) and are available online for the entire 1990-2018 time series (see appendix).

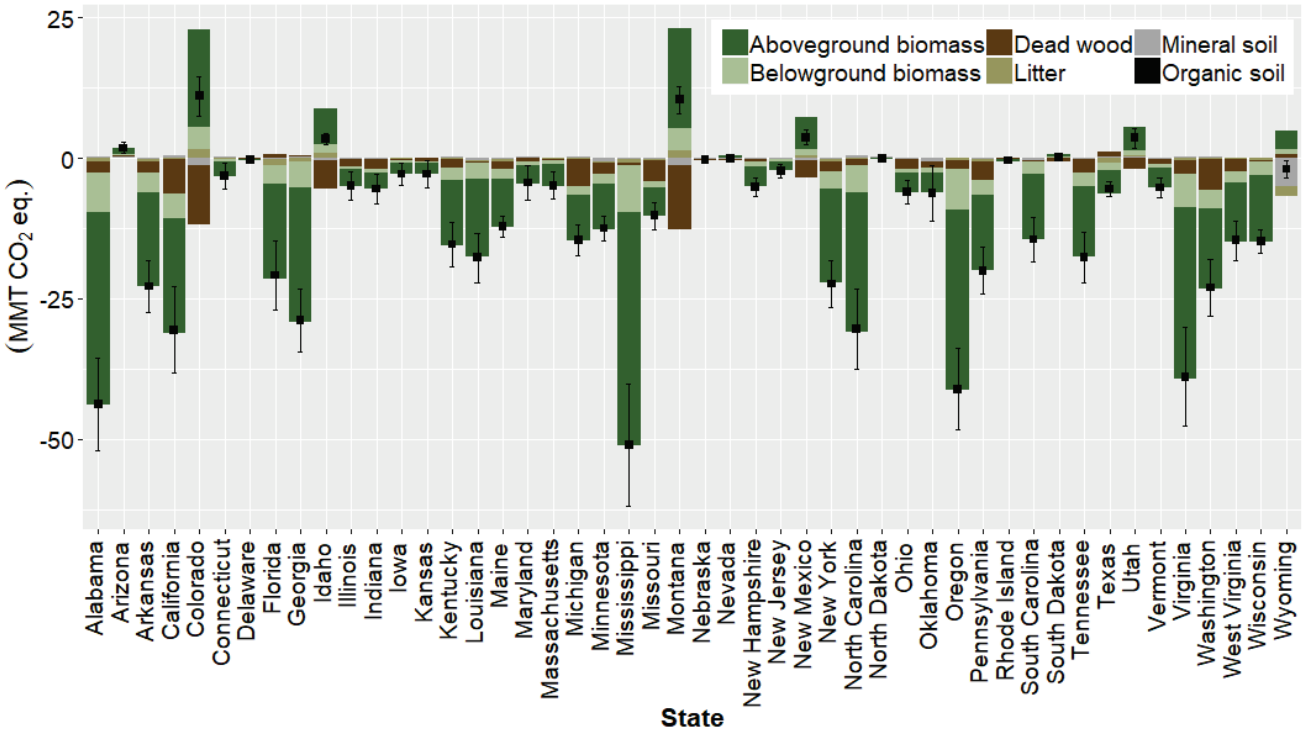


Figure 1.—Estimated annual emissions and removals from forest land remaining forest land by carbon pool for each of the conterminous 48 states in 2018 (MMT CO_2 Eq.). Note that points and confidence intervals (95 percent) reflect net flux for all carbon pools in each state. Negative estimates indicate net C uptake (i.e., a net removal of C from the atmosphere).

Forest Carbon Cycle

Carbon is continuously cycled among ecosystem pools and the atmosphere as a result of biogeochemical processes in forests (e.g., photosynthesis, respiration, decomposition, and disturbances such as fires or pest outbreaks) and anthropogenic activities (e.g., harvesting, thinning, and replanting). As trees photosynthesize and grow, C is removed from the atmosphere and stored in living tree biomass. As trees die and otherwise deposit litter and debris on the forest floor, C is released to the atmosphere and is also transferred to the litter, dead wood, and soil pools by organisms that facilitate decomposition.

The net change in forest C is not equivalent to the net flux between forests and the atmosphere because timber harvests do not result in an immediate flux of all harvested biomass C to the atmosphere. Instead, following harvesting a portion of the C stored in wood is transferred to a "product pool." Once in a product pool, the C is emitted over time as carbon dioxide (CO_2) from decomposition and as CO_2, methane (CH_4), nitrous oxide (N_2O), carbon monoxide (CO), and other nitrogen oxides (NO_x) when the wood product combusts. The rate of emission varies considerably among different product pools.

Carbon Pools

For estimating C stocks or stock change (flux), C in forest ecosystems can be divided into the following five storage pools (IPCC 2006):

- Aboveground biomass—all living biomass above the soil including stem, stump, branches, bark, seeds, and foliage. This pool includes live understory.
- Belowground biomass—all living biomass of coarse living roots greater than 2 millimeters (mm) diameter.
- Dead wood—all nonliving woody biomass either standing, lying on the ground (but not including litter), or in the soil.
- Litter—the litter, fumic, and humic layers, and all nonliving biomass with a diameter less than 7.5 centimeters (cm) at transect intersection, lying on the ground.
- Soil organic C (SOC)—all organic material in soil to a depth of 1 meter but excluding the coarse roots of the belowground pools.

In addition, two harvested wood pools are included when estimating C flux:

- Harvested wood products (HWP) in use.
- HWP in solid waste disposal sites (SWDS).

Total Emissions and Removals

Forest land, HWPs, woodlands, and urban trees in settlements collectively represent a net GHG sink over the UNFCCC reporting period, with interannual variability driven, in large part, by natural and anthropogenic disturbances (e.g., wildfire, harvesting), land conversions, and changes in HWPs in use (Table 1.; US EPA 2020). In 2018, forest land, HWPs, woodlands, and urban trees in settlements collectively represented an estimated net uptake of 752.9 million metric tons of carbon dioxide equivalent (MMT CO_2 Eq.). The category "forest land remaining forest land" was the largest net sink in the land sector, with an estimated uptake of 564.5 MMT CO_2 Eq. Conversions from forest land were the largest source of emissions within the categories included in this report, with estimated emissions of 127.4 MMT CO_2 Eq. (Table 1; US EPA 2020).

Table 1.—Emissions and removals (net flux) from land use, land-use change, and forestry (MMT CO_2 Eq.)

Emissions and Removals Category[a]	1990	1995	2000	2005	2010	2016	2017	2018
Forest land remaining forest land[b]	(610.1)	(598.7)	(572.1)	(572.6)	(556.2)	(565.5)	(552.0)	(564.5)
Non-CO_2 emissions from fire	1.5	0.6	2.9	8.2	4.6	5.6	18.8	18.8
N_2O emissions from forest soils	0.1	0.3	0.5	0.5	0.5	0.5	0.5	0.5
Non-CO_2 emissions from drained organic soils	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Forest land converted to non-forest land[b]	119.1	120.8	122.5	124.4	126.0	127.4	127.4	127.4
Non-forest land converted to forest land[b]	(109.4)	(109.7)	(109.9)	(110.2)	(110.4)	(110.6)	(110.6)	(110.6)
Harvested wood products	(123.8)	(112.2)	(93.4)	(106.0)	(69.1)	(92.4)	(95.7)	(98.8)
Woodlands remaining woodlands[c]	5.0	4.9	4.8	4.6	4.4	4.1	4.0	4.0
Urban trees in settlements[d]	(96.4)	(103.3)	(110.4)	(117.4)	(124.6)	(129.8)	(129.8)	(129.8)
Total Emissions and Removals	**(813.9)**	**(797.2)**	**(755.0)**	**(768.4)**	**(724.7)**	**(760.6)**	**(737.3)**	**(752.9)**

[a] For details on how estimates were compiled see US EPA 2020.
[b] Estimated emissions and removals include the net changes to C stocks stored in all ecosystem pools.
[c] Estimates for woodlands, which are included in the grassland land use category, were compiled using the same methods and models as those in the forest land category.
[d] Estimates of emissions and removals from urban trees in settlements were compiled using percentage tree cover in carbon sequestration density per unit of tree cover.
Notes: Totals may not sum due to independent rounding. Parentheses indicate net C uptake (i.e., a net removal of C from the atmosphere).

Forest Land Remaining Forest Land and Harvested Wood Products

Within the "forest land remaining forest land" category, aboveground live biomass is the largest contributor to the net uptake over the reporting period, followed by belowground live biomass and dead wood (Table 2). Harvested wood products in use and in solid waste disposal sites (SWDS) are also an important contributor to the net sink in the land sector, and 2018 estimates for both pools increased from previous years.

Table 2.—Emissions and removals (net flux) from forest land remaining forest land and harvested wood pools (MMT CO_2 Eq.)

Carbon Pool[a]	1990	1995	2000	2005	2010	2016	2017	2018
Forest ecosystem	**(610.1)**	**(598.7)**	**(572.1)**	**(572.6)**	**(556.2)**	**(565.5)**	**(552.0)**	**(564.5)**
Aboveground biomass	(425.1)	(416.1)	(392.7)	(391.3)	(391.3)	(397.0)	(381.2)	(385.2)
Belowground biomass	(98.6)	(96.6)	(91.5)	(90.8)	(90.3)	(91.1)	(87.6)	(88.6)
Dead wood	(81.9)	(82.8)	(82.7)	(84.1)	(83.4)	(87.6)	(83.1)	(86.4)
Litter	(5.0)	(3.5)	(4.5)	(5.2)	(1.4)	(0.9)	(3.5)	(3.1)
Soil (mineral)	0.3	(0.1)	(1.0)	(1.8)	4.6	8.2	1.4	(3.3)
Soil (organic)	(0.6)	(0.5)	(0.3)	(0.1)	4.9	2.3	1.4	1.4
Drained organic soil	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Harvested wood	**(123.8)**	**(112.2)**	**(93.4)**	**(106.0)**	**(69.1)**	**(92.4)**	**(95.7)**	**(98.8)**
Products in use	(54.8)	(51.7)	(31.9)	(42.6)	(7.4)	(27.8)	(30.3)	(31.5)
SWDS	(69.0)	(60.5)	(61.5)	(63.4)	(61.7)	(64.6)	(65.5)	(67.2)
Total Net Flux	**(733.9)**	**(710.9)**	**(665.5)**	**(678.6)**	**(625.3)**	**(657.9)**	**(647.7)**	**(663.2)**

[a] For details on these estimates and how they were compiled see US EPA 2020.

Notes: Totals may not sum due to independent rounding. Parentheses indicate net C uptake (i.e., a net removal of C from the atmosphere).

Carbon stock estimates for forest ecosystem and harvested wood C storage pools are presented in Table 3. Together, the estimated aboveground biomass and soil C pools account for a large proportion of total forest ecosystem C stocks. By maintaining current harvesting practices and regeneration activities on these forested lands, along with continued input of harvested products into the HWP pool, C stocks in forests are likely to continue to increase in the near term, though possibly at a lower rate. Because most of the timber harvested from U.S. forest land is used in wood products and many discarded wood products are disposed of in SWDS rather than by incineration, significant quantities of C in harvested wood are transferred to these long-term storage pools rather than being released rapidly to the atmosphere (Skog 2008).

Table 3.—Carbon stocks in forest land remaining forest land and harvested wood pools (MMT C)

Carbon Pool[a]	1990	1995	2000	2005	2010	2017	2018	2019
Forest	**51,527**	**52,358**	**53,161**	**53,886**	**54,663**	**55,746**	**55,897**	**56,051**
Aboveground biomass	11,833	12,408	12,962	13,484	14,020	14,780	14,884	14,989
Belowground biomass	2,350	2,483	2,612	2,734	2,858	3,033	3,056	3,081
Dead wood	2,120	2,233	2,346	2,454	2,568	2,731	2,753	2,777
Litter	3,662	3,670	3,676	3,647	3,646	3,639	3,640	3,641
Soil (mineral)	25,636	25,636	25,637	25,639	25,641	25,637	25,637	25,638
Soil (organic)	5,927	5,928	5,928	5,929	5,929	5,926	5,926	5,926
Harvested wood	**1,895**	**2,061**	**2,218**	**2,353**	**2,462**	**2,616**	**2,642**	**2,669**
Products in use	1,249	1,326	1,395	1,447	1,471	1,505	1,513	1,521
SWDS	646	735	823	906	991	1,112	1,129	1,148
Total stocks	**53,423**	**54,419**	**55,380**	**56,239**	**57,124**	**58,362**	**58,539**	**58,720**

[a] For details on these estimates and how they were compiled see US EPA 2020.

Notes: Totals may not sum due to independent rounding. Forest C stock estimates include all forest land remaining forest land in the conterminous 48 states and Alaska. Forest ecosystem C stocks do not include U.S. Territories because managed forest land for U.S. Territories is not currently included in Section 6.1 Representation of the U.S. Land Base. Forest ecosystem C stocks also do not include Hawaii because there is not sufficient NFI data to support inclusion at this time. Forest ecosystem C stocks on managed forest land in Alaska were compiled using the gain-loss method as described in Annex 3.13. Harvested wood product stocks include exports, even if the logs are processed in other countries, and excludes imports. Harvested wood estimates are based on results from annual surveys and models. Totals may not sum due to independent rounding. Population estimates compiled using FIA data are assumed to represent stocks as of January 1 of the inventory year. Flux is the net annual change in stock. Thus, flux estimates for 2018 require C stocks for 2018 and 2019.

Forest Land Conversions

Land use conversions to and from forest land result in substantial emissions and removals each year. In this section all emissions and removals included for land conversions to and from forest land, as reported in US EPA (2020), are included in Table 4. Forest land conversion to settlements was the largest source of emissions in the conversion categories while cropland conversion to forest land resulted in the largest annual uptake. Considering all forest land conversions included in the US EPA (2020) report, over the reporting period there have been net emissions each year, with estimated net emissions of 16.7 MMT CO_2 Eq. for the most recent year.

Table 4.—Emissions and removals (net flux) from conversions to and from forest land (MMT CO_2 Eq.)

Land Conversions[a]	1990	1995	2000	2005	2010	2016	2017	2018
Forest land converted to cropland	48.6	48.7	48.5	48.4	48.3	48.7	48.7	48.7
Forest land converted to grassland	15.9	15.8	16.0	16.0	16.0	15.9	15.9	15.9
Forest land converted to settlements	54.6	56.3	58.0	59.9	61.6	62.9	62.9	62.9
Cropland converted to forest land	(45.9)	(45.9)	(46.0)	(46.1)	(46.2)	(46.3)	(46.3)	(46.3)
Grassland converted to forest land	(9.8)	(9.7)	(9.7)	(9.6)	(9.6)	(9.7)	(9.7)	(9.7)
Other land converted to forest land	(14.3)	(14.5)	(14.6)	(14.8)	(14.9)	(14.9)	(14.9)	(14.9)
Settlements converted to forest land	(38.6)	(38.6)	(38.7)	(38.7)	(38.8)	(38.9)	(38.9)	(38.9)
Wetlands converted to forest land	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)	(0.9)
Net Emissions and Removals	**9.6**	**11.2**	**12.6**	**14.3**	**15.6**	**16.7**	**16.7**	**16.7**

[a] For details on these estimates and how they were compiled see US EPA 2020.

Notes: Totals may not sum due to independent rounding. Parentheses indicate net C uptake (i.e., a net removal of C from the atmosphere). Emissions and removals from forest land converted to other lands are currently not included in US EPA (2020). Forest land converted to wetlands estimates were not compiled by the Forest Service.

Land Area

The land area included in the US EPA (2020) report includes lands directly influenced by human intervention. Direct intervention occurs mostly in areas accessible to human activity and includes altering or maintaining the condition of the land to produce commercial or noncommercial products or services; to serve as transportation corridors or locations for buildings, landfills, or other developed areas for commercial or noncommercial purposes; to extract resources or facilitate acquisition of resources; or to provide social functions for personal, community, or societal objectives where these areas are readily accessible to society. Forest Inventory and Analysis data from each of the conterminous 48 states and Alaska comprise an estimated 280 million hectares (ha) of forest land that are considered managed and are included in this report along with an additional 10 million ha of non-forest land converted to forest land. Some differences exist in forest land area estimates in the latest update to the Resources Planning Act Assessment (Oswalt et al. 2019) and the forest land area estimates included in the US EPA (2020) report, which are based on annual FIA data through 2018 for all states (USDA Forest Service 2019). These differences are due, in large part, to the separation of land categories and the managed land definition used in the US EPA (2020) report (Nelson et al. 2020). Sufficient annual inventory data are not yet available for Hawaii, but estimates of these areas are included in Oswalt et al. (2019). Even though Hawaii and U.S. Territories have relatively small areas of forest land that may not substantially influence the overall C budget for forest land, these regions will be added to the forest C estimates as sufficient data become available. Agroforestry systems that meet the definition of forest land are also not currently included in the US EPA (2020) report since they are not explicitly inventoried (i.e., they are classified as agroforestry system) by either the FIA program or the Natural Resources Inventory of the USDA Natural Resources Conservation Service. Woodland area is included in the "grassland remaining grassland" and "land converted to grassland" categories and is not explicitly separated in the US EPA (2020) report as a subcategory of grasslands. Combined, forest land and woodland area accounts for more than 311 million ha (Table 5).

Table 5.—Annual estimates of forest land and woodland area (1000 ha)

Land Area Category[a]	1990	1995	2000	2005	2010	2018	2019
Forest land remaining forest land	279,748	279,840	280,025	279,749	279,918	279,787	279,682
Non-forest land converted to forest land	9,622	9,654	9,689	9,725	9,761	9,796	9,796
Woodland remaining woodland[b]	19,891	19,669	19,255	18,630	17,733	16,000	15,776
Non-woodland converted to woodland[b]	5,782	5,702	5,552	5,322	4,994	4,607	4,607
Total Area	**315,043**	**314,865**	**314,521**	**313,426**	**312,405**	**312,209**	**311,880**

[a] For details on these estimates and how they were compiled see US EPA 2020.

[b]Woodland area is included in the "remaining grassland" and "land converted to grassland" categories and is not explicitly separated in the US EPA (2020) report.

Notes: Totals may not sum due to independent rounding. The estimates reported here may differ from the Land Representation section of US EPA (2020) report consistent with estimates used to compile emissions and removals in these categories. See Annex 3.13 in US EPA (2020) for more details.

Planned Improvements

Planned improvements to estimation and reporting include the following general topics: development of a more robust estimation and reporting system, individual C pool estimation, coordination with other land-use categories, and annual inventory data incorporation. Research is underway to leverage auxiliary information (i.e., remotely sensed information) to operate at finer spatial and temporal scales. As in past submissions, emissions and removals associated with natural (e.g., wildfire, insects, and disease) and human (e.g., harvesting) disturbances are implicitly included in the report given the design of the annual NFI, but are not explicitly estimated. In addition to integrating auxiliary information into the estimation framework, alternative estimators are also being evaluated that will eliminate latency in population estimates from the NFI, improve annual estimation and characterization of interannual variability, facilitate attribution of fluxes to particular activities, and allow for easier harmonization of NFI data with auxiliary data products. There are also investments being made to leverage state-level wood products and harvest information to allow for the disaggregation of HWPs estimates at the state level. Collectively these improvements are expected to reduce uncertainties in the estimates at the national and state scales and facilitate entity-level estimation and reporting.

2020 Estimates at a Glance

Below are summary statistics from the compilation of the forest land, woodlands, HWPs, and urban trees in settlements in the US EPA (2020) report.

- Forest land, HWPs, and urban trees in settlements collectively offset more than 11 percent (752.9 MMT CO_2 Eq.) of total GHG emissions annually, or 14 percent of CO_2 emissions.
- Forest land accounts for more than 95 percent of the net C sink within the land sector.
- Live vegetation in forests and urban trees account for nearly 80 percent of the C sink strength.
- Land conversions to and from forest land continue to result in net emissions (16.7 MMT CO_2 Eq.).
- More than 56 percent of all carbon in forest ecosystems is stored in the soil with small stock changes annually.
- Carbon storage in HWPs continues to increase annually since the Great Recession.
- Forests uptake averages 0.6 metric tons of C per hectare per year (MT C ha^{-1} yr^{-1}) with live vegetation accounting for more than 85 percent (0.5 MT C ha^{-1} yr^{-1}) of the uptake.

Literature Cited

Intergovernmental Panel on Climate Change [IPCC]. 2006 IPCC guidelines for national greenhouse gas inventories. Hayma, Japan: Institute for Global Environmental Strategies. https://www.ipcc-nggip.iges.or.jp/public/2006gl/ (accessed 9 April 2020).

Nelson, M.D.; Riitters, K.H.; Coulston, J.W.; Domke, G.M.; Greenfield, E.J.; Langner, L.L.; Nowak, D.J.; O'Dea, C.B.; Oswalt, S.N.; Reeves, M.C.; Wear, D.N. 2020. Defining the United States land base: a technical document supporting the USDA Forest Service 2020 RPA assessment. Gen. Tech. Rep. NRS-191. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 70 p. https://doi.org/10.2737/NRS-GTR-191.

Oswalt, S.N.; Smith, W. B.; Miles, P.D.; Pugh, S.A., coords. 2019. Forest resources of the United States, 2017: a technical document supporting the Forest Service 2020 RPA Assessment. Gen. Tech. Rep. WO-97. Washington, DC: U.S. Department of Agriculture, Forest Service. 223 p. https://doi.org/10.2737/WO-GTR-97.

Skog, K.E. 2008. Sequestration of carbon in harvested wood products for the United States. Forest Products Journal. 58(6): 56-72.

USDA Forest Service. 2020. Forest inventory and analysis national program: FIA data mart. Washington, DC: U.S. Department of Agriculture, Forest Service. https://apps.fs.usda.gov/fia/datamart/datamart.html (accessed 1 November 2020).

U.S. Environmental Protection Agency [US EPA]. 2020. Inventory of U.S. greenhouse gas emissions and sinks: 1990-2018. EPA 430-R-20-002. Washington, DC: U.S. Environmental Protection Agency. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2018 (accessed 14 April 2020).

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The role of reforestation in carbon sequestration

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Abstract
In the United States (U.S.), the maintenance of forest cover is a legal mandate for federally managed forest lands. More broadly, reforestation following harvesting, recent or historic disturbances can enhance numerous carbon (C)-based ecosystem services and functions. These include production of woody biomass for forest products, and mitigation of atmospheric CO_2 pollution and climate change by sequestering C into ecosystem pools where it can be stored for long timescales. Nonetheless, a range of assessments and analyses indicate that reforestation in the U.S. lags behind its potential, with the continuation of ecosystem services and functions at risk if reforestation is not increased. In this context, there is need for multiple independent analyses that quantify the role of reforestation in C sequestration, from ecosystems up to regional and national levels. Here, we describe the methods and report the findings of a large-scale data synthesis aimed at four objectives: (1) estimate C storage in major ecosystem pools in forest and other land cover types; (2) quantify sources of variation in ecosystem C pools; (3) compare the impacts of reforestation and afforestation on C pools; (4) assess whether these results hold or diverge across ecoregions. The results of our synthesis support four overarching inferences regarding reforestation and other land use impacts on C sequestration. First, in the bigger picture, soils are the dominant C pool in all ecosystems and land cover types in the U.S., and soil C pool sizes vary less by land cover than by other factors, such as spatial variation or soil wetness. Second, where historically cultivated lands are being reforested, topsoils are sequestering significant amounts of C, with the majority of reforested lands yet to reach their capacity relative to the potential indicated by natural forest soils. Third, the establishment of woody vegetation delivers immediate to multi-decadal C sequestration benefits in aboveground woody biomass and coarse woody debris pools, with two- to three-fold C sequestration benefits in biomass during the first several decades following planting. Fourth, opportunities to enhance C sequestration through reforestation vary among the ecoregions, according to current levels of planting, typical forest growth rates, and past land uses (especially cultivation). Altogether, our results suggest that an immediate, but phased and spatially targeted approach to reforestation can enhance C sequestration in forest biomass and soils in the U.S. for decades to centuries to come.

Keywords Forest ecosystem · Land cover · Land use · Soil · Biomass · ECOMAP

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Introduction

In the United States, there is a legal mandate to maintain forest cover on designated forest lands managed by the U.S. Department of Agriculture, Forest Service (USDA-FS). The earliest version of this mandate dates to the Forest Service Organic Administration Act of 1897, and has been reinforced repeatedly by Acts of Congress many times since the initiation of the Forest Service (1911, 1930, 1949, 1974, 1976, and 1980). At the agency level, numerous internal directives in the Forest Service Manual (https://www.fs.fed.us/im/directives/) specify guidance for management activities intended to maintain, regenerate, or restore forest cover, and reforestation is one of the most important of these activities on the 77 million hectares comprising the National Forest System (NFS). However, land area targets for reforestation on NFS lands have been under-attained by 75–85% for at least 15 years, partly due to insufficient infrastructure and funding for forest management activities, resulting in a widening gap between required and realized reforestation goals (Watrud et al. 2012). Unless reforestation is increased at a national level, concerns such as the uncertain longevity of the U.S. forest sector carbon (C) sink (Birdsey et al. 2006; Zhang et al. 2012; Oswalt et al. 2014; USDA Forest Service 2016), forest area decline (Yang and Mountrakis 2017), increases in forest disturbance extent and severity (Bentz et al. 2010; Kurz et al. 2008; Schoennagel et al. 2017), or interactions with ongoing climate change (Hicke et al. 2012; Liang et al. 2017) will only magnify.

The role of forests in mitigating atmospheric CO_2 pollution and climate change provides long-term context, and argues for a closer look at intensified reforestation efforts in the U.S. (Dumroese et al. 2015). In terms of context, the U.S. forest sector is providing a tremendous, but slowly diminishing ecosystem service by acting as a long-term net C sink, driven largely by forest regrowth following widespread historic disturbances (Caspersen et al. 2000; Williams et al. 2012, 2014). In terms of justification, not only is reforestation necessary to promptly re-establish forest cover after catastrophic disturbances such as large wildfires, but deliberate reforestation—even after less severe or extensive disturbances—may enhance C sequestration rates compared to passive management approaches such as waiting for natural regeneration (MacDonald et al. 2015; Nave et al. 2018; Post and Kwon 2000; Sample 2017). Across many regions and types of stand-replacing disturbances, even re-growing forests are net C sources to the atmosphere for a period of years to decades (Bond-Lamberty et al. 2004; Gough et al. 2007; Kashian et al. 2006; Law et al. 2003). Shortening the duration of this period during which ecosystem C outputs (e.g., through heterotrophic respiration) exceed ecosystem C inputs (e.g., through primary production) equates to a more positive C balance (i.e., greater storage) over the lifetime of the stand, and one obvious way to do so is accelerate canopy closure by ensuring adequate stocking density in the re-growing stand.

The scale and scope of the problems facing U.S. forests—in particular, the increasing area of disturbances and chronic reforestation shortfall—call for multiple evaluations, projections, and predictions of the C cycle implications of reforestation (or its neglect). In the present study, offered as complementary to the many recent, regional to national-scale reviews and projections of the forest sector C balance (e.g., Coulston et al. 2015; Creutzburg et al. 2017; Jin et al. 2017; Oswalt et al. 2014; Puhlick et al. 2017; Wear and Coulston 2015; Woodall et al. 2015), we use empirical data, statistical analyses, and ecoregional scaling to quantify the impacts of reforestation on C sequestration at broad levels. We address this overall goal via four specific objectives in this study, which uses space-for-time substitution to compare C stocks on lands differing in their use: (1) estimate C

stocks of major ecosystem pools in forest and other land cover types, in order to contextualize forests as C sinks; (2) quantify sources of variation in ecosystem C pools, focusing on regional patterns and drivers; (3) compare C pools among lands differing in past and present land use, thereby inferring impacts of forest loss, reforestation, and afforestation; (4) for all objectives, assess how results scale across ecological (rather than political) units.

Methods

Approach

We approached this work using several large data sets and sources, described in detail in the following subsections and in Nave et al. (2018). The first source, the 3rd generation version of the International Soil Carbon Network (ISCN) Database (Nave et al. 2017), is a database containing geographic, physical, chemical, and ecological data for > 433,000 individual soil layers (horizons or sampled depth increments) worldwide. Individual soil layers are the constituents of soil profiles; profiles are from one to many (> 10) per site, and most sites are georeferenced. Data in the ISCN Database were derived from 39 datasets contributed by individual investigators, research networks, and U.S. government agencies. The second principal data source in this analysis consists of "overlay data;" these are point-specific attributes, extracted from remote sensing data products, for the geographical coordinates of individual ISCN sites. Overlay data utilized in this analysis include: (1) land cover attributes from all four versions (1992, 2001, 2006, 2011) of the National Land Cover Dataset (Vogelmann et al. 2001; Homer et al. 2004, 2015; Fry et al. 2011), a LANDSAT-derived, 30 m resolution data product; (2) estimates of aboveground biomass C stocks from the National Biomass Carbon Dataset for the year 2000 (NBCD2000; Kellndorfer et al. 2013), also a 30 m data product. The third major data source for our analysis was the USDA-Forest Service, Forest Inventory and Analysis Database (FIADB; https://apps.fs.usda.gov/fia/datamart/). FIADB is the central source for systematically collected as part of the National Forest Inventory (NFI) program (http://www.fia.fs.fed.us); for the present analysis we report aboveground biomass and coarse woody debris data derived from the NFI plot inventory network.

ISCN data handling and C stock estimates

We began our work with the ISCN DB using the map-based data retrieval tool on the ISCN website <soilcarb.net> to download essential geolocation, descriptive, physical, chemical, and data contributor information for 319,316 individual soil layers from 52,178 unique profiles contained in a polygon completely surrounding the conterminous U.S. (CONUS). Importantly, given the variety of motivations and sampling designs represented by the contributors of these data, the dataset we downloaded as a starting point does not constitute a random nor systematic sample of soils in the U.S.; on the other hand, however, given its large size and origins from many data contributors, there is no a priori reason to assume that it is not representative of the range of soils in the U.S. Data used in this analysis are from sources including the USDA-Natural Resources Conservation Service (specifically, the September 2014 version of the National Soil Survey Laboratory's Soil Characterization Database); the U.S. Geological (Survey Site-Specific Soil Carbon Database for Mineral Soils of the Mississippi River Basin; Buell and Markewich 2004), the USDA-FS (Database

for Landscape-scale Carbon Monitoring Sites; Cole et al. 2013), and several projects by individual researchers (Heckman et al. 2009, 2013; Nave and Nadelhoffer unpublished). Beginning with these 52,178 profiles, we proceeded through a series of filtering steps to eliminate those that were of non-CONUS or unknown geographic location, sampled prior to 1989, or had layers with bulk density values in excess of 2.65 g cm^{-3} or C concentrations greater than 60% (mass/mass). Our intent with these filters was to include only soils that were of known CONUS origin, were sampled reasonably concurrently with the remote sensing overlay datasets (see "Land cover and biomass overlay data"), and had individual layers with realistic bulk density values and C concentrations. We also harmonized layer and profile depths to a common standard in which the top of the profile (0 cm depth) was equal to the top of the O-horizon, as some contributed profiles were sampled with a zero reference equal to the top of the mineral soil and O-horizon depths entered as negative values. Additionally, we created a decision tree and used gap-filling to compute C concentrations for the maximum number of layers possible. Specifically, we used the organic C concentration as the preferred metric of C concentration; for layers missing this parameter, we derived a prediction equation based on total C concentration and inorganic C concentration to predict the organic C concentration (all in per cent by mass). For those layers missing inorganic C concentration, we assumed that the organic C concentration was equal to the total C concentration. Layers having no C concentration data were not usable for C stock calculations. Similarly, we developed a decision tree and used gap-filling to estimate missing bulk density values. We used the fine earth bulk density (mass of soil materials < 2 mm per volume of soil materials < 2 mm) as the preferred metric for layers possessing multiple variant forms of bulk density; for layers missing this parameter we used the whole soil bulk density (mass of all soil materials per volume of all soil materials) if available, and otherwise used predictions generated by USDA-NRCS (Sequeira et al. 2014) as estimates if no measurements were available. Overall, 50% of the soil layers possessed measured bulk density values and 50% were gap-filled using the published prediction equations. After computing the C stock of each soil layer as the product of its C concentration (%), bulk density (g cm^{-3}), and thickness (cm), and scaling to Mg C ha^{-1}, we summed the individual layer C stock values up to the whole profile level (the maximum sampled depth as reported by the data contributor). Throughout this process, we repeatedly checked our calculations, compared our assembled datasets against the originally downloaded source data and against previous, internally versioned files, in order to ensure consistency, repeatability, and quality of the data used in subsequent analyses. After completing all steps, we were left with 22,847 profiles meeting the criteria specified above.

Land cover and biomass overlay data

Our intent with remote sensing overlay data was to derive land cover and biomass information for the ISCN profiles (and their individual layers) described in "Land cover and biomass overlay data" section. For this reason, our first step in deriving overlay data was to exclude profiles sampled before 1 January 1989 (as described in "Land cover and biomass overlay data" section), and our second was to assign each profile to its closest (in time) NLCD product. Specifically, we assumed that the land cover type for soil profiles sampled between 1 January 1989 and 31 December 1996 was reasonably represented by the NLCD 1992 product; soil profiles from 1 January 1997 to 31 December 2001 were represented by NLCD 2001; soil profiles from 1 January 2002 to 31 December 2006 by NLCD 2006; soil profiles from 1 January 2007 to present (2014) by NLCD 2011. Thus, all soil profile

sampling dates were within 3–4 years of their derived land cover dates. Previously, we successfully employed this conceptual approach on the ISCN 2nd generation DB in an assessment of afforestation effects on soil C in top soils of the U.S. northern prairie states, but did not explicitly test concurrence of the remotely sensed versus directly observed land cover information (Nave et al. 2013). In the present analysis, we chose to combine soil profiles in generally similar land cover types recognized as distinct by NLCD into major land cover groups (e.g., Mishra and Riley 2015), in order to increase within-group sample sizes and decrease the number and complexity of multiple comparisons in statistical analyses. Specifically, we placed all developed lands (high intensity, medium intensity, low intensity, and open space) into a single category (developed lands); pasture/hay and grassland cover types into a pasture/grassland group; different forest types (evergreen, deciduous, mixed) into a single forest group; wetland land cover types (herbaceous, woody, and water) into a single wetland category. Next, before proceeding with further data manipulations or analyses, we validated a subset of the NLCD classifications using observed profile vegetation notes (as provided by ISCN data contributors) for the 674 profiles possessing this information. Based on general familiarity with the various plant common and scientific names, taxonomic codes, and ecosystem classifications used by data contributors, we were able to interpret the vegetation notes for 71% (479) of these profiles. Of these, 79% (379) had vegetation observations consistent with the NLCD groups specified above and 9% were obviously incorrect, reflecting a spatial or temporal mismatch between the ISCN profile and the NLCD data. The remaining 12% misclassified low density or low stature forest vegetation types as shrub/scrub or vice versa. For this reason, we combined forest and shrub/scrub land cover types into a single land cover group (woody vegetation) for several of our statistical analyses.

From the NBCD2000, we extracted aboveground woody biomass densities (AGWB; Mg C ha^{-1}) for ISCN profiles associated with NLCD 2001 or 2006 land cover data, in order to ensure that the biomass values (which are themselves derived values based on remote sensing, NFI training plot data, and algorithms) were closely concurrent with the date of soil profile sampling. For both land cover and biomass datasets, we used ArcGIS (ESRI, Redlands, CA USA) to assign NLCD codes and biomass C stocks to each ISCN location.

Aboveground C stocks from FIADB

The NFI plots that are the basis for FIA data derive from an equal-probability sample of forestlands across the CONUS. There is one permanent plot on approximately every 2400 ha across the U.S., with each plot placed randomly within a systematic hexagonal grid (Bechtold and Patterson 2005). Sampling of each plot is conducted on fixed area subplots that vary in size depending on the metric, with inventory of canopy-level trees (> 12.7 cm dbh) being conducted on four 0.016 ha subplots. This design across the CONUS ensures that NFI data have no systematic bias with regard to forestland location, ownership, composition, soil, physiographic or other factors. For this analysis, we queried the FIADB for records of the mass density (Mg C ha^{-1}) of AGWB (derived from individual tree measurements and allometric equations) and coarse woody debris (CWD; derived from quadrat measurements of CWD piece volume and decay class, and estimates of CWD density). We acquired these C pool sizes for all single-condition plots in CONUS, i.e., only plots that are not divided along sharp boundaries into conditions of different stand age, slope, wetness, etc. These sources of localized (within-plot) variability complicate plot data interpretation and may introduce edge effects; furthermore, given the enormous number of NFI

plots available we felt this decision was a reasonable way to exercise stringent control on data quality in our analysis. As an additional constraint, we only utilized the most recent observation of each long-term NFI plot, and only plots observed since 2000, in order to make NFI data reasonably concurrent with the ISCN soil C and overlay land cover and biomass data described above. In contrast to ISCN data, we did not gain access to nor require precise geolocations of NFI plots (which are legally obscured). Our analyses test variation in AGWB and CWD C stocks against predictors including forest age, establishment type, and ecoregion; because these are internally recorded attributes associated with each NFI plot in the FIADB, there is no particular need for highly localized geographic coordinates. Altogether, our datasets for AGWB and CWD consisted of 81,673 and 22,043 plots, respectively.

Ecoregional framework

All of the recent, insightful large-scale assessments of forest C storage in the U.S. have reported regional variation according to politically defined spatial units, such as individual states or arbitrary multi-state regions. While the subdivision of space along political boundaries can have a legitimate basis, such as a legal directive for a specific assessment, we chose in the present analysis to utilize an ecoregional framework to explore spatial variation in land cover and use, ecosystem and forest C stocks. In particular, we used ECOMAP, an effort initiated by the USDA-Forest Service in the 1990s to organize the U.S. land base into a hierarchical structure of ecological units (Cleland et al. 1997; McNab et al. 2007). ECOMAP is a framework, subject to ongoing refinement, that is intended to identify ecologically scalable spatial units for planning and management purposes. Because there are fundamental climatic, geologic, and other natural constraints that affect forest growth and C storage heedless of political boundaries, an ecological basis for scaling may be quite useful to silviculturists, nursery managers, and others interested in reforestation and C sequestration. Currently, ECOMAP divides the national land base into nested, successively finer-level units including domains, divisions, provinces, sections, and subsections. Moving from coarse down to increasingly fine levels, the fundamental ecological units are defined first by broad climate zones (domains, of which there are three in CONUS), then by regional climate types, vegetation affinities and soil Orders (divisions), then by increasingly localized information about climate, lithology, geomorphology, and soil units classified to finer taxonomic levels (provinces, sections). Some locations, such as states, National Forests, and ecological reserves, have finer-level ecological unit classifications that nest sub-subsections, landtype associations, landtypes, and landtype phases into the ECOMAP hierarchy, but these are less common and culminate in more locally resolved spatial units than the results we present here. For our analyses, we retain a high-level view, exploring regional variation only down to the province level (hundreds of thousands of square km), where within-group sample sizes (e.g., hundreds to thousands of ISCN profiles or NFI plots) are sufficient to ensure that statistical tests are not influenced by lurking or confounded variables. As described in "Aboveground C stocks from FIADB", FIA datasets contained ECOMAP classifications; for ISCN sites, we used an approach similar to other overlay data types to extract ECOMAP classifications. Specifically, we downloaded domain, division, and province polygons from the USDA-Forest Service Geodata Clearinghouse (https://data.fs.usda.gov/geodata/), and used the 'extract attributes for points' tool in ArcGIS to assign each ISCN geolocation to its appropriate place in the ecoregional classification system.

Data analysis: approach and tests

Before beginning our data analyses or the data synthesis and manipulation activities described above, we defined the specific statistical tests needed to address the objectives of this work. Explicit definition of statistical tests at the beginning not only informed the structure of our datasets and approach to manipulation, but also necessitated critical consideration of strengths and limitations of the very large datasets underlying this work. Because ISCN and FIA databases contain data generated by a number of investigators working across the range of lands and ecosystems in the CONUS, their size and extent simultaneously enable and challenge far-reaching inferences. Perhaps most importantly, in very large datasets such as these, skewed distributions are to be expected. Whether due to erroneous data entry, e.g., unrealistically high C stocks for an ISCN soil profile, representing truth (e.g., a deep wetland soil with massive C stocks), or present for other reasons, right-skewed distributions were obvious for most response parameters (e.g., forest stand ages, biomass or soil C stocks) in our datasets. Rather than remove such observations as statistical outliers, or allow their magnitude to skew mean values in parametric statistics, we chose to use nonparametric tests of medians in our analyses. Specifically, for two-group comparisons, we used the Mann–Whitney U test, and for comparing the medians of three or more groups, we used Kruskal–Wallis with Dunn's multiple comparisons procedure. In addition to retaining as many observations as possible while avoiding leveraging by extreme values, we argue that this approach is actually more appropriate than parametric statistics for the scope of our analysis and its questions of interest. Thus, for the portions of our data analysis that depend upon inferential statistics, we accepted test results as significant if $P < 0.05$, and the utilized median, percentiles (25th and 75th), and interquartile range (IQR) as the basis for assessing differences in the distribution of observations within groups. For some tests, we also interpreted the Kruskal–Wallis H statistic associated with each categorical predictor as a relative ranking of its predictive strength.

For several statistical tests intended to infer the impacts of land use (cultivation, reforestation, and natural forest) on soil C and physical properties, we utilized a pedologically informed conceptual approach previously described in Nave et al. (2013), and described briefly here. In particular, we interpreted the presence of Ap horizons (sometimes called plow layers) in soil profiles as evidence of cultivation (past or present). An Ap horizon is readily recognized in a soil pit by its consistent thickness and clear abrupt boundary over underlying horizons, and may persist for decades to centuries following agricultural abandonment (Compton and Boone 2000). Most Ap horizons in our dataset were in lands categorized as cultivated by NLCD; the interpretation of these cases is self-explanatory. However, many soil profiles indicated by NLCD as having woody vegetation also had Ap horizons; we interpreted these as evidence of reforestation on previously cultivated soils. By defining a condition for a third land use group (natural forest) as a soil profile supporting woody vegetation but lacking an Ap horizon, we made statistical comparisons between actively cultivated lands, reforesting cultivated lands, and never-cultivated forests, the latter two groups including both forest and shrub/scrub land covers for reasons described in 2.1.2. Before turning to the Results, we clarify two important points regarding our treatment of land cover and use. First, by inferring that forest soils without Ap horizons were never cultivated, we may sometimes mis-categorize land use, i.e., where erosion eliminated Ap horizons before trees were established on badly degraded cultivated soils. Second, and more importantly, it is

important to recognize that because our data sources possess different types of information, they must be used to address only those specific questions to which they are suited. Specifically, while we rely on indirect evidence to assess three land uses (cultivated, reforesting, natural forest) for the ISCN-NLCD observations, NFI plot data make direct assessments that offer more detail about land uses (e.g., previous forest vs. nonforest, afforestation and reforestation as different types of forest establishment). Throughout the Results and Discussion, we clearly indicate which data sources have been used in order that readers can refer to the Methods we have reported above, appreciating how the data used constrain the inferences gained.

Results

National snapshot: soil and aboveground biomass C stocks by land cover

For ISCN sites across the U.S., soils dominate AGWB as the principal ecosystem C pool for all land cover types (Table 1), and land cover types differ significantly in their median whole-profile soil C storage ($P < 0.001$). Wetlands (1139 profiles) have the greatest soil C storage, followed by shrub/scrub (1743 profiles), cultivated (4568 profiles), and pasture/grass, developed, and forest cover types holding the least (n = 6089, 1483, and 7619, respectively). In contrast to their low soil profile C stocks, lands covered by forest have significantly greater median C storage in AGWB than all other land cover types ($P < 0.001$); wetlands and developed lands are intermediate, while for sites with shrub/scrub, pasture/grassland, and cultivated land covers, the median AGWB is 0. In terms of their combined C stocks in the whole soil profile plus AGWB, C stocks are highest in wetlands (n = 340), intermediate to high in forest (n = 2719) and shrub/scrub (n = 565) land cover types, low to intermediate for cultivated (n = 1350) and developed (n = 593) lands, and lowest in pasture/grassland (n = 1885) cover types. Here, it is important to note that the median values for combined soil + biomass C that are reported in Table 1 are not direct sums of the independent median values of soil C and biomass C within each land cover type. This is because the median value for each of these three C stocks (soil C, biomass C, summed soil + biomass C) is actually a different observation (i.e., location). In other words, the ISCN-NLCD site that was the median in terms of its profile total C stock was not also the median site in terms of biomass C stock, nor were either of these sites the median observation in the sum of these two ecosystem pools.

Table 1 Storage of C within soil (profile total), aboveground woody biomass (AGB), and their sum, for major land cover groups in the U.S.

Pool	Developed	Cultivated	Pasture/grass	Shrub/scrub	Forest	Wetland
Soil	105 (64–187)^{d}	119 (70–205)^{c}	106 (70–175)^{d}	133 (64–290)^{b}	105 (70–185)^{d}	151 (81–291)^{a}
AGB	10 (0–39)^{b}	0 (0–1)^{c}	0 (0–10)^{c}	0 (0–12)^{c}	45 (34–58)^{a}	25 (1–44)^{b}
Sum	148 (97–241)^{c}	135 (79–251)cd	124 (87–213)^{d}	182 (97–428)^{b}	156 (119–260)^{b}	234 (142–375)^{a}

Values presented are median C stocks in Mg ha^{-1} (with 1st and 3rd quartile values in parentheses). Within each C pool, land cover groups with significantly different median C stocks ($P < 0.001$) are indicated with superscripts. See "National snapshot: soil and aboveground biomass C stocks by land cover" section for the number of observations within each pool × land cover group, and notes regarding summation and presentation of medians

National to regional variation in soil C stocks

At the broadest level of the ecoregional hierarchy, domains differ significantly in their profile total C storage ($P < 0.001$). Specifically, the median whole-profile soil C stock in the dry domain is 136 Mg C ha^{-1}, with 25th and 75th percentiles ranging from 69 to 293 Mg C ha^{-1}; the median profile total in the humid temperate domain is 107 Mg ha^{-1}, with an IQR of 70–183 Mg C ha^{-1}. (Parenthetically, we note that we excluded data from the small number of ISCN profiles in the humid tropical domain, which occupies extreme southern Florida). Variation in profile total soil C between domains (H = 163) is less than variation between divisions (H = 1309) or provinces (H = 2234), indicating that increasingly regionalized ecological units have increasingly different soil C stocks from one another. Among many potential factors that can explain this spatial variation in profile total C stocks, natural drainage index (H = 915) is much more important than land cover (H = 195).

Within ecoregional divisions, natural drainage index is consistently the strongest predictor of variation in profile total soil C stocks (Table 2). Land cover, which co-varies with drainage index (i.e., wetland cover types equate to poor drainage classes), is also a significant predictor of variation in profile total soil C stocks within ecoregional divisions, although there is no consistent pattern as to which land cover group has the greatest or least profile total soil C stocks. While wetlands have the greatest median soil C stocks in four divisions, forest soil C stocks are greatest in three divisions, and least in one division. In two divisions (warm temperate and temperate desert), variation in profile C stocks between montane and non-montane provinces is greater than variation attributable to drainage or land cover, highlighting the utility of province-level maps for regionalized views of representative (median) profile C stocks and their variability (Fig. 1a, b).

Impacts of land use on soil C and bulk density

At the national level, cultivated, reforested, and natural forest land uses differ in their soil C concentrations, stocks, and bulk densities. However, the direction and magnitude of these

Table 2 Sources of variation in profile total soil C stocks, by ecoregional division

Division	Province	Drainage	Land cover
Marine	$P < .001$, H = 30	$P < .001$, H = 22	***P* < .001, H = 56**
Tropical/subtr. steppe	$P = .001$, H = 16	$P = .003$, H = 20	$P < .001$, H = 27
Prairie	$P = .656$, H < 1	***P* < .001, H = 177**	$P < .001$, H = 134
Mediterranean	$P < .001$, H = 87	$P = .018$, H = 15	***P* < .001, H = 102**
Temperate desert	***P* < .001, H = 111**	$P < .001$, H = 56	$P = .002$, H = 19
Warm continental	***P* < .001, H = 176**	$P < .001$, H = 85	$P < .001$, H = 21
Temperate steppe	$P < .001$, H = 74	***P* < .001, H = 99**	$P < .001$, H = 23
Hot continental	$P < .001$, H = 377	***P* < .001, H = 410**	$P < .001$, H = 143
Subtropical	$P = .005$, H = 13	***P* < .001, H = 302**	$P < .001$, H = 117
Tropical/subtr. desert	$P = .017$, H = 19	$P = .094$, H = 8	$P = .015$, H = 14

For each of the 10 divisions, cell contents show the *P* value significance and Kruskal–Wallis H statistic for one-way tests conducted using finer-level (province) spatial variation, natural drainage class, or land cover as the categorical variable. Within each division, the bold cell indicates the most significant source of variation, assessed according to the H statistic

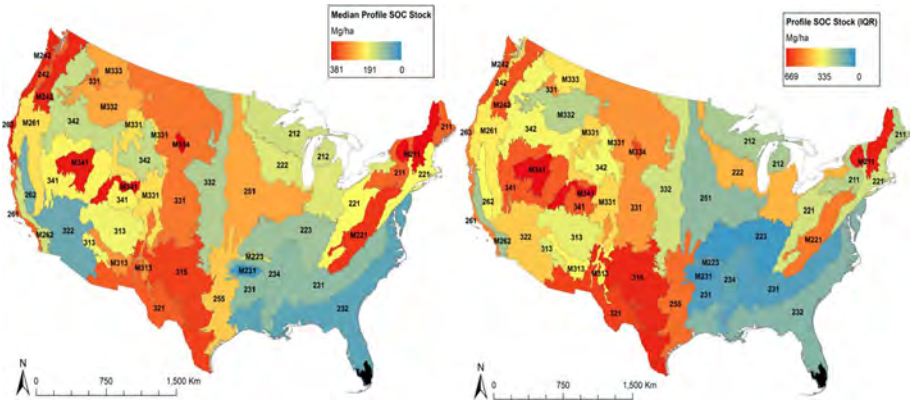

Fig. 1 Map showing the median (left panel) and interquartile range (right panel) of profile total soil carbon stocks, in Mg ha^{-1}. Warmer colors show higher (or more variable) C stocks while cooler colors show lower (or less variable) C stocks; note that the color ramp ranges differ between the two panels. Map units are the 36 ecoregional provinces delineated within the CONUS by the ECOMAP framework, less extreme southern Florida (due to low data density). (Color figure online)

differences between land uses are not consistent between topsoils (A horizons) and subsoils (B horizons). In terms of C stocks, topsoils from reforesting cultivated lands are intermediate between actively cultivated lands and natural forests; in subsoils, cultivated lands have the largest median C stocks, followed by natural forest and reforesting lands (Table 3, all $P < 0.001$). Examining the properties of these soil horizons more closely, topsoils from reforesting cultivated lands have bulk densities and C concentrations intermediate between topsoils from actively cultivated lands and those from natural forests (Fig. 2; all $P < 0.001$). Among subsoils (Fig. 3), bulk densities are lowest in natural forest ($P < 0.001$) and similar in cultivated and reforesting soils; C concentrations are highest in natural forest, intermediate in cultivated soils, and lowest in reforesting soils ($P < 0.001$).

Impacts of land use on biomass C stocks

At the national level, lands that were previously cultivated but are now reforesting have significantly lower AGWB C stocks than natural forests that, based on our inferential approach, were not previously cultivated ($P < 0.001$). This result holds whether considering only ISCN sites with NLCD forest cover types, or grouping forest and shrub/scrub cover types into the combined woody vegetation cover type described in "Land cover and

Table 3 Carbon storage in Mg ha^{-1} for topsoils (A horizons) and subsoils (B horizons) of three different land uses, for soils across the CONUS

Horizon	Ongoing cultivation	Previously cultivated, reforesting	Natural forest and shrub/scrub
A	28 (15–49)^{c}	30 (19–45)^{b}	37 (21–64)^{a}
B	11 (6–22)^{a}	8 (5–15)^{c}	10 (5–23)^{b}

Values presented are median C stocks (with 25th and 75th percentiles in parentheses). Within each horizon, land uses with significantly different median C stocks ($P < 0.001$) are indicated with superscripts

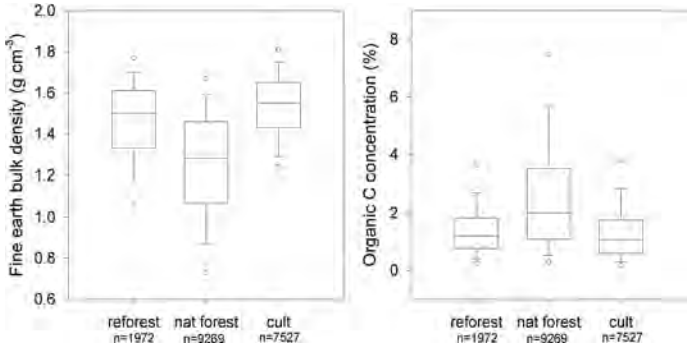

Fig. 2 Bulk density (left panel) and organic C concentration (right panel) for A horizons from soils undergoing continuous cultivation (cult), natural forest and shrub/scrub (nat forest), and previously cultivated, reforesting soils (reforest). Boxplots show medians (all groups are significantly different at $P < 0.001$) and 25th and 75th percentiles; whiskers show the 10th and 90th percentiles; points are outliers (5th and 95th percentiles)

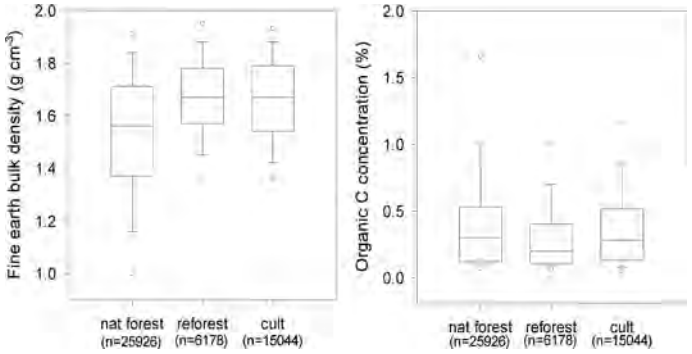

Fig. 3 Bulk density (left panel) and organic C concentration (right panel) for B horizons from soils undergoing continuous cultivation (cult), natural forest and shrub/scrub (nat forest), and previously cultivated, reforesting soils (reforest). Boxplots show medians, 25th and 75th percentiles; whiskers show the 10th and 90th percentiles; points are outliers (5th and 95th percentiles). Carbon concentrations differ significantly between all groups; bulk density is significantly lower ($P < 0.001$) for natural forest from the other two land uses, which are not significantly different

biomass overlay data" section. For all woody vegetation lands collectively, median AGWB C stocks are 31 Mg C ha^{-1} (IQR = 15–45) for (previously cultivated) reforesting lands, versus 44 Mg C ha^{-1} (IQR = 27–57) for natural forest lands.

Examining the effects of forest establishment type and stand age using the more detailed, direct data from the NFI plot network reveals several significant patterns. Across the U.S., forests resulting from afforestation, reforestation, or forest establishment (planted or natural) on previously non-forested lands are younger and have lower median AGWB C stocks than naturally regenerated forests (Table 4; $P < 0.001$). In terms of their median values of AGWB accumulation (C stock divided by stand age), young, deliberately established forests (afforestation and reforestation) are accumulating C in AGWB 2–3 times faster than naturally regenerated forests ($P < 0.001$), except for forests on previously non-forested lands. On these lands, the rate of AGWB is roughly half that of lands maintained as forest (Table 4; $P < 0.001$). When controlling for stand

Table 4 National Forest Inventory (NFI) plot data from CONUS comparing aboveground woody biomass C for two options each under three different forest conditions, including afforestation, reforestation, and forest establishment on previously non-forest land

	N	Age	Mg C ha^{-1}	Mg C ha^{-1} year^{-1}
Afforested				
N	23,163	65 (33–86)	43 (20–69)	0.8 (0.4–1.3)
Y	135	16 (7–35)	21 (5–63)	1.4 (0.8–2.1)
Reforested				
N	74,726	70 (43–98)	37 (13–69)	0.6 (0.2–1.1)
Y	7396	20 (10–30)	32 (10–55)	1.6 (0.9–2.5)
Prev. nonforest				
N	43,529	61 (31–83)	46 (22–71)	0.9 (0.5–1.3)
Y	1648	37 (10–71)	14 (2–43)	0.5 (0.2–1.1)

Under each condition, "N" indicates plots in which forest cover was not established by that option; "Y" indicates plots in which forest cover was established by that option. For example, for reforestation, "N" plots represent forestland not resulting from replanting (i.e., natural regeneration); "Y" plots indicate forestland that results from replanting. For each approach × option group, the table shows the number of plots, the age (years), C storage in aboveground woody biomass (Mg C ha^{-1}), and annualized rate of aboveground biomass production (Mg C ha^{-1} year^{-1}). Values shown are medians, with 25th and 75th percentiles in parentheses; medians are significantly different ($P < 0.001$) for the N × Y comparisons within each of the three forest conditions

age to more closely examine C accumulation in AGWB over time during reforestation, planted forests accumulate more C in biomass than naturally regenerated forests (Fig. 4; $P < 0.001$ for differences between medians within the first 4 time categories). Per time, the C sequestration benefit of planting is greatest in the first several decades, when AGWB C stocks are roughly three-fold greater than naturally regenerated forests. During this period, the consistently high initial stocking density of planted forests appears important to their C sequestration advantage.

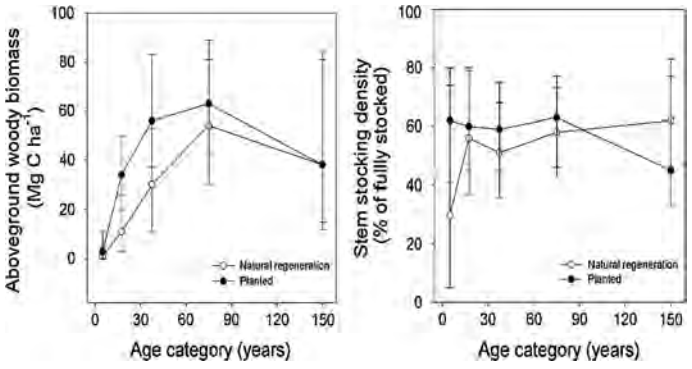

Fig. 4 Carbon storage in aboveground woody biomass (left panel) and stem stocking density (right panel) for forests resulting from natural regeneration (open symbols) versus reforestation (filled symbols). Data are from NFI plots. Points plotted are medians, which differ significantly between reforestation and natural regeneration in the first 4 time categories ($P < 0.001$); error bars are the 25th and 75th percentiles

Table 5 National Forest Inventory (NFI) plot data from CONUS comparing coarse woody debris C stocks for two options each under two different forest conditions, including reforestation and forest establishment on previously non-forest land

	n	Age	Mg C ha^{-1}
Reforested			
N	20,171	70 (40–100)	3 (0–10)
Y	1871	22 (12–34)	7 (1–15)
Previous non-forest			
N	1660	55 (25–75)	1 (0–4)
Y	80	33 (8–60)	0 (0–2)

Under each approach, "N" indicates plots in which forest cover was not established by that option; "Y" indicates plots in which forest cover was established by that option. For example, for previously non-forest land, "Y" indicates forests growing on previously non-forest lands; "N" indicates forests growing on lands under continuous forest land use. For each approach × option group, the table shows the number of plots, the age (years), and C storage in coarse woody debris (Mg C ha^{-1}). Values shown are medians, with 25th and 75th percentiles in parentheses; medians are significantly different ($P < 0.001$) for the N × Y comparisons within each of the two forest conditions

Table 6 Carbon storage in coarse woody debris for forests resulting from natural regeneration versus planting (reforestation)

Age class	Natural	Planted
< 10	0 (0–4)	5 (1–14)
10–25	0 (0–1)	6 (1–14)
25–50	0 (0–3)	7 (2–18)
50–100	3 (1–9)	7 (3–17)
> 100	10 (3–21)	6 (3–16)

Values are medians, which differ significantly between reforestation versus natural regeneration in all time categories ($P < 0.001$), with 25th and 75th percentiles in parentheses

Impacts of land use on woody debris C stocks

At the national level, NFI data on CWD C stocks (Table 5) show similar trends to AGWB C stocks. First, planted forests and forests growing on previously nonforest lands are significantly younger than naturally regenerated forests and lands under continuous forest uses, respectively. Second, planted forests have median CWD C stocks approximately double those of naturally regenerated forests, and stocks of C in CWD are significantly greater in lands maintained under forest cover than in forests growing on previously nonforest land (both $P < 0.001$). In all cases, these C stocks are very small relative to the soil C and AGWB pools previously described. In terms of temporal patterns, planted forests have significantly larger CWD C stocks than naturally regenerated forests throughout the first century of forest development ($P < 0.001$). However, while CWD C stocks in planted forests appear to maintain at more or less steady state over time, naturally regenerated forests begin accumulating substantial CWD C during the decades approaching the close of the first century, and hold significantly more C in forests > 100 years old ($P < 0.001$) (Table 6).

Regional patterns in land use and a national perspective on reforestation

Regional variation in land use transitions and reforestation activities indicate that opportunities for C sequestration resulting from forest establishment are not equally distributed across the U.S. Considering ISCN sites with woody vegetation and Ap horizons (i.e., reforesting sites) reveals that, in the prairie and subtropical ecoregional divisions, over 1/3 of lands now possessing woody vegetation (forest or shrub/scrub) were once plowed (Fig. 5). Based on results pertaining to topsoil C stocks (3.3), reforesting soils in these divisions are currently recovering C lost during historic cultivation and are likely to continue doing so as long as forests are allowed to continue recovering. Additionally, NFI plot data show that the percentages of forestland less than 10 years old that result from replanting are mostly low across the U.S., but are on the order of 50% in the subtropical and marine divisions (Fig. 6). Importantly, these two divisions also have the highest median rates of AGWB C accumulation; divisions with the lowest percentage of young forests resulting from reforestation generally had the lowest median rates of AGWB C accumulation (Fig. 7).

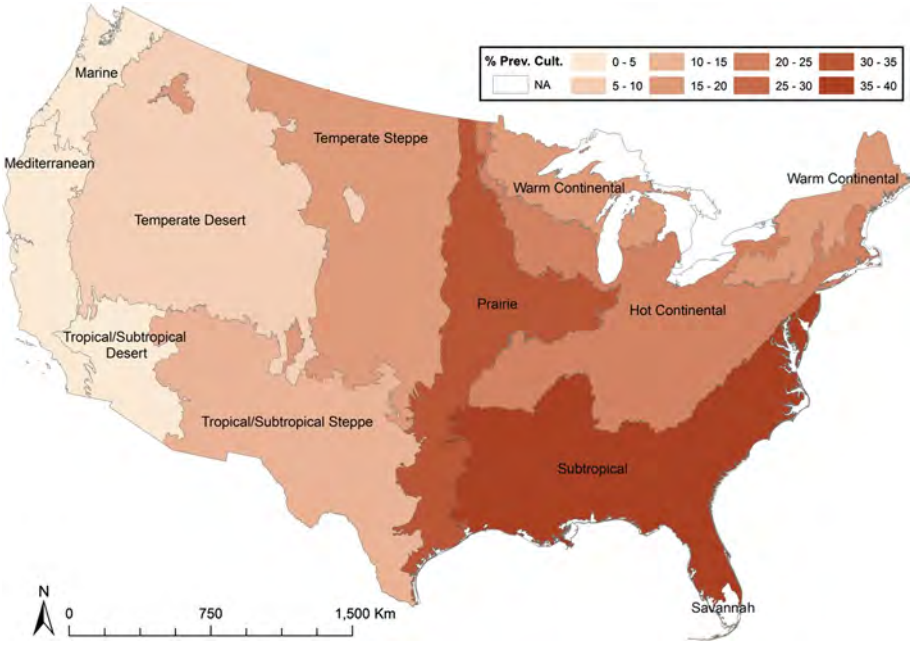

Fig. 5 Map showing the percentage of ISCN sites covered with woody vegetation that also possess an Ap horizon, indicative of past cultivation. Darker shading indicates a higher proportion of lands now covered in woody vegetation that were previously cultivated. Map units are the 10 ecoregional divisions delineated within the CONUS by the ECOMAP framework, less extreme southern Florida (Savannah division, due to low data density). (Color figure online)

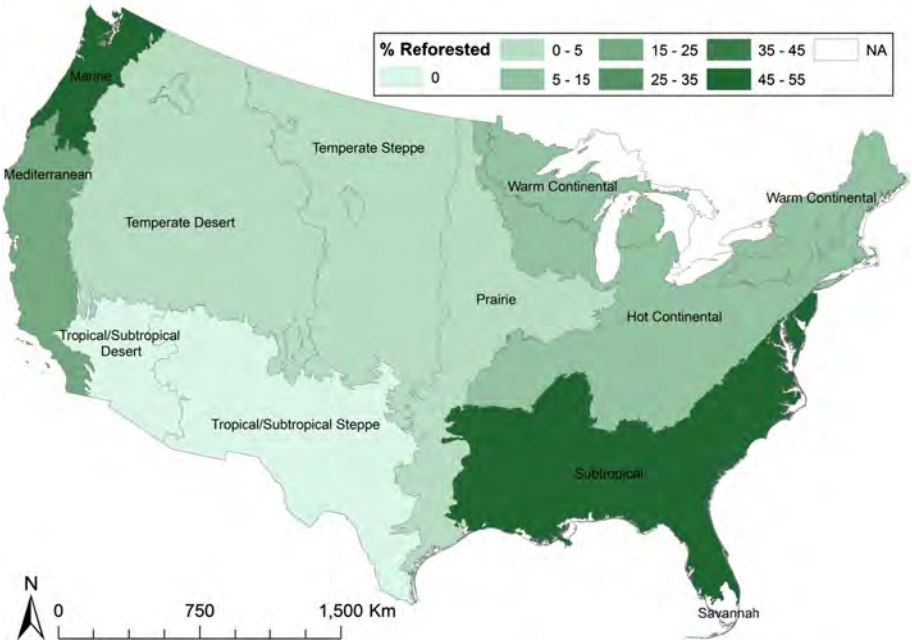

Fig. 6 Map showing the percentage of forests less than 10 years old that result from deliberate planting, based on NFI plot inventory data. Darker shading indicates a higher proportion of reforestation. Map units are the 10 ecoregional divisions delineated within the CONUS by the ECOMAP framework, less extreme southern Florida (Savannah division, due to low data density). (Color figure online)

Discussion

Key findings

The results of our analysis support four key inferences regarding land use impacts on C sequestration, discussed in subsequent sections, and highlight the large, measureable benefits that reforestation has for ecosystem C storage. First, in the bigger picture, soils are the dominant storehouse of C in all ecosystems and land cover types in the U.S., and variation in soil C pool sizes across the nation has less to do with land cover than with other factors. Nonetheless, soils hold the potential for long-term C increases following specific land use transitions; namely, where cultivated lands are converted to forest land uses. Third, the establishment of woody vegetation delivers immediate to multi-decadal C sequestration benefits in biomass and woody debris pools. Fourth, opportunities for reforestation-enhanced C sequestration (whether ongoing or not yet initiated) are not equally distributed across the U.S. Taken together, these inferences suggest that an immediate, yet phased and spatially selective approach to reforestation can enhance terrestrial C sequestration in the U.S. for decades to centuries to come.

Variation in soil and AGWB C stocks between land cover types, and the importance of ecoregional variation in these C pool sizes, does more than provide a broad overview of contemporary patterns (Tables 1, 2). More importantly, this national snapshot of C stocks by land cover suggests that the majority of the C held in terrestrial ecosystems (i.e., that in

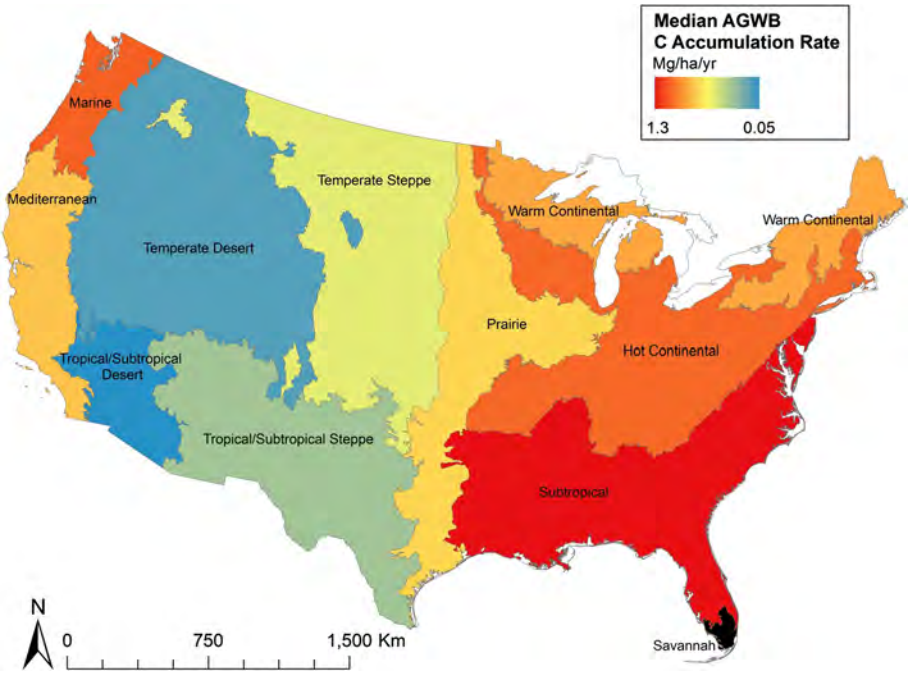

Fig. 7 Map showing the median rate of annual C accumulation in aboveground woody biomass (Mg C ha^{-1} $year^{-1}$). Warmer colors show higher rates while cooler colors show lower rates. Map units are the 10 ecoregional divisions delineated within the CONUS by the ECOMAP framework, less extreme southern Florida (Savannah division, due to low data density). (Color figure online)

soil) is not especially responsive to typical land use decisions. On the other hand, such a broad, observational snapshot is not a high-confidence approach to quantifying the impacts of a specific land use transition, such as reforestation on formerly cultivated soil, on ecosystem C stocks. In particular, in a nationwide assessment such as this, there is the potential for nonrandom spatial patterns in land use, such as cultivation of inherently richer soils and forest persistence on poor soils, to obscure true effects of reforestation. Furthermore, the use of remotely sensed land cover data (despite its validity according to independent observations in the ISCN DB) as a proxy for land use carries many problems of interpretation, and requires alternative sources of information to quantify C sequestration impacts resulting from reforestation.

The detailed soil descriptions and C data, coupled with remotely sensed land cover in the ISCN DB allow attribution of land use and quantification of its impacts on soil C. Specifically, the separation of cultivated lands, reforesting cultivated lands, and natural forest lands demonstrate the current status and potential for continued C sequestration during forest establishment on formerly plowed soils. Comparing median topsoil C stocks across these three land uses (Table 3) suggests that, in general, deforestation and cultivation release 25% of topsoil C stocks relative to a forested baseline (28 vs. 37 Mg C ha^{-1}). Given a median topsoil C stock of 30 Mg C ha^{-1} in reforesting cultivated lands, it appears these soils have yet to recover the majority of their "lost" C, assuming that never-cultivated natural forests represent an attainable long-term target. Considered collectively with results from subsoil horizons, which have smaller C stocks but show a net decrease in soil

C during reforestation compared to natural forest or cultivated lands, these results fit with patterns observed during long-term studies of individual sites undergoing post-agricultural reforestation. For example, on the Calhoun Experimental Forest (South Carolina), which suffered severe soil degradation during cultivation in the 19th and early 20th centuries, reforestation by *Pinus taeda* L. since the 1950s has been driving net accumulation of C in the topsoil and net loss of C from subsoils (Mobley et al. 2015; Richter et al. 1999). More broadly, quantitative reviews have demonstrated that while turnover and net replacement of deep soil C such as this is typical during forest regrowth, whole-profile C stocks typically increase during reforestation (Guo and Gifford 2002; Laganiere et al. 2010; Nave et al. 2013; Post and Kwon 2000). In general, residence times of soil C increase, and rates of C cycling processes decrease, with depth (Heckman et al. 2014; Schrumpf et al. 2013; von Lutzow et al. 2006). Given that even relatively "fast-cycling" soil horizons, such as topsoils, have C residence times spanning many decades to centuries, with deeper horizons holding C that turns over on century- to millennial scales, the recovery times for soil C lost during cultivation are likely quite long. Therefore, a sustained commitment to reforestation, rather than re-initiation of cultivation, is a requirement for meaningful C gains in reforesting soils. This is all the more important given predicted increases land use transfers from forest to non-forest land uses as the twentyfirst century proceeds (USDA-Forest Service 2016), as these would sacrifice soil C gains in reforesting soils on a long-term trajectory to C recovery.

In the immediate to medium-term, such as the multi-decadal period over which most forests are allowed to mature before harvesting in the U.S., AGWB is the pool that presents a clear opportunity for reforestation to enhance terrestrial C sequestration. While NFI data allowing an assessment of reforestation are much more abundant than data allowing for assessment of afforestation (Table 4), both land use decisions show the same patterns relative to naturally regenerated forests. Specifically, that planted forests tend to be younger and faster-growing than naturally regenerated forests. Generalizations that forest biomass accumulation rates are highest in younger stands (Gower et al. 1996; Ryan et al. 1997) argue for making direct comparisons of planted versus naturally regenerated forests within specific stand age ranges, yet even when age differences are controlled in this way the benefit of planting remains clear, at least through the first several decades (Fig. 4). By appearances, the key to C sequestration enhancements in planted versus naturally regenerated forests is the high initial stocking density of planted stands (Sample 2017). However, the leveling off of stocking density and AGWB C stocks in the latter decades of the first century (and the decline in both beyond 100 years of development) highlights the importance of accounting for biomass removals or stand-eliminating disturbances (e.g., fires) in the life cycle C budgets of mid- to later-successional forests. In other words, net declines in AGWB in forests > 100 years old indicate loss of woody C from the ecosystem; whether this material is lost fairly quickly to the atmosphere (e.g., due to fire or bioenergy combustion) or sequestered in a long-lived pool such as construction materials has a major impact on the broader role of forests in the C cycle (Brunet-Navarro et al. 2016; Heath et al. 2011; Smyth et al. 2014).

To the degree that they provide independent assessments of the same land use transition (forest establishment on previously nonforested land), the combined ISCN soil profile + NLCD + NBCD2000 overlay data ("Impacts of land use on biomass C stocks" section) and the FIADB plot data (Table 4) generate mutually consistent results. Specifically, both approaches suggest slower AGWB C accumulation in forests growing on previously non-forested lands. As many of these lands were likely cultivated in the past, these results suggest that reforestation of agricultural lands may be preferentially occurring on lands

that have been degraded, perhaps through the deterioration of soil properties that support tree growth, such as lower organic matter and higher bulk density (Figs. 2, 3). Regardless the mechanism, the slower biomass accumulation rates on previously nonforest (cultivated) lands illustrate how targeted reforestation of such lands can fit into a phased approach for maximizing C sequestration at a national level. Specifically, reforestation on degraded agricultural lands represents a land use transition with longer-term returns. Whereas there is a clear and immediate C accrual benefit of immediately replanting forests that have been recently disturbed or harvested (Table 4, Fig. 4), with the largest gains above natural regeneration during the first 1–3 decades, the slower recovery time for soil characteristics and forest production rates suggests that reforestation on depleted agricultural soils may play a role more in the 50 to > 100 year timeframe as soil quality begins to improve.

Patterns of convergence and disparity between reforestation activity, forest growth rates, and the establishment of forests on previously cultivated lands point the way to a range of priorities and opportunities for increasing C sequestration through tree planting in the U.S. (Figs. 5, 6, 7). Perhaps most importantly, the generally low rates of replanting across the Nation indicate that any investment in reforestation can improve the situation from its current, chronically under-attaining level. And, because AGWB C accumulation rates differ so widely across ecoregional divisions, it is apparent that while some ecoregions should not be prioritized for large-scale increases in reforestation (e.g., the dry tropical/subtropical divisions of the interior Southwest), even marginal increases in high-productivity divisions (e.g., marine in the Northwest and subtropical in the Southeast) can produce large C gains. At a minimum, these gains include C sequestered in AGWB, while in the Southeast, reforestation is also adding significant C to historically cultivated soils that recover and hold C over longer timescales. In other areas, such as the warm and hot continental divisions of the Northeast, AGWB accumulation rates are moderately high, yet reforestation rates scarcely exceed 10% of forests less than 10 years old. Increased reforestation here—especially in the hot continental division, where historic cultivation was quite extensive—has the potential to make a large impact on the national forest sector C balance, especially given the large land area. The prairie and temperate steppe divisions of the central U.S. furnish a final example. Here, many lands currently covered by woody vegetation were once cultivated, yet very few of these lands originate from deliberate reforestation (or afforestation if they were truly never forested). Given that these lands are currently realizing C accruals in soils due to the establishment of woody vegetation, a targeted increase in tree planting in this region, rather than passive woody encroachment following agricultural abandonment, can likely increase C sequestration over longer timeframes. Similar efforts have been mounted in the past, such as during the U.S. dust bowl era of the 1930s, when over one million hectares of National Forest System lands were planted or seeded by the Civilian Conservation Corps, and elsewhere, such as in degraded sand and loess soil regions of China (Liu et al. 2008) more recently for similar reasons.

Caveats and considerations

In this paper, we have referred variously to land cover and to land use, in the interest of speaking explicitly to the land attribute in question. Our principal aim in this analysis is focused on land *use*—the activity being conducted on a parcel of land; most particularly on forest establishment (whether through deliberate planting or natural regeneration, afforestation or woody encroachment). However, in many cases, we have relied upon remotely-sensed land *cover* data as an indication of land use, and in these

cases we use the term land cover to be specific while acknowledging that a snapshot of land cover does not necessarily indicate land use. For example, a freshly clearcut forest could be detected as a land cover of shrub/scrub based on the low stature and density of its woody vegetation, even though the actual land use was forest remaining forest, its temporary disturbance aside. On the other hand, to accurately attribute land *use*, additional information collected via on-the-ground observation is necessary. For cases in which we have such information, such as through the combination of soil morphology (Ap horizon presence/absence) and land cover (cultivated vs. covered by woody vegetation), we have used the term land use with confidence. Others have addressed the issue of land use versus land cover in the context of large-scale land assessments (e.g., Coulston et al. 2014; Woodall et al. 2016); here, our intent is to highlight the potential limitation of our inferences resulting from reliance on remote sensing data. In the end, corroborative results derived from ISCN land cover overlay data and data from NFI plots ("Impacts of land use on biomass C stocks" section) allows our inferences to speak for themselves, especially in light of other limitations to our approach.

The most important caveats that must be considered in this analysis pertain to our use of data collected across space and time as a means to make indirect comparisons of land use. First, the past—in this case, currently available inventory data that reflect recent land cover, land use and management practices—may not predict the future. In that regard, inferences that are forward-looking, such as the potential for C accumulation to continue on lands that have undergone cultivation-to-forest transition, are open to question. Second, because we rely for many of our inferences on space-for-time substitutions, such as NFI plots spanning a range of forest ages, there is the potential for our approach to mis-attribute causation or obscure important underlying constraints. For example, it is possible that certain agricultural lands are preferentially abandoned for underlying factors that later influence the rate of forest biomass accumulation, and it is these factors (rather than cultivation itself) that results in slower growth rates for forests on previously cultivated lands. Similarly, it is possible that the soil datasets contributed to ISCN comprise a non-representative sample of lands in the U.S., and this could obfuscate trends that we do, or do not detect and report in this analysis.

A third consideration that could impact our results pertains to those C pools that we did versus did not include in our analyses. Specifically, in this paper, we do not report the contributions of trees < 12.7 cm diameter, or of roots (coarse or fine) to ecosystem C stocks. Early in analyses, we examined data from NFI plots, and upon determining that small trees represent < 10% of the AGWB on > 90% of the plots, chose to exclude these as a pool of interest. Roots- in particular, the coarse, woody roots that represent a C pool that is similarly long-lived to AGWB, are likely a significant C stock at all spatial levels (plots, ecosystems, ecoregions). However, the NFI approach, similar to that often used in large-scale C work, is to estimate the pool size of this belowground woody biomass as a static fraction of AGWB (e.g., 20%), and estimate it on that basis. Rather than inflate our C stock analyses by including these uncertain estimates, we exclude them. While the overall result is likely that we underestimate C sequestration due to reforestion as a consequence, we suggest this is an acceptable trade-off in an analysis that otherwise incorporates so many sources of uncertainty. Ultimately, while there are still other caveats and considerations that could be raised around this work, its inferences are based on very large datasets that provide a degree of confidence in its overarching results, and we offer its results as self-supporting.

Conclusions

Wide-ranging data from independent, complementary sources suggest that reforestation enhances C sequestration in multiple ecosystem pools, differing in their C residence times, at regional to national levels. In general, soil C stocks are not particularly sensitive to land cover type, but specific land use transitions, such as the establishment of forests on formerly cultivated lands, causes increases in topsoil C storage. Under these situations, rates of C accumulation in aboveground woody biomass are lower than rates observed for continuous forest land uses, but represent an additional pool for C gains during reforestation. In forest lands that have been harvested or affected by stand-eliminating disturbances, deliberate re-planting realizes two- to three-fold gains in C accumulation in aboveground woody biomass compared to natural regeneration. Coarse woody debris C stocks, while much smaller overall, are also increased as a result of reforestation. Given wide variation in fundamental ecologic factors, such as climate and geology, that influence forest growth rates, an ecoregional framework is well-suited to identifying and prioritizing areas for reforestation efforts at regional to national levels.

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References

Bechtold WA, Patterson PL (eds) (2005) The enhanced forest inventory and analysis program—national sampling design and estimation procedures. General technical report SRS-80. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC, 85 p

Bentz BJ, Regniere J, Fettig CJ, Hansen EM, Hayes JL, Hicke JA, Kelsey RG, Negron JF, Seybold SJ (2010) Climate change and bark beetles of the western United States and Canada: direct and indirect effects. Bioscience 60:602–613

Birdsey R, Pregitzer K, Lucier A (2006) Forest carbon management in the United States: 1600–2100. J Environ Qual 35:1461–1469

Bond-Lamberty B, Wang CK, Gower ST (2004) Net primary production and net ecosystem production of a boreal black spruce wildfire chronosequence. Glob Change Biol 10:473–487

Brunet-Navarro P, Jochheim H, Muys B (2016) Modelling carbon stocks and fluxes in the wood product sector: a comparative review. Glob Change Biol 22:2555–2569

Buell GR, Markewich HW (2004) Data compilation, synthesis, and calculations used for organic-carbon storage and inventory estimates for mineral soils of the Mississippi River basin. US geological survey professional paper 1686-A, U.S. Department of the Interior, U.S. Geological Survey, Reston, VA

Caspersen JP, Pacala SW, Jenkins JC, Hurtt GC, Moorcroft PR, Birdsey RA (2000) Contributions of land-use history to carbon accumulation in US forests. Science 290:1148–1151

Cleland DT, Avers PE, McNab WH, Jensen ME, Bailey RG, King T, Russell WE (1997) National hierarchical framework of ecological units. In: Boyce MS, Haney A (eds) Ecosystem management: applications for sustainable forest and wildlife resources. Yale University Press, New Haven, pp 181–200

Cole JA, Johnson KD, Birdsey RA, Pan Y, Wayson CA, McCollough K, Hoover CM, Hollinger DY, Bradford JB, Ryan MG, Kolka RK, Weishampel P, Clark KL, Skowronski NS, Hom J, Ollinger SV, McNulty SG, Gavazzi MJ (2013) Database for landscape-scale carbon monitoring sites. General technical report, U.S. Department of Agriculture, Forest Service, Northern Research Station. GTR-NRS-119

Compton JE, Boone RD (2000) Long-term impacts of agriculture on soil carbon and nitrogen in New England Forests. Ecology 81:2314–2330
Coulston JW, Reams GA, Wear DN, Brewer CK (2014) An analysis of forest land use, forest land cover and change at policy-relevant scales. Forestry 87:267–276
Coulston JW, Wear DN, Vose JM (2015) Complex forest dynamics indicate potential for slowing carbon accumulation in the southeastern United States. Scientific reports 5
Creutzburg MK, Scheller RM, Lucash MS, LeDuc SD, Johnson MG (2017) Forest management scenarios in a changing climate: trade-offs between carbon, timber, and old forest. Ecol Appl 27:503–518
Dumroese RK, Williams MI, Stanturf JA, St. Clair JB (2015) Considerations for restoring temperate forests of tomorrow: forest restoration, assisted migration, and bioengineering. New Forest 46:947–964
Fry J, Xian G, Jin S, Dewitz J, Homer C, Yang L, Barnes C, Herold N, Wickham J (2011) Completion of the 2006 national land cover database for the conterminous United States. Photogramm Eng Remote Sensing 77:858–864
Gough CM, Vogel CS, Harrold KH, George K, Curtis PS (2007) The legacy of harvest and fire on ecosystem carbon storage in a north temperate forest. Glob Change Biol 13:1935–1949
Gower ST, McMurtrie RE, Murty D (1996) Aboveground net primary production decline with stand age: potential causes. Trends Ecol Evol 11:378–382
Guo LB, Gifford RM (2002) Soil carbon stocks and land use change: a meta analysis. Glob Change Biol 8:345–360
Heath LS, Smith JE, Skog KE, Nowak DJ, Woodall CW (2011) Managed Forest Carbon Estimates for the US Greenhouse Gas Inventory, 1990-2008. J Forest 109:167–173
Heckman K, Welty-Bernard A, Rasmussen C, Schwartz E (2009) Geologic controls of soil carbon cycling and microbial dynamics in temperate forests. Chem Geol 267:12–23
Heckman KA, Campbell JL, Powers H, Law B, Swanston C (2013) The influence of fire on the radiocarbon signature and character of soil organic matter in the Siskiyou Forest, Oregon. Fire Ecol 9:40–56
Heckman K, Throckmorton H, Clingensmith C, Vila FJG, Horwath WR, Knicker H, Rasmussen C (2014) Factors affecting the molecular structure and mean residence time of occluded organics in a lithosequence of soils under ponderosa pine. Soil Biol Biochem 77:1–11
Hicke JA, Allen CD, Desai AR, Dietze MC, Hall RJ, Hogg EH, Kashian DM, Moore D, Raffa KF, Sturrock RN, Vogelmann J (2012) Effects of biotic disturbances on forest carbon cycling in the United States and Canada. Glob Change Biol 18:7–34
Homer CC, Huang L, Yang B Wylie, Coan M (2004) Development of a 2001 National Landcover Database for the United States. Photogramm Eng Remote Sensing 70:829–840
Homer CG, Dewitz JA, Yang L, Jin S, Danielson P, Xian G, Coulston J, Herold ND, Wickham JD, Megown K (2015) Completion of the 2011 National Land Cover Database for the conterminous United States-representing a decade of land cover change information. Photogramm Eng Remote Sensing 81:345–354
Jin WC, He HS, Thompson FR, Wang WJ, Fraser JS, Shifley SR, Hanberry BB, Dijak WD (2017) Future forest aboveground carbon dynamics in the central United States: the importance of forest demographic processes. Scientific reports 7
Kashian DM, Romme WH, Tinker DB, Turner MG, Ryan MG (2006) Carbon storage on landscapes with stand-replacing fires. Bioscience 56:598–606
Kellndorfer J, Walker W, Kirsch K, Fiske G, Bishop J, LaPoint L, Hoppus M, Westfall J (2013) NACP aboveground biomass and carbon baseline data, V. 2 (NBCD 2000), U.S.A., 2000. Data set. http://daac.ornl.gov from ORNL DAAC, Oak Ridge, Tennessee, USA
Kurz WA, Dymond CC, Stinson G, Rampley GJ, Neilson ET, Carroll AL, Ebata T, Safranyik L (2008) Mountain pine beetle and forest carbon feedback to climate change. Nature 452:987–990
Laganiere J, Angers DA, Pare D (2010) Carbon accumulation in agricultural soils after afforestation: a meta-analysis. Glob Change Biol 16:439–453
Law BE, Sun OJ, Campbell J, Van Tuyl S, Thornton PE (2003) Changes in carbon storage and fluxes in a chronosequence of ponderosa pine. Glob Change Biol 9:510–524
Liang S, Hurteau MD, Westerling AL (2017) Response of Sierra Nevada forests to projected climate-wildfire interactions. Glob Change Biol 23:2016–2030
Liu JG, Li SX, Ouyang ZY, Tam C, Chen XD (2008) Ecological and socioeconomic effects of China's policies for ecosystem services. Proc Natl Acad Sci USA 105:9477–9482
MacDonald SE, Landhausser SM, Skousen J, Franklin J, Frouz J, Hall S, Jacobs DF, Quideau S (2015) Forest restoration following surface mining disturbance: challenges and solutions. New Forest 46:703–732
McNab WH, Cleland DT, Freeouf JA, Keys JE, Nowacki GJ, Carpenter CA (2007) Description of ecological subregions: sections of the conterminous United States. USDA, Forest Service, Washington, p 80

Mishra U, Riley WJ (2015) Scaling impacts on environmental controls and spatial heterogeneity of soil organic carbon stocks. Biogeosciences 12:3993–4004
Mobley ML, Lajtha K, Kramer MG, Bacon AR, Heine PR, Richter DD (2015) Surficial gains and subsoil losses of soil carbon and nitrogen during secondary forest development. Glob Change Biol 21:986–996
Nave LE, Swanston CW, Mishra U, Nadelhoffer KJ (2013) Afforestation effects on soil carbon storage in the United States: a synthesis. Soil Sci Soc Am J 77:1035–1047
Nave L, Johnson K, van Ingen C, Agarwal D, Humphrey M, Beekwilder N (2017) International Soil Carbon Network (ISCN) Database, International Soil Carbon Network (ISCN) Database, Version 3. International Soil Carbon Network. https://doi.org/10.17040/ISCN/1305039
Nave LE, Domke GM, Hofmeister KL, Mishra U, Perry CH, Walters BF, Swanston CW (2018) Reforestation can sequester two petagrams of carbon in U.S. topsoils in a century. In: Proceedings of the National Academy of Sciences of the United States. https://doi.org/10.1073/pnas.1719685115
Oswalt SN, Smith WB, Miles PD, Pugh SA (2014) Forest resources of the United States, 2012: a technical document supporting the Forest Service 2015 update of the RPA assessment. General technical report GTR WO-91, U.S. Department of Agriculture, Forest Service, Washington Office, Washington, DC, 218 pp
Post WM, Kwon KC (2000) Soil carbon sequestration and land-use change: processes and potential. Glob Change Biol 6:317–327
Puhlick J, Woodall C, Weiskittel A (2017) Implications of land-use change on forest carbon stocks in the eastern United States. Environ Res Lett 12:024011
Richter DD, Markewitz D, Trumbore SE, Wells CG (1999) Rapid accumulation and turnover of soil carbon in a re-establishing forest. Nature 400:56–58
Ryan MG, Binkley D, Fownes JH (1997) Age-related decline in forest productivity: pattern and process. In: Begon M, Fitter AH (eds) Advances in ecological research, vol 27. Elsevier Academic Press, London, pp 213–262
Sample VA (2017) Potential for additional carbon sequestration through regeneration of nonstocked forest land in the United States. J Forest 115:309–318
Schoennagel T, Balch JK, Brenkert-Smith H, Dennison PE, Harvey BJ, Krawchuk MA, Mietkiewicz N, Morgan P, Moritz MA, Rasker R, Turner MG, Whitlock C (2017) Adapt to more wildfire in western North American forests as climate changes. Proc Natl Acad Sci USA 114:4582–4590
Schrumpf M, Kaiser K, Guggenberger G, Persson T, Kogel-Knabner I, Schulze ED (2013) Storage and stability of organic carbon in soils as related to depth, occlusion within aggregates, and attachment to minerals. Biogeosciences 10(3):1675–1691
Sequeira CH, Wills SA, Seybold CA, West LT (2014) Predicting soil bulk density for incomplete databases. Geoderma 213:64–73
Smyth CE, Stinson G, Neilson E, Lempriere TC, Hafer M, Rampley GJ, Kurz WA (2014) Quantifying the biophysical climate change mitigation potential of Canada's forest sector. Biogeosciences 11:3515–3529
USDA Forest Service (2016) Future of America's forests and rangelands: update to the 2010 resources planning act assessment. General technical report WO-GTR-94, Washington, DC, 250 pp
Vogelmann JE, Howard SM, Yang L, Larson CR, Wylie BK, Van Driel JN (2001) Completion of the 1990s National Land Cover Data Set for the conterminous United States. Photogramm Eng Remote Sensing 67:650–662
von Lutzow M, Kogel-Knabner I, Ekschmitt K, Matzner E, Guggenberger G, Marschner B, Flessa H (2006) Stabilization of organic matter in temperate soils: mechanisms and their relevance under different soil conditions—a review. Eur J Soil Sci 57(4):426–445
Watrud E, Zensen F, Darbyshire R (2012) Laws affecting reforestation on USDA Forest Service lands. Tree Plant Notes 55:39–42
Wear DN, Coulston JW (2015) From sink to source: regional variation in US forest carbon futures. Scientific reports 5
Williams CA, Collatz GJ, Masek J, Goward SN (2012) Carbon consequences of forest disturbance and recovery across the conterminous United States. Global Biogeochem Cycles 26:GB1005
Williams CA, Collatz GJ, Masek J, Huang CQ, Goward SN (2014) Impacts of disturbance history on forest carbon stocks and fluxes: merging satellite disturbance mapping with forest inventory data in a carbon cycle model framework. Remote Sens Environ 151:57–71
Woodall CW, Walters BF, Coulston JW, D'Amato AW, Domke GM, Russell MB, Sowers PA (2015) Monitoring network confirms land use change is a substantial component of the forest carbon sink in the eastern United States. Scientific reports 5

Woodall CW, Walters BF, Russell MB, Coulston JW, Domke GM, D'Amato AW, Sowers PA (2016) A tale of two forest carbon assessments in the eastern United States: forest use versus cover as a metric of change. Ecosystems 19:1401–1417

Yang S, Mountrakis G (2017) Forest dynamics in the US indicate disproportionate attrition in western forests, rural areas and public lands. PLoS ONE 12:e0171383

Zhang F, Chen JM, Pan Y, Birdsey RA, Shen S, Ju W, He L (2012) Attributing carbon changes in conterminous U.S. forests to disturbance and non-disturbance factors from 1901–2010. J Geophys Res 117:G02021

Affiliations

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5 Argonne National Laboratory, Argonne, IL 60439, USA

6 USDA-Forest Service, Northern Research Station, Houghton, MI 49931, USA

From: Courtney Bangs
To: ODF_DL_Board of Forestry
Subject: Santiam State Forest Restoration and Recovery item #6 public testimony
Date: Tuesday, March 02, 2021 7:48:11 PM

Hello,
For those of you that do not know me my name is Courtney Bangs. I am a County Commissioner out of Clatsop County and a CFTLC board member. I am speaking for myself today and not as the commission as a whole. As a county commissioner I know how important the State Forests are to our communities. It is honestly difficult for me to imagine what the impact to Clatsop County would be if this percentage of our forest was devastated as much as the Santiam Forest was. The socio economic impact to our county alone would have irreconcilable long term effects. The Department of Forestry has managed these lands for a balance of economic, social, and environmental goals for decades. I wanted to give recognition for their work and sacrifice as they continue to work to find that delicate balance during these trying times.

I ask myself what I would wish for my county if we were so negatively affected. I would hope for an expediated response of both salvage logging and reforestation. I appreciate that the department is looking at salvage logging in the areas of burn as the loss of potential economic returns in these areas is complete. This loss of economic opportunity affects the social side of the triangle as well. Economic health impacts social health greatly in all of our communities. In conjunction with the socio economic impact, social losses are also high due to danger of snags and devastated recreational opportunities. The safety and liability concerns are currently very high. Finally, without salvaging these areas, we will not be able to safely replant healthy trees to bring back the vibrant environmental conditions that all of the foresters worked so hard to achieve.

The clock is ticking on these salvage trees as they decay quickly making them undesirable to local mills. This is not an economic loss that can be made up in following years. Once these trees reach a certain point they cannot be sold and the loss to the county and its constituents will be staggering.

Thank you for your consideration,

Courtney Bangs
Clatsop County Commissioner District 4
Mail Address: 800 Exchange St., Suite 410, Astoria OR, 97103
Phone: (971) 286-0175
Email: cbangs@co.clatsop.or.us

Boise Cascade Wood Products, LLC
110 N. Monmouth Ave, Suite #103
Monmouth, OR 97361
T 503-606-3860 F 503-606-3866

Boise Cascade

March 1, 2021

Via email: BoardofForestry@oregon.gov

Board of Forestry
2600 State Street
Salem, OR 97310

RE: ODF North Cascades Draft Implementation Plan Revision

Dear Board of Forestry,

Thank you for the opportunity to offer comments regarding the Oregon Department of Forestry restoration plan for the catastrophic fires that affected the North Cascades District lands. Please consider the following:

Active Forest Management is vital for the recovery effort

- Active management, harvesting dead standing trees and replanting native tree seedlings, is vital to stabilize soils and banks along streams, promote clean water, sequester carbon, and restore vital fish and wildlife habitat for generations to come.
- Harvesting standing dead trees and promptly reforesting reduces the risk of future wildfires and creates a safer and more vibrant forest for the protection and benefit of communities.
- Leaving standing dead trees riddled throughout the forest promotes a dangerous situation for anyone recreating or traveling through the State Forests.

Recovery of the lands is good for the forest AND the community; it is the right thing to do

- Harvesting standing dead trees and promptly reforesting these lands will help create jobs in the short term that will aid the recovery in local communities- while helping to restore the forest in the short and long-term.
- The Tillamook burn recovery effort created a forest Oregonians enjoy today, thousands of acres of green forest in the North Coast. This is a shining example of the long-lasting and real value of prompt recovery actions.
- This is a vital moment in the careers of the managers of the Santiam State Forest as well as for the Board of Forestry. If this recovery is done right, their legacy of stewardship as well as yours will stand as a testament for generations to come.

ODF needs to prioritize management on as many acres as possible

- The Draft Plan currently lists over 10,000 acres that have not been assessed for damages for a several reasons including access constraints. These acres need to be assessed for management soon with the goal of fast and efficient recovery.
- The Draft Plan currently lists some 5,400 acres as not warranted for management for a myriad of reasons including operability and low value. Staff needs to reconsider these acres and plan management that will accelerate recovery, this likely includes harvest, slashing, erosion control, and road work, and certainly reforestation.

While much has been done with the timber salvage sales that have been sold or selling, reforestation of burned acres, and other management activities; an accelerated pace in this recovery process is encouraged.

If you have any questions, please contact me.

Respectfully,

Todd Merritt
Manager, NW Oregon Log Procurement
toddmerritt@bc.com
503-586-6011 (mobile)

3/2/2021

Oregon Department of Forestry
2600 State Street
Salem, Oregon 97310

Submitted via email: ODF.SFComments@oregon.gov

Re: Santiam Post-Fire Logging

Greetings:

The Audubon Societies of Corvallis and Salem, Cascadia Wildlands, Center for Biological Diversity, Oregon Wild, and Wild Salmon Center recently submitted a notice alerting the Board of Forestry to legal violations stemming from the continuing authorization of post-fire clearcutting projects in the Santiam State Forest. This challenge is in part focused upon the Department's clearcutting of forests that were designated by this Board to develop into complex, older forest. This Board had previously determined that allowing these areas to develop into older, complex forest replete with snags and downed wood was necessary to meet its obligation to manage these lands to achieve the greatest permanent value for the state. Clearcutting these areas is not permitted under the Forest Management Plan, or only allowed in circumstances that would further these area's development into older, complex forest.

The newly revised Implementation Plan before the Board today will clearcut these areas that the Board previously set aside. The Department does not even attempt to argue within this plan that post-fire clearcutting these areas will accelerate or facilitate the development of older forest characteristics. This is because the Department's biologists would not and could not make such a scientifically baseless argument.

The State Forester operates under the authority and at the direction of the State Board of Forestry. ORS 530.050. The Board under OAR 629-03-0010 has specific authority to direct the State Forester to forgo the sale of forest products on parcels to protect other values such as wildlife habitat and water protection. We would ask that the Board halt the ongoing sale of post-fire projects under the Department's newly revised implementation plan because it violates the applicable Forest Management Plan and the determination by this Board that some limited areas needed to be set aside to secure the greatest permanent value of those lands to the state.

We look forward to hearing from you, and have any questions, or would like to discuss this matter, please do not hesitate to contact us.

Sincerely,

Nick Cady, Legal Director
Cascadia Wildlands

POB 10455 Eugene OR 97440 - ph 541.434.1463 - f 541.434.6494 - info@cascwild.org
www.CascWild.org

From: Jim Fairchild
To: ODF_DL_Board of Forestry
Subject: Santiam Forest Fire Recovery/Restoration Response Testimony
Date: Wednesday, March 03, 2021 8:01:47 AM

Dear Board of Forestry Members,

It has come to our attention that the Department of Forestry intends to log in areas of the burned Santiam Forest under its Revised Implementation Plan.
We strenuously object to logging activities that target areas already identified as older complex forest or already thinned or manipulated to create layered forest conditions. These activities would effectively reduce acreage targets for this forest cover type under the current management plan, and we believe would be contrary to meeting the Greatest Permanent Value rule.

Robust management plans need not be abandoned or altered in the face of predictable events, even events with low frequency and high severity occurrence patterns. Similarly, planning efforts such as the multi-agency HCP management plan process underway should not be undercut by altering the acreages already identified as Riparian Conservation Areas and Habitat Conservation Areas while that planning is underway.

We appreciate Department efforts to adjust current Fiscal Year sales not already auctioned or awarded to protect the above identified resource values and avoid cutting and harvest where more natural fire recovery processes have begun. And we complement ODF on focusing its efforts, expensive though they need to be, to recover young plantations and restore Santiam Forest conditions to provide more natural and stable forests able to achieve the greatest permanent value at the lowest cost for all Oregonians into an even less predictable future.

Thank you,
Jim Fairchild, Conservation Chair
alderspring@peak.org
Audubon Society of Corvallis
www.audubooncorvallis.org

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Santiam State Forest

2021 Forest Restoration Plan

Seth Barnes
Director of Forest Policy

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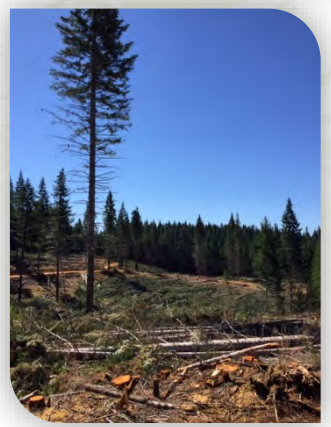
My Background



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Purpose of these State Forests

- Deeded by Counties to the State
- Management to benefit county beneficiaries
- NOT: Wilderness, Park, Research forest, etc.

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USDA United States Department of Agriculture
Forest Service

PNW Pacific Northwest Research Station

Science FINDINGS

issue two hundred eleven / november 2018

"Science affects the way we think together."
Lewis Thomas

INSIDE

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IMARY

existing for-
ave behind dead
at become fuel
Harvesting fire-
times proposed as
roach for reduc-
ing future fuels and wildfire sever-
ity. Postfire logging, however, is
controversial. Some question its fuel
reduction benefits and its ecological
impacts.

avid W. Peterson, a research for-
er with the USDA Forest Service,
his colleagues investigated the
term effects of postfire logging
dy fuels in 255 coniferous for-
est stands that burned with high fire
severity in 68 wildfires between 1970
and 2007 in eastern Washington and
Oregon. They found that postfire
logging significantly reduced future
surface woody fuel levels in forests

Standing dead trees in a high-severity patch burned in the 2015 Chelan Complex Fire on the

"The big take home here is that postfire logging can and does serve as a valid fuel reduction treatment."

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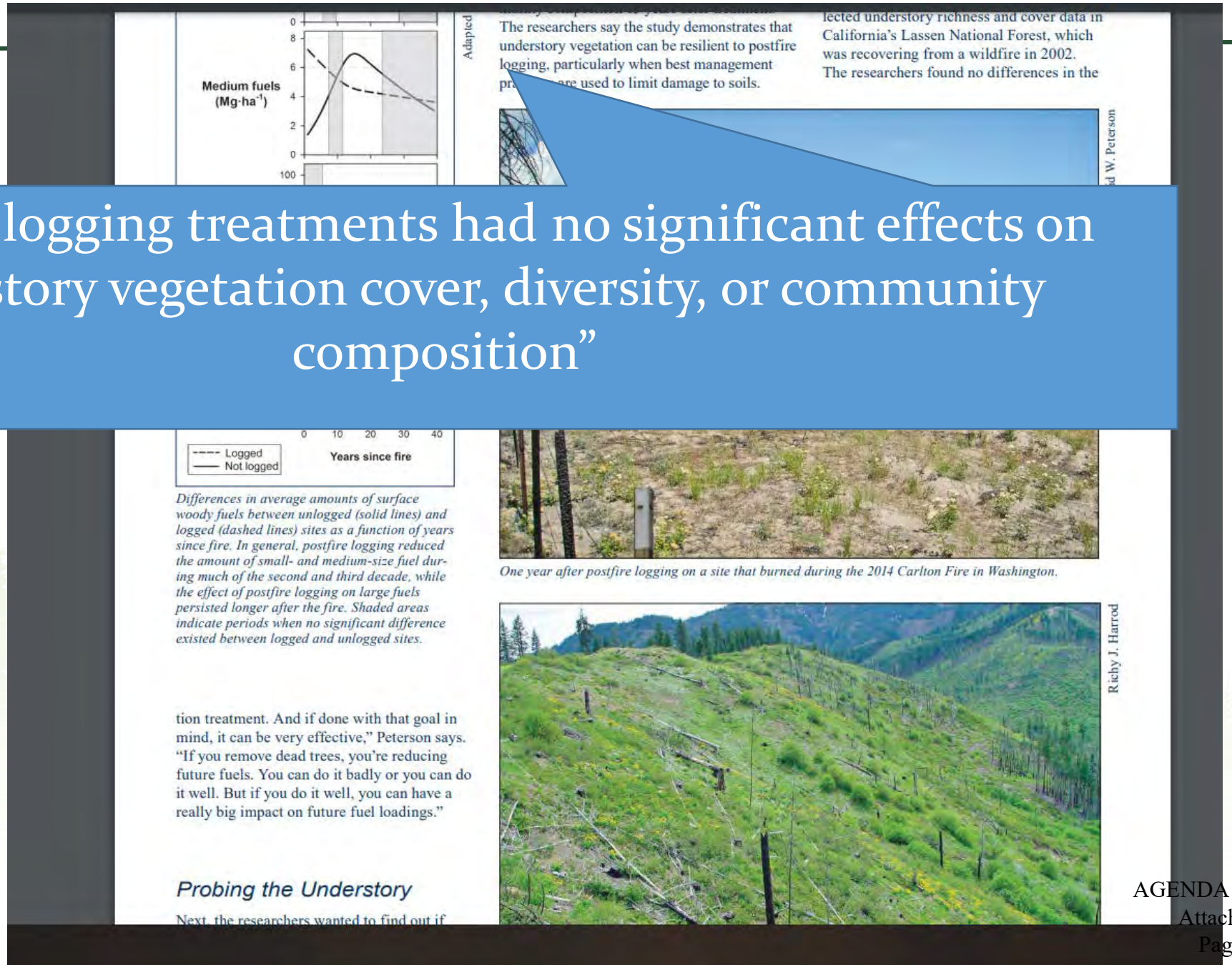
"Postfire logging treatments had no significant effects on understory vegetation cover, diversity, or community composition"



Differences in average amounts of surface woody fuels between unlogged (solid lines) and logged (dashed lines) sites as a function of years since fire. In general, postfire logging reduced the amount of small- and medium-size fuel during much of the second and third decade, while the effect of postfire logging on large fuels persisted longer after the fire. Shaded areas indicate periods when no significant difference existed between logged and unlogged sites.

Adapted

The researchers say the study demonstrates that understory vegetation can be resilient to postfire logging, particularly when best management pr… used to limit damage to soils.

lected understory richness and cover data in California's Lassen National Forest, which was recovering from a wildfire in 2002. The researchers found no differences in the

d W. Peterson

One year after postfire logging on a site that burned during the 2014 Carlton Fire in Washington.

Richy J. Harrod

tion treatment. And if done with that goal in mind, it can be very effective," Peterson says. "If you remove dead trees, you're reducing future fuels. You can do it badly or you can do it well. But if you do it well, you can have a really big impact on future fuel loadings."

Probing the Understory

Next, the researchers wanted to find out if

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BRIEF REPORT

Tree planting has the potential to increase carbon sequestration capacity of forests in the United States

Grant M. Domke[a,1], Sonja N. Oswalt[b], Brian F. Walters[a], and Randall S. Morin[c]

[a]Forest Service Northern Research Station, US Department of Agriculture, St. Paul, MN 55108; [b]Forest Service Southern Research Station, US Department of Agriculture, Knoxville, TN 37919; and [c]Forest Service Northern Research Station, US Department of Agriculture, York, PA 17402

Edited by James A. Estes, University of California, Santa Cruz, CA, and approved August 18, 2020 (received for review June 1, 2020)

Several initiatives have been proposed to mitigate forest loss and climate change through tree planting as well as maintaining and restoring forest ecosystems. These initiatives have both inspired and been inspired by global assessments of tree and forest attributes and their contributions to offset carbon dioxide (CO_2) emissions. Here we use data from more than 130,000 national forest inventory plots to describe the contribution of nearly 1.4 trillion trees on forestland in the conterminous United States to mitigate CO_2 emissions and the potential to enhance carbon sequestration capacity on productive forestland. Forests and harvested wood products uptake the equivalent of more than 14% of economy-wide CO_2 emissions in the United States annually, and there is potential to increase carbon sequestration capacity by ~20% (−187.7 million metric tons [MMT] CO_2 ±9.1 MMT CO_2) per year by fully stocking all understocked productive forestland. However, there are challenges and opportunities to be considered

and challenges for increasing C sequestration capacity on existing forestland.

This work provides context and estimates for assessments of the potential contributions of trees and forests to mitigate forest loss and climate change through tree planting in the United States.

Results

There are an estimated 1.38 trillion live trees (±8.71 billion live trees, 95% CI) across all size classes on 256.3 Mha of forestland (±0.65 Mha) in the CONUS (Fig. 1*A*). Collectively, there are an estimated 71,808 million metric tons (MMT) carbon dioxide (CO_2) (±901.19 MMT CO_2) stored in all live trees (aboveground and belowground) and they sequestered an estimated 546.7 MMT CO_2 (±31.6 MMT CO_2) in the year 2018 (Fig. 1 *A* and *D*). The CONUS-wide estimates translate to 280 MT CO_2 stored per

ENVIRONMENTAL SCIENCES

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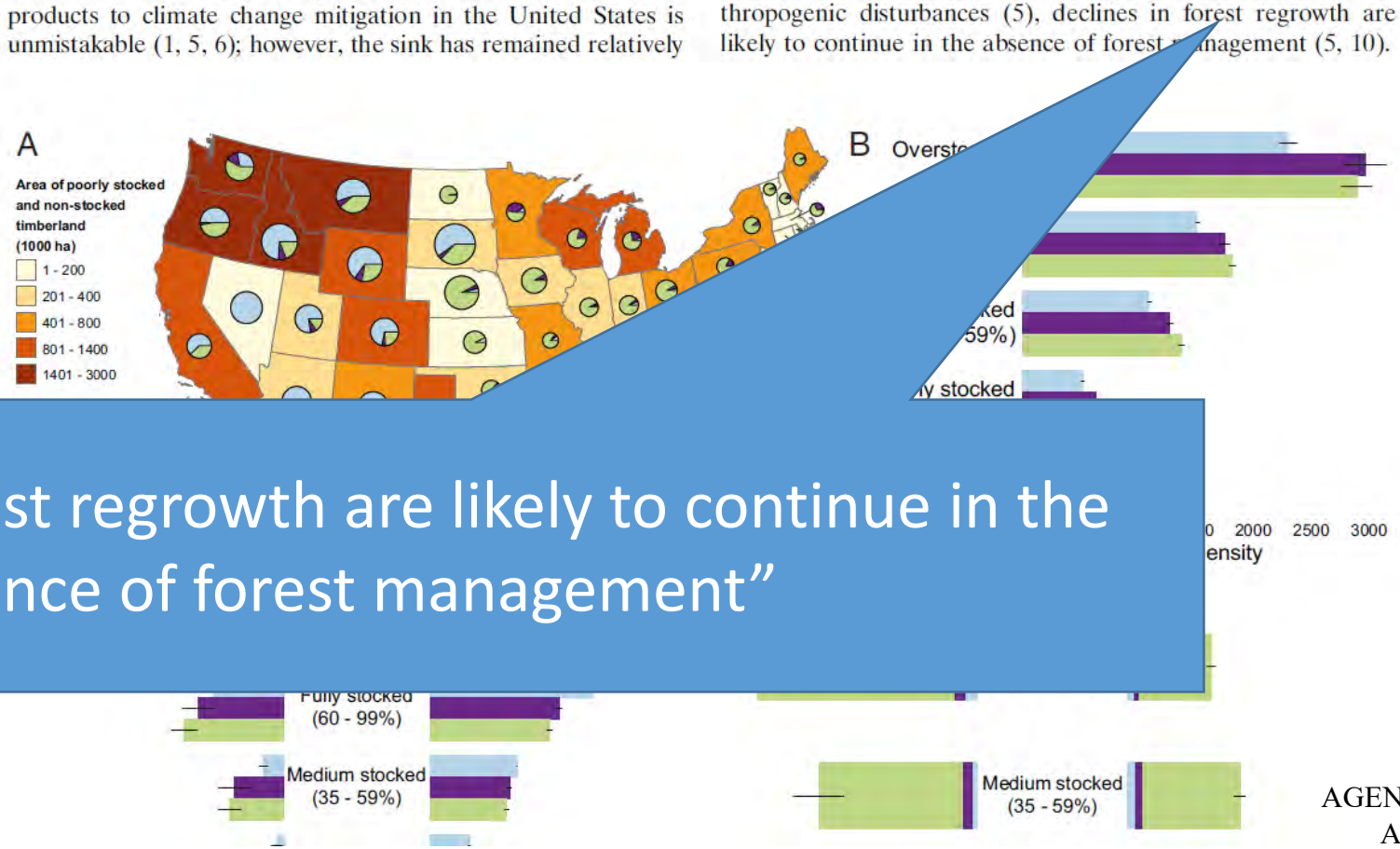
forestland in the CONUS, (*C*) approximate locations of national forest inventory plots with at least one forested condition (n = 130,250) in the CONUS used in the study, and (*D*) total greenhouse gas emissions and removals on forestland by US state in 2018. Negative estimates indicate net C uptake (i.e., a net removal of C from the atmosphere).

Discussion

The contribution of existing forestland and harvested wood products to climate change mitigation in the United States is unmistakable (1, 5, 6); however, the sink has remained relatively stable, while total economy-wide CO_2 emissions in the United States have declined (2). Considering trends in natural and anthropogenic disturbances (5), declines in forest regrowth are likely to continue in the absence of forest management (5, 10).



"Declines in forest regrowth are likely to continue in the absence of forest management"

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BRIEF REPORT

Tree planting may accelerate live-tree sequestration of C stocks in forests (7, 8) [illegible]e accumulation of C in soils (9). However, infra[illegible]straints (e.g., planting stock availability) [illegible]d economic competition with other [illegible]bjectives (5, 7), natural disturbances [illegible] change (4, 5), have limited and may [illegible]ntation. Approximately 1% of underberland in the CONUS which may benefit from forest management activities. Further, there may be opportunities on land which was historically forested (reforestation) or where the current or past land use was not forestland (afforestation) (12). Finally, while reforestation and afforestation activities will help to maintain and potentially enhance the forest C sink in the United States and beyond (12), this is just one of many nature-based solutions which must be deployed to mitigate climate change.

"If all understocked timberland were fully stocked in the United States, potential C sequestration capacity would increase by ~20% per year"

Methods

This analysis relied on the most recent publicly available data from the US NFI conducted by the US Department of Agriculture (USDA) Forest Service Forest Inventory and Analysis (FIA) program (13). Base intensity permanent ground plots are distributed approximately every 2,428 ha across the CONUS. Each permanent ground plot is a series of four fixed-radius (7.32 m) plots (i.e., subplots) spaced 36.6 m apart in a triangular arrangement with one subplot in the center. Tree-level (diameter at breast height [dbh] ≥ 12.7 cm) and site-level attributes are measured at regular temporal intervals on plots that have at least one forested condition. Saplings (2.54 cm ≤ dbh < 12.7 cm)

current annual tree planting capacity (11), and reforestation estimates were based entirely on empirical estimates obtained from the NFI and current tree planting capacity (11, 13–15).

Data Availability. National forest inventory data have been deposited in FIA DataMart (https://apps.fs.usda.gov/fia/datamart/).

ACKNOWLEDGMENTS. We acknowledge Annarita Mariotti from the White House Office of Science Technology Policy (OSTP) and Tracy C. Hancock from the USDA Forest Service for sharing questions that resulted in the estimates described here. We also thank Linda S. Heath, Greg Reams, Jeff Turner, Pat Miles, and Scott Pugh from the USDA Forest Service for helpful discussions regarding OSTP questions and responses.

1. Y. Pan *et al.*, A large and persistent carbon sink in the world's forests. *Science* **333**, 988–993 (2011).
2. US Environmental Protection Agency, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018" (EPA 430-R-20-002, Environmental Protection Agency, 2020).
3. T. A. M. Pugh *et al.*, Role of forest regrowth in global carbon sink dynamics. *Proc. Natl. Acad. Sci. U.S.A.* **116**, 4382–4387 (2019).
4. C. A. Williams, H. Gu, R. MacLean, J. G. Masek, G. J. Collatz, Disturbance and the carbon balance of US forests: A quantitative review of impacts from harvests, fires, insects, and droughts. *Global Planet. Change* **143**, 66–80 (2016).
5. G. Domke *et al.*, "Forests" in *Second State of the Carbon Cycle Report (SOCCR2): A Sustained Assessment Report*, N. Cavallaro, Ed. (US Global Change Research Program, Washington, DC, 2018), pp. 365–398.
6. G. M. Domke *et al.*, "Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018" (Resource Update FS-227, US Department of Agriculture, Madison, WI, 2020).
7. L. E. Nave *et al.*, The role of reforestation in carbon sequestration. *New For.* **50**, 115–137 (2019).
8. B. E. Law *et al.*, Land use strategies to mitigate climate change in carbon dense temperate forests. *Proc. Natl. Acad. Sci. U.S.A.* **115**, 3663–3668 (2018).
9. L. E. Nave *et al.*, Reforestation can sequester two petagrams of carbon in US topsoils in a century. *Proc. Natl. Acad. Sci. U.S.A.* **115**, 2776–2781 (2018).
10. R. Birdsey, K. Pregitzer, A. Lucier, Forest carbon management in the United States: 1600-2100. *J. Environ. Qual.* **35**, 1461–1469 (2006).
11. D. L. Haase *et al.*, Forest nursery seedling production in the United States—Fiscal year 2018. *Tree Planters' Notes* **62**, 20–24 (2019).
12. National Academies of Sciences, Engineering, and Medicine, *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda*, (The National Academies Press, Washington, DC, 2020).
13. USDA Forest Service, The Forest Inventory and Analysis Database. Version 8.0. https://www.fia.fs.fed.us/tools-data/. Accessed 7 May 2020.
14. W. A. Bechtold, P. L. Patterson, "The enhanced forest inventory and analysis program-national sampling design and estimation procedures" (Gen. Tech. Rep. SRS-80, US Department of Agriculture, Asheville, NC, 2005).
15. USDA Forest Service, Database Description User Guide for Phase 2. Version 8.0. https://www.fia.fs.fed.us/library/database-documentation/current/ver80/FIADB%20User%20Guide%20P2_8-0.pdf. Accessed 7 May 2020.

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SUSTAINABILITY SCIENCE

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RESEARCH ARTICLE

J. For. 115(4):309–318
https://doi.org/10.5849/jof.2016-005

policy

Potential for Additional Carbon Sequestration through Regeneration of Nonstocked Forest Land in the United States

V. Alaric Sample

"National forests constitute the largest area of nonstocked forestland (54%) in the combined Pacific Southwest and Northwest regions."

"Fire is the single largest primary source of forest disturbance. It is associated with more of the nonstocked forest area [62%] than all other sources of natural and human disturbance combined."

portion of the total could produce an additional 44.4 million metric tons of CO_2e annually in
sequestration. On National Forest System lands, more than 50% of the total potential carbon sequestration

mitment to supporting forest-sector initia-

sent 90% of the country's terrestrial carbon sink and currently offset 14–16% of total US carbon emissions. A 2010 assessment of US forest resources projected that this forest carbon sink could decline significantly and that as soon as 2030 US forests overall could become a net *source* of greenhouse gas

average age of US forests (Wear and
2013, Woodall et al. 2015b). Subsequent developments may moderate these projections, particularly in regard to potential increases in timber harvest for wood bioenergy (Abt et al. 2014, Wear and Coulston 2015, Woodall et al. 2015a) and changes in the

of Nature 2011).

Recent policy studies on options to increase net carbon sequestration by terrestrial carbon sinks have focused heavily on the agricultural sector (USEPA 2005, 2014) but have also identified a range of opportunities in the forest sector for expanding the capac-

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Northeast	192	5,485	33,685	195,432	234,794
North Central	15,746	13,886	73,252	203,219	306,103
Southeast	11,015	40,784	64,758	436,575	553,132
South Central	3,232	42,837	70,278	1,879,582	1,995,929
Rocky Mountain	1,574,054	955,195	219,129	982,421	3,730,799
Pacific Southwest	237,050	37,214	3,347	82,507	360,118
Pacific Northwest	375,651	45,100	53,838	300,569	775,158
Total (%)	2,216,942 (28)	1,140,499 (14)	518,286 (7)	4,080,305 (51)	7,956,032

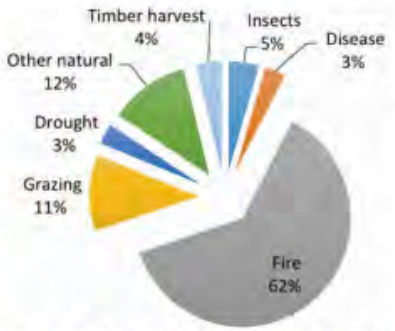

Figure 2. Nonstocked forestland in the United States, by disturbance source, 2014.

the Southeast and South Central regions and are primarily in private ownership (Table 3). Although less than 2% of the land in the highest site productivity classes is on public (federal and state) forestland, 84% of the nonstocked area on the National Forests is classified as productive timberland.

It is estimated that regeneration of the 4.6 million ha of nonstocked productive timberland has the capacity to produce a total volume of 40.4 million m^3 of wood annually. This estimate may be less than what is actually possible, since the growth rate in the highest site productivity class is recorded in the FIA data as ≥15.8 m^3/ha/year and some forestlands in this class may have sig-

vate lands in different categories are reforested after harvest or disturbance.

In instances after a fire, insect infestation, disease, or timber removal, expected returns to private forest owners from future wood production alone may not be sufficient to finance the up-front expenses of site preparation and planting (de Steiguer 1984, Hyberg and Holthausen 1989, Beach et al. 2005). Opportunities to augment these returns with income from carbon offsets are presently limited, and owners of small forest tracts typically find that transaction costs (carbon inventory, modeling, and verification) outweigh potential financial returns from carbon offsets (Fletcher et al. 2009,

"Timely regeneration after harvest or natural disturbance can expand other ecosystem goods and services, especially watershed protection, wildlife habitat, wood production, and increased economic opportunity in rural communities, that should also be valued and factored into an analysis of costs and benefits."

Forests and other federal lands in the western regions, but more than 58% of these low-productivity forests (2 million ha) is on private lands, 76% of which are in the South Central region.

The remaining 4.6 million ha of currently nonstocked forestland is categorized as productive timberland, distributed across site productivity classes ranging from 1.4 to

this total that is produ
(≥1.4 m^3/ha/year),
mated at 20.3 m
mated potential additional carbon sequestration of 22.4 million metric tons per year ($Mg\ CO_2e\ year^{-1}$) (Table 4). Published FIA data for private forestlands do not distinguish between those of small woodland owners and those managed by large com-

mitigation activities is highly sensitive to carbon market prices and/or subsidies (USEPA 2005). Using a combination of models including the Forest and Agriculture Sector Optimization Model with Greenhouse Gases (FASOMGHG), the Timber Assessment Market Model (TAMM), and the North American Pulp and Paper model

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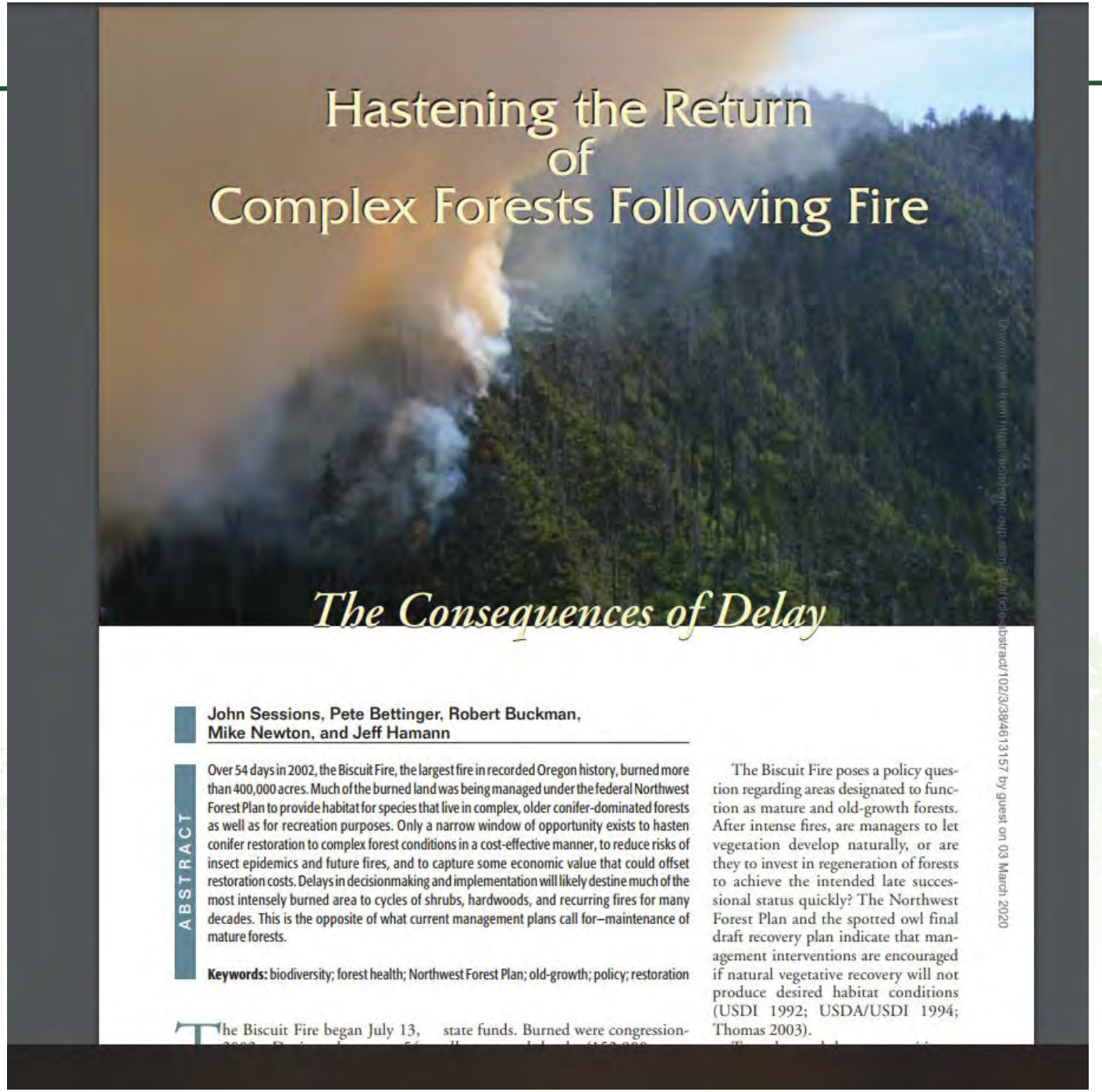

Hastening the Return of Complex Forests Following Fire

The Consequences of Delay

John Sessions, Pete Bettinger, Robert Buckman, Mike Newton, and Jeff Hamann

ABSTRACT

Over 54 days in 2002, the Biscuit Fire, the largest fire in recorded Oregon history, burned more than 400,000 acres. Much of the burned land was being managed under the federal Northwest Forest Plan to provide habitat for species that live in complex, older conifer-dominated forests as well as for recreation purposes. Only a narrow window of opportunity exists to hasten conifer restoration to complex forest conditions in a cost-effective manner, to reduce risks of insect epidemics and future fires, and to capture some economic value that could offset restoration costs. Delays in decisionmaking and implementation will likely destine much of the most intensely burned area to cycles of shrubs, hardwoods, and recurring fires for many decades. This is the opposite of what current management plans call for—maintenance of mature forests.

Keywords: biodiversity; forest health; Northwest Forest Plan; old-growth; policy; restoration

The Biscuit Fire began July 13, [illegible] state funds. Burned were congression-

The Biscuit Fire poses a policy question regarding areas designated to function as mature and old-growth forests. After intense fires, are managers to let vegetation develop naturally, or are they to invest in regeneration of forests to achieve the intended late successional status quickly? The Northwest Forest Plan and the spotted owl final draft recovery plan indicate that management interventions are encouraged if natural vegetative recovery will not produce desired habitat conditions (USDI 1992; USDA/USDI 1994; Thomas 2003).

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about 10 percent of the area and treated after use to control runoff and erosion. Preliminary results from an eastern Oregon study of carefully planned salvage-logging operations with ground-based machines are encouraging (USDA Forest Service 2002). Although some soil disturbance was observed after the operations, little or no sediment left the harvest units, and the reburn hazard was estimated to be either reduced or unchanged. Any increased sediment yield would be temporary and dwarfed by increases due to the recent fire and by natural geologic erosion in the Biscuit area.

Markets for salvaged timber depend on quality, quantity, and price. Processing capability in southern Oregon is approximately 2.75 billion board feet per year (Paul Ehinger, pers. commun., 2003). Additional processing centers exist in northern California. The actual effect of Biscuit salvage harvests on regional employment would depend on whether fire-killed timber is additive or substituted for green timber from other forestlands. In the current forest products market, substitution would proba-

John Sessions

Much of the burned area looks as this did in April 2003.

John Sessions

Road access exists in much of the matrix and some of the administratively withdrawn and late-successional reserves, making possible management action to regenerate the damaged areas.

owl (USDI 1992) to provide future large green [illegible] and future large snags.

large, intense wildfires for at least 60 years into the future, further jeopardizing the potential of remaining conifers and newly planted conifers to reach late-successional conditions.

We estimate that the Biscuit Fire destroyed approximately 4.2 billion board feet (conifer and hardwood), or 40 percent of the prefire tree volume within the fire perimeter, and that the average standing live tree volume in the area (excluding low-productivity serpentine soils) has declined from 26,000 to 14,000 board feet per acre. We believe that fire-stressed conifers containing an additional 0.8 billion board feet are at high risk of insect attack in the near future. Ongoing Forest Service studies will refine these estimates.

The recovery value of fire-killed timber will decrease as trees deteriorate from checking, fungal decay, and woodborer activity. Based on data in Lowell et al. (1992), we estimate that approximately 22 percent of the fire-killed volume that existed immediately after the fire was lost during the first year, and by the

"If the goal is to hasten restoration of the complex mature conifer-dominated forest on the Biscuit Fire landscape, careful timber salvage can be useful."

up to 100 years to approach prefire conditions. Without planting and subsequent shrub control, however, it could take more than 100 years to even establish conifer forests. This is well beyond the guidelines in the draft re-

fall over time, and while providing habitat for many species and slowly returning organic matter to soils, the debris could also fuel the intensity of future fires . Significant portions of dead and dying trees in a largely shrub and

60 percent of the volume in administratively withdrawn areas and 80 percent in the late-successional reserves.

Depending on the scope and timing of a salvage program, we estimate that, at a stumpage value (mill value minus

OREGON FOREST & INDUSTRIES COUNCIL

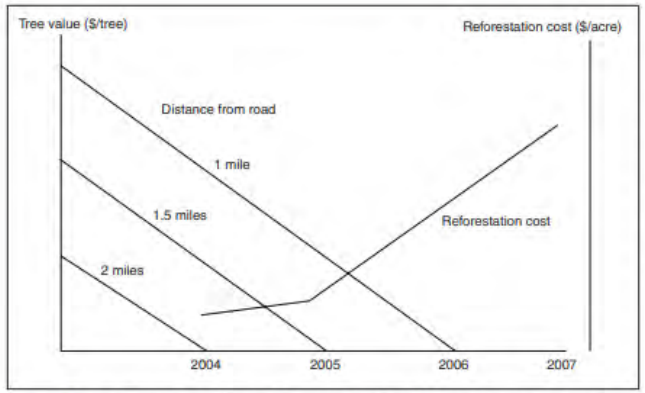

Figure 3. **Average salvage value of fire-killed trees as a function of distance from road and year, using helicopter logging, and cost of reforestation.**

vide short-term local employment and enhance long-term recreational opportunities.

The fixed and variable costs of harvest are particularly important because of time constraints. As timber deteriorates, there is a smaller economic base over which to spread the fixed costs of harvest. For low-impact, high-cost systems such as helicopter logging, the window of opportunity for cost-effective salvage closes quickly.

A Science-Based Strategy

Given the immense number of fire-killed trees within the Biscuit Fire area, a location-specific

board feet of salvage, 1 billion board

effects of natural

or about 40 percent of the combined volume of the fire-killed plus fire-stressed trees that are expected to die.

Discussion

Choices for management options following the Biscuit Fire revolve around societal goals for future forests and the relative risks, benefits, and costs of both action and inaction. Where society and managers choose to let nature deliver future landscapes and ecosystems, human-aided forest restoration and timber salvage are not only unnecessary but counterproductive. If the goal is to let natural processes dominate, there may be "no ecological need for immediate intervention on the postfire landscape" (Beschta et al. 1995). More recently, Everett (1995) and Ice and Beschta (1999) have provided differing perspectives. Our understanding of forest

and Park (1995) concluded that "the lack of adverse impacts from salvage logging is attributed to protection of riparian areas, improved road construction practices, and minimizing disturbance through the use of helicopter logging."

If the goal is to hasten restoration of complex mature conifer-dominated forests on the Biscuit Fire landscape, careful timber salvage can be useful. Ecologically, it would allow full sunlight to reach young seedlings, reduce future fuel loads, and reduce potential additional tree death from insect attack, all of which will hasten the regrowth and recovery of a complex forest. Economically, it would generate source of funds for forest restoration, reduce the costs of future fire suppression, and make future helicopter stand-maintenance operations feasible. Timber salvage could also provide a tempo-

future stand maintenance activities; and public involvement.

Alternative timber sale preparation procedures could also be considered. Typical federal timber sale procedures now take up to two years. For live tree timber sales, this time investment reflects the costs and benefits of the proposed actions. In timber salvage, however, the costs of delay are extreme: Fire-killed trees will lose more than 40 percent of their value in two years, and delays in forest regeneration will increase costs *(fig. 3)*. Alternatives such as "end-result contracting," tested by the Bureau of Land Management, offer significant time savings. Marginal cost timber pricing to encourage salvage at longer distances from roads could also be considered.

The Northwest Forest Plan attempts to protect and perpetuate mature forests and their associated bio-

"The window of opportunity for cost-effective salvage closes quickly."

OREGON FOREST & INDUSTRIES COUNCIL

What Does the Public Think?

From May 28 – June 3, 2020, DHM Research Survey of Oregonians

- Survey consisted of 605 Oregonians- sample size sufficient to assess Oregonian opinions generally
- Contacted from a list of registered voters from across Oregon
- Purpose was to gauge Oregonian opinions about federal forest management in Oregon
- A variety of quality control measures employed
- DHM Research has provided opinion research and consultation throughout the PNW and other regions of the US for over 40yrs. The firm is nonpartisan and independent and specializes in research projects to support public policy making.

OREGON FOREST & INDUSTRIES COUNCIL

What Does the Public Think?

Please indicate if you think the following are very good, good, poor, or very poor reasons to actively manage federal forests.

In the last 5 years over 1.5 million acres of federal forestlands have burned in Oregon. The damage caused by this level of intense fires can take up to 100 years or more to restore naturally. That is too long, and environmentally sound practices can be used to restore our lost forests more quickly.

83% Very Good/ Good

OREGON FOREST & INDUSTRIES COUNCIL

What Does the Public Think?

Please indicate if you think the following are very good, good, poor, or very poor reasons to actively manage federal forests.

Replanting can quickly restore our federal forests so the public can get back to enjoying them sooner.

82% Very Good/ Good

OREGON FOREST & INDUSTRIES COUNCIL

What Does the Public Think?

Please indicate if you think the following are very good, good, poor, or very poor reasons to actively manage federal forests.

Without the prompt removal of some dead trees following catastrophic fires, our forests are at greater risk of harm from more severe future fires.

67% Very Good/ Good

OREGON FOREST & INDUSTRIES COUNCIL

What Does the Public Think?

Please indicate if you think the following are very good, good, poor, or very poor reasons to actively manage federal forests.

Because of lack of active management practices, fires on federal forests have become so large and severe they cause great damage to the land and wildlife habitat. When federal forests do burn we should do everything we can to restore them to their historic conditions.

84% Very Good/ Good

OREGON FOREST & INDUSTRIES COUNCIL

What Does the Public Think?

Please indicate if you think the following are very good, good, poor, or very poor reasons to actively manage federal forests.

Trees killed by forest fires decay rapidly and within 2 to 3 years have little to no economic value. Harvesting these trees promptly after forest fires can generate revenue to help fund local government services and schools.

74% Very Good/ Good

Chair Imeson and Oregon Board of Forestry members –

Between December 16 and December 28, 774 letters were sent to the Oregon Department of Forestry by Oregonians voicing their support for post-fire restoration and reforestation on the Santiam State forest. Those emails included the following messages:

- Now that the smoke has cleared, it's time for recovery and hope. An urgent and robust recovery effort is needed to remove dead trees from our burned forests. Let's start with the Santiam State Forest.

- Please remove the dead trees. Replant this public forest so that it can become once again a place for Oregonians to work and play.

- When it comes to post-fire harvest and recovery of our forests, there's no time to waste. After the heat and flames of a fire, it only takes a few weeks for insects to make their way in and break down trees and other organic matter that holds our forest soils in place and filters our water.

- Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

- One need only look to the Tillamook and Elliott State Forests and remember the devastating fires they succumbed to 80 years ago to see the value of a robust recovery effort to restore healthy watersheds, recreation, and local communities.

- By harvesting quickly, we may reclaim the wood and help offset the costs of reforestation efforts necessary to restore our forests back to healthy, thriving lands that protect soil and water quality.

- When trees are harvested for lumber this stores carbon in the lumber and when you plant a new tree it starts storing carbon. Why not turn trees harvested from these devastating fires into essential building products by local manufacturing facilities that we can use to rebuild our communities?

- Take action today to ensure that our future generation of Oregonians have forests to work in and enjoy. No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

- Please get to work now on recovering our forests. Don't wait. Don't waste this precious public resource.

A representative sample of those emails has been included in this document, as well as a full list of the 774 Oregonians who voiced their support for post-fire restoration.

We ask that you please hear their request.

Sara Duncan
Oregon Forests Forever

Oregon Forests Forever is growing statewide coalition of individuals, organizations and businesses – led by the Oregon Forest & Industries Council — who support active, sustainable management of Oregon's forests.

-- *Sent from* ***Donna Miller*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

When it comes to post-fire harvest and recovery of our forests, there's no time to waste. After the heat and flames of a fire, it only takes a few weeks for insects to make their way in and break down trees and other organic matter that holds our forest soils in place and filters our water.

By harvesting quickly, we may reclaim the wood and help offset the costs of reforestation efforts necessary to restore our forests back to healthy, thriving lands that protect soil and water quality.

Why not turn trees harvested from these devastating fires into essential building products by local manufacturing facilities that we can use to rebuild our communities? Please get to work now on recovering our forests.

This is a matter of future survival. It's a matter of people's lives. Please act positively now for the citizens in Oregon. Thank you.

Thank you,
Donna Miller
1111 Avenue D
Seaside, OR 97138

-- *Sent from* ***Lisa Mattes*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

Having a relationship to forestry related issues, I send this message with strong encouragement. The standing burned timber will not convey any improvement to the State of Oregon unless harvested. Knowing the effects of not harvesting burned areas from the 1990's, I can attest to the fact that more than many industries will be adversely affected. The trickle effect is prominent and will only cause more separation and an unstable economy unless harvests are allowed. Now that the smoke has cleared, an urgent and robust recovery effort is needed to remove dead trees from our burned forests. Leaving dead trees standing on the Santiam State Forest only leaves fuel for future fires.

One need only look to the Tillamook and Elliott State Forests and remember the devastating fires they succumbed to 80 years ago to see the value of a robust recovery effort to restore healthy watersheds, recreation, and local communities. Take action today to ensure that our future generation of Oregonians have forests to work in and enjoy.

Thank you,
Lisa Mattes
625 NW Erin Crest
Albany, OR 97321

-- *Sent from* ***John Price*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

I live on several acres of forested land surrounded by government owned property. In 2020 we were directly threatened by the Holiday Farm fire. The lack of maintenance of, and environmental red tape involved in caring for our forests allowed over 1 million acres to burn this year. Many lives were lost and the economic losses are in the billions of dollars. We need to make sure this never happens again. One way to do that is to maintain our forests. We need to harvest any salvage timber we can. We need to replant and clean up debris. We need to reduce fuel loads to prevent future fires. How many endangered species animals were wiped out by these fires? How much air pollution and greenhouse gases were released? Doing nothing is not an option.

Thank You,
John Price
31835 Owl Rd
Eugene, OR 97405

-- *Sent from* ***Bonny Glendenning*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

Please harvest the dead trees in our state forests. Don't let this captured carbon escape through decay, keep it sequestered by turning these dead trees into wood products. And capture more carbon quickly by planting young growing trees.

Rehabilitate these burned areas by replanting, and bring back habitat for wildlife. Make these state forests productive again.

All Oregonians were devastated during this year's horrific fire season. Now that the smoke has cleared, it's time for recovery and hope. Let's start with the Santiam State Forest. Please remove the dead trees. Replant this public forest so that it can become once again a place for Oregonians to work and play.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

Don't wait. Don't waste this precious public resource.

Thank You,
Bonny Glendenning
11466 S Mulino Rd
Canby, OR 97013

-- *Sent from* ***Cary Richardson*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 17, 2020* --

Oregon Department of Forestry,

Wildfires devastated Oregon this year. It is vital that the Department of Forestry to do everything it can to remove dead trees, restore roads, and trails and recover this state forests for future generations of Oregonians.

We need to perform all the salvage logging possible and replant to protect water quality in rivers and streams by reducing soil erosion. This also helps to ensure clean water for fish and wildlife and for drinking.

By not properly managing our forests, you will increase future fire risk and prevent these lands recreation and productive use for decades. Please do everything you can to properly manage our forests.

Thank You,
Cary Richardson
92074 Marcola Rd
Marcola, OR 97454

-- *Sent from* ***Lary McKee*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 17, 2020* --

Oregon Department of Forestry,

Now that the smoke has cleared, an urgent and robust recovery effort is needed to remove dead trees from our burned forests. Leaving dead trees standing on the Santiam State Forest only leaves fuel for future fires.

One need only look to the Tillamook and Elliott State Forests and remember the devastating fires they succumbed to 80 years ago to see the value of a robust recovery effort to restore healthy watersheds, recreation, and local communities. Take action today to ensure that our future generation of Oregonians have forests to work in and enjoy.

I absolutely agree that it is sad that our beautiful State of Oregon had so much of our forests, especially on Public lands, burned! Now because of those devastating fires everything is all caught up in red tape so recovery is almost impossible to get done! This MUST stop NOW! It is time to recover what ws lost!

Thank you,
Lary McKee
850 Mesquite Ln NE
Gervais, OR 97026

-- *Sent from **John Kendall** to **Oregon Department of Forestry Oregon Department of Forestry** on Dec 18, 2020* --

Oregon Department of Forestry,

I help you grow your forests, now lets make sure none of these forests go to waste!

When it comes to post-fire harvest and recovery of our forests, there's no time to waste. After the heat and flames of a fire, it only takes a few weeks for insects to make their way in and break down trees and other organic matter that holds our forest soils in place and filters our water.

By harvesting quickly, we may reclaim the wood and help offset the costs of reforestation efforts necessary to restore our forests back to healthy, thriving lands that protect soil and water quality.

Why not turn trees harvested from these devastating fires into essential building products by local manufacturing facilities that we can use to rebuild our communities? Please get to work now on recovering our forests.

Thank you,
John Kendall
2703 N Fremont St
Cornelius, OR 97113

-- *Sent from* ***David Hahn*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 18, 2020* --

Oregon Department of Forestry,

For Heaven's sake...cut the red tape and get some seeds on these burned areas before all the topsoil washes away. Any fool can see this is critical.

Thank You,
David Hahn
3637 Canyonville-Riddle Rd
Riddle, OR 97469

-- *Sent from* ***Lorinda Gayl*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 18, 2020* --

Oregon Department of Forestry,

After searching Oregon Forestry Department's webpage, I could not find the department's plan to remove forest fire debris and replant Oregon's burned forests. Is there a plan?

Oregon is known for its beautiful, green forests. If clean-up and reforestation aren't implemented immediately, then the burned forest floors will be damaged by winter weather. And don't forget that all the forest creatures that managed to escape with their lives have been left homeless.

Oregon's Department of Forestry's responsibility is to maintain its forests. It was not created to support interdepartmental bureaucracy.

Please, please put healing our forests first.

Very sincerely, Lorinda Gayl

Thank you,
Lorinda Gayl
89834 Surf Pines Landing Dr
Warrenton, OR 97146

-- *Sent from* ***Angela West*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 20, 2020* --

Oregon Department of Forestry,

It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. The environment and ecology has been altered. Replanting is of utmost importance! I'm urging the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state's forest for future generations of Oregonians. Please don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action diminishes air with and will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

Thank You,
Angela West
213 W D St
Springfield, OR 97477

-- *Sent from* ***Michael Bryant*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 22, 2020* --

Oregon Department of Forestry,

Please include my voice in the many you'll hear from. I encourage you folks to ast swiftly, as you did with the Tillamook and Elliott forests to clear, harvest what we can, and replant.

Thank you.

Thank you,
Michael Bryant
20764 S Lower Highland Rd
Beavercreek, OR 97004

-- *Sent from* ***Sandra Dye*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 28, 2020* --

Oregon Department of Forestry,

As a solid waste company serving in South Tillamook County we understand and experienced the direct effect that these fires had on not only the victims but the ability to have roadways cleared for the safe removal of solid waste and debris. The true environmental impact is what happens when proper reforestation plans are usurped by the lack of true education and experience of past catastrophic events! Learn from these events!

Go to the Native Americans' plan book: clear and clean up and burn debris so that new forest can grow strong and tall!

The only thing that is stopping these horrific events that also kill and drive out our beloved wildlife is ignorance in lawmaking!

Let Oregon be a leader in making the right decisions for our citizens and their property as well as protecting our beautiful forests!

One need only look to the Tillamook and Elliott State Forests and remember the devastating fires they succumbed to 80 years ago to see the value of a robust recovery effort to restore healthy watersheds, recreation, and local communities. Take action today to ensure that our future generation of Oregonians have forests to work in and enjoy.

Thank you,
Sandra Dye
14160 Campground St
Cloverdale, OR 97112

-- *Sent from* ***Linda Barrett*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 29, 2020* --

Oregon Department of Forestry,

Good morning,
I am writing to support an effort to restore Oregon forests by harvesting and replanting in areas that have been burned.
Please make reasonable choices to manage our forests to the mutual benefit of the local communities as well as the forests themselves.
I am not a forester, so I cannot recommend specific practices, but I encourage you to use your best judgment and experience.
Thank you very much.

Thank you,
Linda Barrett
10404 Gale Rd
Bonanza, OR 97623

-- *Sent from* ***Richard Campbell*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

As an active motorcyclist for the part 50 years, both on-road and off-road, I have seen more of Oregon's forests that the average person.

The best example of multi-use sustained-yield is the Tillamook State Forest. I have ridden there since the 1970s, long enough to see an entire generation of trees planted, nurtured, thinned, and harvested. The resulting revenue provides jobs in Washinton, Tillamook and Yamhill Counties, and also provides much-needed revenue for schools.

There has been ample protection for the Coast Rivers, and trout and salmon are gradually coming back. We have learned a lot about riparian zones.

This June, I also led a group through Ripplebrook and down to Detroit, and an previous off-roadrides, I have seen the Table Rock/Opal Creek/Lyons area. With proper forest management, this area did not have to burn. Unfortunately, many of the access roads have been closed, making it much harder to fight a fire. I have many friends in the Gates/Mill City area, and they are left with nothing unless these forests are planted and actively managed.

I encourage you to get to work, cut the red tape, and create a sustainable forest that will provide both revenues to local communities and multiple-use recreation opportunities.

Thank you,
Richard Campbell
16423 SW Luke Ln
Tigard, OR 97223

-- *Sent from* ***Gayle Davis*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

All Oregonians were devastated during this year's horrific fire season. Now that the smoke has cleared, it's time for recovery and hope. Let's start with the Santiam State Forest. Please remove the dead trees. Replant this public forest so that it can become once again a place for Oregonians to work and play.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

Don't wait. Don't waste this precious public resource.

I was at the virtual panel meeting hosted by Oregon State Parks last month. When the state forester spoke, he did say that this December there would be seeds planted in the Santiam forest, but not seedlings for a while. That is a good start. He also said that some of the burned parks would likely not recover in our lifetime. I still think that it is important to get in there an replant for the reasons listed above. Please consider this request for replanting now.

Thank You,
Gayle Davis
PO Box 1501
Redmond, OR 97756

-- *Sent from* ***Gary Blanchard*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 17, 2020* --

Oregon Department of Forestry,

As a native of this state (Oregon) it pains me to see fire damaged forests left to rot. Immediate salvage and replanting is the correct way to manage all federal, state, and private forests. the six year intervals of the Tillamook Burn is a good example of what can happen if the snags and other fuels aren't cleaned up. Please expedite the sale of damaged timber and reforestation of all state lands and encourage as strongly as possible doing the same on federal lands. Time is critical. DON"T DELAY
Thanks you

Thank you,
Gary Blanchard
7250 SW Philomath Blvd
Corvallis, OR 97333

-- *Sent from* ***Heidi Kupitz*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 17, 2020* --

Oregon Department of Forestry,

It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. I urge the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state forest for future generations of Oregonians. Don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

Furthermore, it is imperative that we create and implement a plan to revitalize the health of Oregon's public forests. Those that have not burned should be thinned, and any other measures that can be taken to protect the older trees should be taken.

Thank You,
Heidi Kupitz
1210 Prescott St
Klamath Falls, OR 97601

-- *Sent from* ***Keri Hanke*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 18, 2020* --

Oregon Department of Forestry,

It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. I urge the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state forest for future generations of Oregonians. Don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

I would love you to have community plant days when the public could go out and help plant trees. I did this several times growing up and it makes a lasting impression on children about the way our renewable forests work. Please let me know if a public event is happening. I will be there with bells on.

Thank You,
Keri Hanke
1407 34th Ave SE
Albany, OR 97322

-- *Sent from* ***Bill McCorkle*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 18, 2020* --

Oregon Department of Forestry,

Please put your full support behind immediate remediation for the forests which have been so badly damaged by fire. This is necessary to prevent further and possible permanent trauma to the forests and harm to the water runoff.

By harvesting quickly, we may reclaim the wood and help offset the costs of reforestation efforts necessary to restore our forests back to healthy, thriving lands that protect soil and water quality.

Please let's get to work now on forest recovery.

Thank you,
Bill McCorkle
1725 NE 101st Ave
Portland, OR 97220

-- *Sent from* ***Greg culver*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 20, 2020* --

Oregon Department of Forestry,

I lost 8 acres of my wooded property in the South Obechain Fire, due to BLM lands behind mine that were mismanaged. Even my riparian area is damaged.
It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. I urge the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state forest for future generations of Oregonians. Don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

Thank You,
Greg culver
590 Derby Rd
Eagle Point, OR 97524

-- *Sent from* ***Darcy Campbell*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 20, 2020* --

Oregon Department of Forestry,

I have been an Oregon resident for more than 50 years, and over the last 30 year's myself and many hardworking Oregonians have been ignored and belittled by the so called environmentalist, that have turned out to be nothing more than activists that scream loudly and throw temper tantrum and has done more damage than good.

When it comes to post-fire harvest and recovery of our forests, there's no time to waste. After the heat and flames of a fire, it only takes a few weeks for insects to make their way in and break down trees and other organic matter that holds our forest soils in place and filters our water.

By harvesting quickly, we may reclaim the wood and help offset the costs of reforestation efforts necessary to restore our forests back to healthy, thriving lands that protect soil and water quality.

Why not turn trees harvested from these devastating fires into essential building products by local manufacturing facilities that we can use to rebuild our communities? Please get to work now on recovering our forests.

Thank you,
Darcy Campbell
1773 SE Eddy St
Roseburg, OR 97470

--

-- *Sent from* ***Linda Haga*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 23, 2020* --

Oregon Department of Forestry,

Following the devastating wildfires in Oregon this year, I am writing to ask that you harvest and remove the dead trees from the Santiam State Forest! Please replant this and other public forests so they can once again become places for Oregonians to work and play.

Harvesting and replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This will help ensure clean drinking water, and fresh water for fish and wildlife. The Tillamook and Elliot forests are good examples of the positive effects of swift reforestation following devastating fires.

Please don't waste this precious public resource.

Thank You,
Linda Haga
93959 Sunny Hill Ln
North Bend, OR 97459

-- *Sent from* ***John Garland*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 23, 2020* --

Oregon Department of Forestry,

Don't be stupid, act professionally. Salvage for values for OR taxpayers. Cleanup unharvestable areas. Replant all areas. Make roads accessible for future management and fire protection. Act like stewards of Oregon's forests.

Thank you,
John Garland
PO Box 152
Waldport, OR 97394

-- *Sent from* ***Leslie Stewart*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 23, 2020* --

Oregon Department of Forestry,

As evidenced by the flooding this week after the heavy yet normal rains, I hope it's clear we need the burned trees removed and replanted to save the watershed and help the healing of the land and our souls. Leslie

It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. I urge the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state forest for future generations of Oregonians. Don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

Thank You,
Leslie Stewart
181 SE Laurel St
Mill City, OR 97360

-- *Sent from* ***Cathie Price*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 28, 2020* --

Oregon Department of Forestry,

I have a home in Detroit Oregon and driving through the devastation brings me to tears.

All Oregonians were devastated during this year's horrific fire season. Now that the smoke has cleared, it's time for recovery and hope. Let's start with the Santiam State Forest. Please remove the dead trees. Replant this public forest so that it can become once again a place for Oregonians to work and play.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

We need to start NOW.

Thank You,
Cathie Price
18451 Waxwing Way
Lake Oswego, OR 97035

-- *Sent from* ***Bob King*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 28, 2020* --

Oregon Department of Forestry,

All Oregonians were devastated during this year's horrific fire season. Now that the smoke has cleared, it's time to clear and replant.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

There will be bug infestation which will spread if we don't not clear and replant. Also new young trees will increase oxygen output and store more carbon.

Do something now. Don't take forever to make this decision. Get it done and get it replanted now.

Don't wait. Don't waste this precious public resource.

Thank You,
Bob King
87657 Portage Way
Florence, OR 97439

-- *Sent from* ***Kris Rees*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

All Oregonians were devastated during this year's horrific fire season. Now that the smoke has cleared, it's time for recovery and hope. Let's start with the Santiam State Forest. Please remove the dead trees. Replant this public forest so that it can become once again a place for Oregonians to work and play. Private land owners recognize that salvage logging and replanting is a HEALTHY way to manage our forests, and benefit from doing so. YOU represent us, the taxpayers and citizens, and should be doing what is in OUR best interest--and the best interest of our forests' long-term. It is your RESPONSIBILITY to do so.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking. And it PROTECTS OUR FOREST FROM CATASTROPHIC WILDFIRES like we have experienced the past number of years.

DO NOT WAIT. DO NOT WASTE this precious public resource.

And BTW, it can be done, EFFECTIVELY and cost efficiently, using a DRONE; it is already being done in other places. Think outside the box for once!!

Thank You,
Kris Rees
1535 NW Ivy Ave
Redmond, OR 97756

-- *Sent from* ***Myles McMillan*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 16, 2020* --

Oregon Department of Forestry,

When it comes to post-fire harvest and recovery of our forests, there's no time to waste. After the heat and flames of a fire, it only takes a few weeks for insects to make their way in and break down trees and other organic matter that holds our forest soils in place and filters our water.

By harvesting quickly, we may reclaim the wood and help offset the costs of reforestation efforts necessary to restore our forests back to healthy, thriving lands that protect soil and water quality.

Why not turn trees harvested from these devastating fires into essential building products by local manufacturing facilities that we can use to rebuild our communities? Please get to work now on recovering our forests.

As a private land/timber owner we have already started replanting and harvesting, why not you?

Thank you,
Myles McMillan
6143 Shaw Hwy SE
Aumsville, OR 97325

-- *Sent from* ***Pat Finley*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 17, 2020* --

Oregon Department of Forestry,

I left California and bought a home in Sutherlin upon being evacuated in October 2019 from the Kincaid Fire in California. In 2017 I lost an in-the-process-of-being-remodeled home I inherited from my mother. That was the Tubbs Fire 2017. The payment from the mass tort lawsuit is due to be paid this month, December 2020, 3 years later. I moved to Sutherlin in February 2020 because it's not dry like where I left. I cannot live with continuous evacuations. I couldn't believe all the smoke here in July, and again bringing back traumatic memories.
Please bring back logging and keep the forests safe.

It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. I urge the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state forest for future generations of Oregonians. Don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

Thank You,
Pat Finley
616 Arnie Ct
Sutherlin, OR 97479

-- *Sent from* ***William Higby*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 17, 2020* --

Oregon Department of Forestry,

It's heartbreaking to see photos of the blackened landscape within Oregon's Santiam State Forest. I urge the Department of Forestry to do everything it can to remove dead trees, restore roads and trails and recover this state forest for future generations of Oregonians. Don't delay.

Replanting after severe fires protects water quality in rivers and streams by reducing soil erosion. This helps to ensure clean water for fish and wildlife and for drinking.

No action will only increase future fire risk and remove these lands from recreation and/or productive use for decades. Please don't let that happen.

The Department of Forestry took no action to prevent the fires, let us see it take immediate action to replant and feforest.

Thank You,
William Higby
4163 SE Summercrest St
Albany, OR 97322

-- *Sent from **Daniel Green** to **Oregon Department of Forestry Oregon Department of Forestry** on Dec 18, 2020* --

Oregon Department of Forestry,

I support the salvage of burned timber from the Santiam State Forest and the replanting of burned areas with Douglas-fir and associated species. If the state is unwilling or unable to do so, I support the return of the Santiam State Forest lands to the counties that originally owned them.

Thank You,
Daniel Green
123 Barclay Ave
Oregon City, OR 97045

-- *Sent from* ***Judith Dickerson*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 18, 2020* --

Oregon Department of Forestry,

Don't make this situation worse than it is. Rely on the site history. Use the science you have within your own files. Be careful with the newer methods - some are not as reliable as the older, tried and true ways. You are standing on the shoulders of self-taught giants - use the knowledge they gathered with much trial and error. GOOD LUCK!!!

Don't wait. Don't waste this OPPORTUNITY.

Thank You,
Judith Dickerson
1745 Quines Creek Rd
Azalea, OR 97410

-- *Sent from* ***Gary Strean*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 20, 2020* --

Oregon Department of Forestry,

Please stop the politics driven idiocy that allowed our forests to burn this year. We need to harvest and replant as soon as possible! I worked the the woods products industry in the 70s and 80s till the Leftists shut down logging on federal and state lands and wiped out our jobs base over an owl that turned out to be fake science! Then we let the Silver Complex fire salvage sit on the stump till it was unsalvageable! When will this idiocy ever stop? Please start logging and replanting as soon as possible! Sincerely, Gary Strean.

Thank You,
Gary Strean
689 Anne Ln
Molalla, OR 97038

-- *Sent from* ***Ann Jenkins*** *to* ***Oregon Department of Forestry Oregon Department of Forestry*** *on Dec 28, 2020* --

Oregon Department of Forestry,

Since 1947 I have travelled over the beautiful Santiam & McKenzie highways always enjoying the great beauty of these areas. This fall I again drove these highways and knew I would never see it restored in my lifetime BUT.....get busy and start the restoration for my grand and great grand children who have been taken to these areas every summer to camp out & have learned to love it dearly. DO NOT DELAY!

Now that the smoke has cleared, an urgent and robust recovery effort is needed to remove dead trees from our burned forests. Leaving dead trees standing on the Santiam State Forest only leaves fuel for future fires.

One need only look to the Tillamook and Elliott State Forests and remember the devastating fires they succumbed to 80 years ago to see the value of a robust recovery effort to restore healthy watersheds, recreation, and local communities. Take action today to ensure that our future generation of Oregonians have forests to work in and enjoy.

Thank you,
Ann Jenkins
2230 Steiwer Rd SE
Jefferson, OR 97352

	A	B	C	D	E	F
1	**Date**	**First**	**Last**	**City**	**Zip**	**email**
2	2020-12-16 15:32:11	Marca	Hagenstad	Bend	97702	mhagenstad@fastmail.fm
3	2020-12-16 15:32:23	Marilyn	Hampton	Medford	97504	hamptondm@yahoo.com
4	2020-12-16 15:32:35	Lorry	Nielsen	La Pine	97739	leadlorry@yahoo.com
5	2020-12-16 15:32:45	Kathleen	Roser	Medford	97504	kathieroser@gmail.com
6	2020-12-16 15:32:46	John	Bodell	Eugene	97401	jbodell1971@gmail.com
7	2020-12-16 15:32:53	Alexandria	flores	Portland	97283	flores_ally@yahoo.com
8	2020-12-16 15:33:28	Richard	Van Hook	Gold Beach	97444	vanhook1@charter.net
9	2020-12-16 15:34:08	Vicki	Theriault	Brookings	97415	vtpeanut6@gmail.com
10	2020-12-16 15:34:25	Karen	Byers	Springfield	97478	mckenzieriverbox@yahoo.com
11	2020-12-16 15:34:54	Jereme	Guenther	Lebanon	97355	jereme.guenther@gmail.com
12	2020-12-16 15:35:11	Heather	Gates	Springfield	97477	holin24@hotmail.com
13	2020-12-16 15:35:16	Donald	Jacobe	Salem	97317	jimjkacobe@comcast.net
14	2020-12-16 15:35:23	Cristy	Rein	Clackamas	97015	rzpublish@aol.com
15	2020-12-16 15:35:23	John	McMurtray	St. Helens	97051	jlmacmicmac@yahoo.com
16	2020-12-16 15:35:55	Albert	Beron	Hillsboro	97123	503beron@gmail.com
17	2020-12-16 15:36:30	Christopher	Duncan	Lake Oswego	97034	christopher.scott.duncan@gmail.com
18	2020-12-16 15:36:40	William	Ocumpaugh	Oakland	97462	ocumpaugh@taesbeeville.com
19	2020-12-16 15:37:29	John	Grant	Grants Pass	97526	lgrant326@gmail.com
20	2020-12-16 15:38:31	Sue	Lewis	Portland	97236	suelewis290@gmail.com
21	2020-12-16 15:38:32	Rodney	Smith	Happy Valley	97086	smithvel@aol.com
22	2020-12-16 15:39:05	Amanda	Wold	Bend	97702	mrsamandawold@gmail.com
23	2020-12-16 15:39:47	Mike	Sampels	Banks	97106	mikesampels@gmail.com
24	2020-12-16 15:40:14	Jennifer	Eichlin	Gold Beach	97444	jdeichlin07@gmail.com
25	2020-12-16 15:40:17	Donna	Gould	Coos Bay	97420	cbto.inc@frontier.com
26	2020-12-16 15:40:22	Terrika	Brown	Salem	97317	terrikamurraybrown@gmail.com
27	2020-12-16 15:41:01	Robert	Miller	Portland	97219	rbmiller@lclark.edu
28	2020-12-16 15:41:04	James	Peterson	Eugene	97403	jjoepete@aol.com
29	2020-12-16 15:41:07	Adam	Shaddy	Sandy	97055	shaddycore@gmail.com
30	2020-12-16 15:41:19	Timothy	Beebe	Glide	97447	timbeebe15@gmail.com
31	2020-12-16 15:41:24	Mary	Bost	Junction City	97448	marybost16@gmail.com
32	2020-12-16 15:43:02	Donna	Miller	Seaside	97138	nandonn0r@gmail.com
33	2020-12-16 15:44:01	Everett	Colley	Eugene	97402	everett@pacrubber.com
34	2020-12-16 15:44:04	Ruby	Garmyn	Bend	97701	rubengarmyn@gmail.com

	A	B	C	D	E	F
35	2020-12-16 15:44:23	John	Ernst	Bend	97701	jsewizard@hotmail.com
36	2020-12-16 15:44:28	Pete	Buffington	Scotts Mills	97375	peteb@onlinenw.com
37	2020-12-16 15:48:19	Pete	Buffington	Scotts Mills	97375	peteb@onlinenw.com
38	2020-12-16 15:44:30	Janine	Bakke	Lyons	97358	jbakke@wvi.com
39	2020-12-16 15:44:31	Michelle	Paul	Medford	97501	alohamichelle1@outlook.com
40	2020-12-16 15:44:58	Thomas	Hardesty	Coquille	97423	4whisman@gmail.com
41	2020-12-16 15:45:08	Gloria	Hall	Clackamas	97015	fredgloriah@yahoo.com
42	2020-12-16 15:45:57	Scott	Sword	Sublimity	97385	swordlogging@gmail.com
43	2020-12-16 15:46:26	Belinda	Colley	Azalea	97410	bizzebee_58@yahoo.com
44	2020-12-16 15:47:10	Kris	Rees	Redmond	97756	krees47@gmail.com
45	2020-12-16 15:47:59	Rebecca	Morrill	Albany	97322	becksmorrill@yahoo.com
46	2020-12-16 15:47:59	Colleen	Foerster	Klamath Falls	97603	tehya65@gmail.com
47	2020-12-16 15:48:29	Doug	Alldridge	Toledo	97391	doug@yaquinaboat.com
48	2020-12-16 15:49:37	Rena	Lynch	Eagle Point	97524	renalynch@renalynch.com
49	2020-12-16 15:51:37	Virginia	Johnston	Clatskanie	97016	fancycaldoc@gmail.com
50	2020-12-16 15:51:42	Jeff	Gates	Springfield	97477	jeffg@americanconco.com
51	2020-12-16 16:03:57	Jeff	Gates	Springfield	97477	jeffg@americanconco.com
52	2020-12-16 15:51:57	Sharla	Smith	Nehalem	97131	sharlaksmith@yahoo.com
53	2020-12-16 15:52:45	Lisa	Mattes	Albany	97321	lcmattes@gmail.com
54	2020-12-16 15:55:35	Sandra	Tuttle	Sutherlin	97479	sandratuttle57@gmail.com
55	2020-12-16 15:56:11	Georgia	Hawkins	Roseburg	97471	georgiahawkins@charter.net
56	2020-12-16 15:56:46	Richard	Butler	Portland	97233	richardbutler40@gmail.com
57	2020-12-16 15:56:54	Jessica	Jansen	Albany	97321	jessicabudge@gmail.com
58	2020-12-16 15:57:06	David	Drago	Blachly	97412	dragobrothers@gmail.com
59	2020-12-16 15:58:16	Ulrich	Lau	Bandon	97411	ulrich@ootci.com
60	2020-12-16 15:58:45	Jessica	Yandell	Philomath	97370	jlkhorses@aol.com
61	2020-12-16 15:59:42	Steve	Courtney	Roseburg	97471	courtney2116@comcast.net
62	2020-12-16 16:00:48	Gerald	Pelletier	Toledo	97391	jerryintoledo@charter.net
63	2020-12-16 16:03:10	Jeanne	Engman	Florence	97439	2315jeanne@gmail.com
64	2020-12-16 16:03:20	Susan	Liesinger	Roseburg	97471	szank62@gmail.com
65	2020-12-16 16:04:58	John	Price	Eugene	97405	jprice@zzzeke.com
66	2020-12-16 16:05:00	Teresa	allen	Walterville	97489	mtnteresa@gmail.com
67	2020-12-16 16:05:40	Marcel	Liberge	Grants Pass	97527	dustypuns@gmail.com
68	2020-12-16 16:05:47	Stephen	Oder	Corvallis	97330	steve.oder@gmail.com

	A	B	C	D	E	F
69	2020-12-16 16:05:49	Amy	Roberts	Albany	97321	homerjim82@gmail.com
70	2020-12-16 16:07:24	Valdek	Parik	Aloha	97007	parik@sbcglobal.net
71	2020-12-16 16:08:01	Tod	Boyer	Ashland	97520	tboy-mail@opendoor.com
72	2020-12-16 16:11:21	Richard	Alderson	Eugene	97408	aldybaldy@aol.com
73	2020-12-16 16:12:33	Sandra	Gray	Salem	97306	slgray3@comcast.net
74	2020-12-16 16:12:37	Alan	Gunderson	Woodburn	97071	agunderson@wavecable.com
75	2020-12-16 16:12:49	Kathleen	Adamson	Mcminnville	97128	grammyadamson@gmail.com
76	2020-12-16 16:15:57	Richard	Campbell	Tigard	97223	ricksax@comcast.net
77	2020-12-16 16:16:10	Ronald	Jellison	Eugene	97401	fnor001@hotmail.com
78	2020-12-16 16:16:25	Barbara	Haynes	Portland	97219	bhaynes14@gmail.com
79	2020-12-16 16:16:42	Gordon	Culbertson	Springfield	97478	ggce@aol.com
80	2020-12-16 16:19:26	Patrick	Wright	Dayton	97114	patrick.wright61@frontier.com
81	2020-12-16 16:19:32	Alex	Olson	Portland	97202	alexolson87@gmail.com
82	2020-12-16 16:19:33	Robert	Beilin	Depoe Bay	97341	thanxcdc@gmail.com
83	2020-12-16 16:20:23	Vicki	Athorne	Coos Bay	97420	sixgunv53@gmail.com
84	2020-12-16 16:20:39	Paul	Banas	Depoe Bay	97341	pbanas@bellsouth.net
85	2020-12-16 16:20:42	Shirley	Lomax	Salem	97317	ladyatfals@aol.com
86	2020-12-16 16:21:49	Casey	Roscoe	Eugene	97405	croscoe@senecasawmill.com
87	2020-12-16 16:22:00	Ned	Zeber	Lincoln City	97367	sargerator@embarqmail.com
88	2020-12-16 16:23:03	Dave	Johnson	Mcminnville	97128	dave97128@gmail.com
89	2020-12-16 16:23:12	David	Erickson	Eagle Point	97524	derickson@lrtco.com
90	2020-12-16 16:24:05	John	Crawford	Newport	97365	john@fairywoodland.com
91	2020-12-16 16:24:15	Linda	Marshall	Culver	97734	lindajoregon@centurylink.net
92	2020-12-16 16:28:42	Nancy	Gault	Lincoln City	97367	nancyredrdh@gmail.com
93	2020-12-16 16:29:51	Kristin	Rasmussen	Portland	97203	krasmussen80@hotmail.com
94	2020-12-16 16:29:57	Bruce	Standley	Winchester	97495	bruce@brucestandleyconstruction.com
95	2020-12-16 16:30:13	Alicia	Sinkule	Eugene	97405	ksinkule@gmail.com
96	2020-12-16 16:30:51	jerry	weis	Stayton	97383	jerry@weisandassociates.com
97	2020-12-16 16:30:55	William	Guy	Redmond	97756	g4guys@bendbroadband.com
98	2020-12-16 16:32:06	Liz	Smith	Mcminnville	97128	lizgrimmsmith@frontier.com
99	2020-12-16 16:32:22	CARMELLA	BLAKE	Roseburg	97471	blakecarmella@gmail.com
100	2020-12-16 16:32:50	Gayle	Davis	Redmond	97756	grammiebear@gmail.com
101	2020-12-16 16:33:20	Fredrick	Weaver	Portland	97236	flweaver1@aol.com
102	2020-12-16 16:33:31	Robbie	Ellis	Salem	97317	msgtellis@gmail.com

	A	B	C	D	E	F
103	2020-12-16 16:35:42	Coleen	Ruiz	Woodburn	97071	coleen_ruiz@gervais.com
104	2020-12-16 16:36:55	Cristy	Murray	Oregon City	97045	doglady8@gmail.com
105	2020-12-16 16:38:54	Cole	Roth	Mcminnville	97128	roth008@yahoo.com
106	2020-12-16 16:40:39	Angie	Heide	Portland	97214	angieheide@yahoo.com
107	2020-12-16 16:43:32	Jeannine	De Marce	Springfield	97478	jebrdem@gmail.com
108	2020-12-16 16:46:05	Andy	Duffus	Bend	97701	andyduffus@comcast.net
109	2020-12-16 16:46:53	Donna	Grubbs	The Dalles	97058	veragrubbs@aol.com
110	2020-12-16 16:47:22	Marsha	Eiding	Salem	97317	eidingma1@att.net
111	2020-12-16 16:47:23	Robert	Vance	Portland	97215	rvance@pacfibre.com
112	2020-12-16 16:48:09	Kelsey	Wood	Roseburg North	97495	kwood@gordonwoodinsurance.com
113	2020-12-16 16:51:20	BC	Shelby	Portland	97209	bcshelby@gmail.com
114	2020-12-16 16:53:27	Donald	Cook	Sutherlin	97479	don.cook@expresspros.com
115	2020-12-16 16:54:10	B.	Garrelts	Roseburg	97471	btg_32@yahoo.com
116	2020-12-16 16:55:42	Dan	Shults	Springfield	97478	shults4851@q.com
117	2020-12-16 16:56:02	rita	Silveus	Powers	97466	rosecitywoodproducts@gmail.com
118	2020-12-16 16:57:52	Aldo	Nava	Roseburg	97470	aldorules27@yahoo.com
119	2020-12-16 16:58:33	Bond	Starker	Corvallis	97333	bond@starkerforests.com
120	2020-12-16 16:59:49	Barbara	Korsmo	Gresham	97080	korsmobj@hevanet.com
121	2020-12-16 17:02:56	Danny	Swarts	Sisters	97759	photodanny@aol.com
122	2020-12-16 17:05:15	Ken	Nygren	Dayton	97114	woodsmantwo@gmail.com
123	2020-12-16 17:09:10	Mollie	Smith	Florence	97439	grouseridgetower@gmail.com
124	2020-12-16 17:09:23	Laurie	Daniel	Estacada	97023	ldaniel@bctelco.com
125	2020-12-16 17:09:40	Peter	Thime	Estacada	97023	peterthime@gmail.com
126	2020-12-16 17:11:05	Candia	Sanders	Redmond	97756	candiasanders@yahoo.com
127	2020-12-16 17:11:14	Phillip	Reindl	Baker City	97814	pnwcutterphil@yahoo.com
128	2020-12-16 17:14:01	MARVIN	ZUBER	Gold Beach	97444	mszuber2@gmail.com
129	2020-12-16 17:15:11	Barbara	Heppner	Roseburg	97471	barb0711@aol.com
130	2020-12-16 17:19:11	Catherine	Tanzer	Eugene	97404	cattanzer@gmail.com
131	2020-12-16 17:23:29	Robert	Shore	Coos Bay	97420	theshoresbs@charter.net
132	2020-12-16 17:24:07	Shannon	Kiehn	Woodburn	97071	shannonkiehn@yahoo.com
133	2020-12-16 17:28:02	Keith	Green	Salem	97317	kgreensing@yahoo.com
134	2020-12-16 17:28:36	Bonny	Glendenning	Canby	97013	bgraphics@canby.com
135	2020-12-16 17:31:06	John	Glen	Warrenton	97146	jglen@pacifier.com
136	2020-12-16 17:31:12	Dean	Blades	Colton	97017	dblades79@gmail.com

	A	B	C	D	E	F
137	2020-12-16 17:32:18	Carolyn	Beardshear	Cottage Grove	97424	cbshear@gmail.com
138	2020-12-16 17:32:49	Richard	Ziegler	Coos Bay	97420	rkziegler25@yahoo.com
139	2020-12-16 17:33:42	John	Hawthorne	Creswell	97426	y2jdot1@gmail.com
140	2020-12-16 17:36:26	Alene	Reaugh	Siletz	97380	softwalk2@yahoo.com
141	2020-12-16 17:37:03	Shirley	Benson	Wilsonville	97070	jmbjr1@comcast.net
142	2020-12-16 17:40:52	Helen	China	Salem	97304	kelliegrrl2k@aol.com
143	2020-12-16 17:42:34	Roger	Bean	Bend	97702	rbean@bendcable.com
144	2020-12-16 17:43:16	Ralph	Wiley	Medford	97504	ralphdinawiley@yahoo.com
145	2020-12-16 17:46:40	Michael	Brown	Independence	97351	brownbrownmc@msn.com
146	2020-12-16 17:50:02	Kathleen	KLAR	Milwaukie	97267	kathleenklar@yahoo.com
147	2020-12-16 17:56:52	Brett	Jantze	Bend	97702	bjantze@live.com
148	2020-12-16 17:57:01	Jayme	Dumford	Noti	97461	jldumford@peak.org
149	2020-12-16 17:58:12	Karen	Grandpre	Jacksonville	97530	lady_grandpre@yahoo.com
150	2020-12-16 18:01:50	John	meyers	Wilsonville	97070	johndianemryers@gmail.com
151	2020-12-16 18:02:53	Cynthia	Sunday	Ashland	97520	snoodsmom3@yahoo.com
152	2020-12-16 18:04:03	William	Seeber	Silverton	97381	gadgettrees@gmail.com
153	2020-12-16 18:09:13	Darlene	McGrady	Sisters	97759	dsings4joy@aol.com
154	2020-12-16 18:10:58	Patricia	Engelmann	Springfield	97478	macsbest13@gmail.com
155	2020-12-16 18:12:34	Michael	Madera	La Pine	97739	maderam47@yahoo.com
156	2020-12-16 18:15:17	Julie	Moore	Otis	97368	medicalmama69@gmail.com
157	2020-12-16 18:16:24	Brittany	Farro	Vida	97488	bg3039dsu@yahoo.com
158	2020-12-16 18:16:25	Hugh	Simpson	Butte Falls	97522	hughsimpson@centurylink.net
159	2020-12-16 18:22:03	Sandra	McCarthy	Wilsonville	97070	sandramx1@comcast.net
160	2020-12-16 18:28:08	Glen	Amick	Waldport	97394	ram2001@peak.org
161	2020-12-16 18:31:37	Rod	Malone	Prineville	97754	rod68201@aol.com
162	2020-12-16 18:36:58	Christine	Hurd	Beaverton	97006	hurd.christine@gmail.com
163	2020-12-16 18:38:39	James	Marquardt	Scappoose	97056	joemarquardt55@yahoo.com
164	2020-12-16 18:40:01	Adam	Patrick	Eugene	97404	patrickoag@gmail.com
165	2020-12-16 18:46:02	Betty	schild	Tillamook	97141	hbschild@gmail.com
166	2020-12-16 18:50:13	Ron	Butler	Culver	97734	cron.butler@gmail.com
167	2020-12-16 18:54:23	Pamela	Goad	Oakridge	97463	pjlebert49@gmail.com
168	2020-12-16 18:57:31	Cam'ielle	Windsor	Gervais	97026	sheconjures6@gmail.com
169	2020-12-16 18:59:48	Greg	Middlebrook	Redmond	97756	gmiddlenrook@verizon.net
170	2020-12-16 19:06:25	Timothy	McCormick	Culver	97734	shooters4h@gmail.com

	A	B	C	D	E	F
171	2020-12-16 19:17:12	John	Robertson	Sisters	97759	jwrobertson61@gmail.com
172	2020-12-16 19:20:06	James	Rhodes	Corbett	97019	jjrrhodes@aol.com
173	2020-12-16 19:29:05	Pat	Harrington	Salem	97306	harrington91@q.com
174	2020-12-16 19:31:30	PATRICIA	CLARKE	Oregon City	97045	333pmc@gmail.com
175	2020-12-16 19:33:20	Diane	Bryan	Newport	97365	dianecookbryan@gmail.com
176	2020-12-16 19:34:10	William	malpass	Tenmile	97481	billymalpass@gmail.com
177	2020-12-16 19:35:52	Michael	Atkinson	Eugene	97405	1964coyote1963@gmail.com
178	2020-12-16 19:37:31	Dale	Christopherson	Forest Grove	97116	dchristo3049@gmail.com
179	2020-12-16 19:40:51	Judith	Sullivan	Salem	97317	jas027678@comcast.net
180	2020-12-16 19:41:39	Dennis	Hlavacek	Redmond	97756	dennish@bendbroadband.com
181	2020-12-16 19:43:05	Janice	Ashford	Lyons	97358	penumbramoon55@gmail.com
182	2020-12-16 19:46:50	Mitchell	Nelson	Eugene	97408	mancantoo@gmail.com
183	2020-12-16 19:52:56	Richard	logging	Florence	97439	rhufflog@yahoo.com
184	2020-12-16 19:53:16	Connor	Amundsen-Kuester	Corvallis	97333	camundsenkuester@gmail.com
185	2020-12-16 19:54:16	Dave	Benthin	La Pine	97739	d.w.benthin@benthin.com
186	2020-12-16 19:56:32	Phyllis	Reynolds	Keizer	97303	choirmompr@gmail.com
187	2020-12-16 19:59:53	Jolene	Mitchell	Jefferson	97352	mtnatheart4@yahoo.com
188	2020-12-16 20:13:59	Ken	Cornelius	Springfield	97477	ken12849@aol.com
189	2020-12-16 20:19:44	Richard	Stonex	Silverton	97381	dlstonex@frontier.com
190	2020-12-16 20:27:40	Jerry	Williams	Stayton	97383	jr922sol@gmail.com
191	2020-12-16 20:29:50	Stan	Rogers	Salem	97302	rsistanr@gmail.com
192	2020-12-16 20:34:51	Molly	Weiland	Newberg	97132	maggiebe55@yahoo.com
193	2020-12-16 20:40:04	Gary	Littlejohn	Willamina	97396	littlejohn4344@gmail.com
194	2020-12-16 20:50:16	marcia	baker	Carlton	97111	mbaker7575@gmail.com
195	2020-12-16 20:55:24	Robert	Porterfield	Eugene	97402	onehot72ss@yahoo.com
196	2020-12-16 20:55:36	Carol	Schatz	Hood River	97031	sencpl66@gmail.com
197	2020-12-16 20:57:04	Bill	Reese	Columbia City	97018	foresttoday@outlook.comfp
198	2020-12-16 21:05:51	Molly	Mulkey	Monmouth	97361	molly@mulkeyfarms.com
199	2020-12-16 21:05:52	Mark	Pauletto	Mcminnville	97128	mwpauletto@gmail.com
200	2020-12-16 21:07:52	BRADLEY	WILLIAMS	Wilsonville	97070	williams.bradley.charles@gmail.com
201	2020-12-16 21:19:04	Greta	Fridlund	Eugene	97408	gfridlund@gmail.com
202	2020-12-16 21:20:13	Wendy	Carlson	Myrtle Point	97458	1yellowpony@gmail.com
203	2020-12-16 21:25:10	Stephen	Brons	Gilchrist	97737	bronsbf@gmail.com
204	2020-12-16 21:27:58	Ronald	Chappell	Oakland	97462	rchap_52@yahoo.com

	A	B	C	D	E	F
205	2020-12-16 21:29:14	Myles	McMillan	Aumsville	97325	acemyles@wvi.com
206	2020-12-16 21:39:32	Helen	Kanode	Monmouth	97361	helencarl9520@gmail.com
207	2020-12-16 21:48:21	Douglas	little	Wilsonville	97070	ddite5little@comcast.net
208	2020-12-16 21:55:37	Lillian	Boynton	Lincoln City	97367	lgbeachhouse@live.com
209	2020-12-16 21:56:34	Yvonne	Brod.	King City	97224	sy.brod@comcast.net
210	2020-12-16 22:02:05	Ron	Cavin	Eugene	97401	ronc2vn@gmail.com
211	2020-12-16 22:05:49	Robert	Ingram	Shedd	97377	jingram234@peak.org
212	2020-12-16 22:11:25	Ingrid	Wendt	Eugene	97405	idwendt@comcst.net
213	2020-12-16 22:12:12	Elizabeth	Brooks	Monroe	97456	brooksl@peak.org
214	2020-12-16 22:14:37	Claude	Hampton	Newberg	97132	claudehamp@aol.com
215	2020-12-16 22:19:12	Cathy	Finney	Molalla	97038	cafinney@gmail.com
216	2020-12-16 22:27:03	George	Patterson	Salem	97302	g_pat@comcast.net
217	2020-12-16 22:31:32	Michael	Bodewitz	Springfield	97477	mbodewitz25@yahoo.com
218	2020-12-16 22:40:37	Cody	Ware	Junction City	97448	cody1ware@icloud.com
219	2020-12-16 22:46:19	Bonnie	Leigh	Eugene	97402	bleigh098@gmail.com
220	2020-12-16 23:10:37	Phil	Maddux	Monmouth	97361	pmaddux@triadmachinery.com
221	2020-12-16 23:11:57	Doug	Walker	St. Helens	97051	shirleyjdoug@netscape.net
222	2020-12-16 23:27:55	Debbi	Weiler	Keizer	97303	zedeb2001@yahoo.com
223	2020-12-16 23:54:55	Barbara	Bodda	Blodgett	97326	bunniefa@yahoo.com
224	2020-12-16 23:57:47	Claude	Rickman	Powell Butte	97753	crickman00@aol.com
225	2020-12-17 00:07:46	Lisa	Samuelson	Oakridge	97463	carwoman6ls@yahoo.com
226	2020-12-17 00:11:42	Richard	Beers	Eugene	97401	rbeers2606@comcast.net
227	2020-12-17 00:30:31	Cary	Richardson	Marcola	97454	carymrichardson@gmail.com
228	2020-12-17 00:52:49	Elizabeth	Fowler	Roseburg	97471	lizzart@sbcglobal.net
229	2020-12-17 00:58:07	Marsha	Ferry	Coos Bay	97420	marshaferry@frontier.com
230	2020-12-17 01:00:28	Ervine	Nelson	Beaverton	97007	grandmaclaus1@comcast.net
231	2020-12-17 01:09:16	Nancy	Benzel	Yoncalla	97499	bzylady.nb@gmail.com
232	2020-12-17 01:37:18	jim	nylund	Springfield	97478	nylundjim@yahoo.com
233	2020-12-17 01:41:58	Leilani	sykes		97760	goatiegal@hotmail.com
234	2020-12-17 02:31:50	Paula	Brown	Roseburg	97471	rpbrown3524@comcast.net
235	2020-12-17 02:37:15	Pat	Finley	Sutherlin	97479	pfinley57@icloud.com
236	2020-12-17 04:08:04	Dyann	Shaver	Madras	97741	tdshaver179@aol.com
237	2020-12-17 05:07:56	Lary	McKee	Gervais	97026	lary@larymckee.com
238	2020-12-17 07:47:29	Daniel	Robertson	Coos Bay	97420	proref@frontier.com

	A	B	C	D	E	F
239	2020-12-17 08:20:49	Joseph	Strubhar	Hubbard	97032	buffalojoe255@gmail.com
240	2020-12-17 09:12:04	HoHo	xmas	Sunriver	97707	hafatoatflt@gmail.com
241	2020-12-17 09:43:25	Diane	Ferguson	Central Point	97502	difergy66@gmail.com
242	2020-12-17 09:52:25	James	Brown	Williams	97544	jimmy-b@verizon.net
243	2020-12-19 10:32:55	Debra	Brown	Bandon	97411	debbiebrown162@yahoo.com
244	2020-12-17 10:22:59	Megan	Vanderpool	Cottage Grove	97424	vanderfamily5@aol.com
245	2020-12-17 10:35:47	Scott	Bennett	Eugene	97402	sebennett01@yahoo.com
246	2020-12-17 10:45:53	Gina	Gardner	Springfield	97478	ginaggaits@gmail.com
247	2020-12-17 11:06:51	Greg	McClean	Ontario	97914	gcmcclean@cableone.net
248	2020-12-17 11:12:16	Terry	Nelson	Salem	97305	shopterry@gmail.com
249	2020-12-17 11:13:03	Gary	Blanchard	Corvallis	97333	gary@starkerforests.com
250	2020-12-17 11:16:09	Becky	Erickson	Milwaukie	97222	watergirl100101@gmail.com
251	2020-12-17 11:18:24	Harold	Smith	Coos Bay	97420	hdsmith@gmail.com
252	2020-12-17 11:27:25	Gayla	Hansen	Molalla	97038	hansentf@molalla.net
253	2020-12-17 11:27:29	William	Higby	Albany	97322	billh42641@gmail.com
254	2020-12-17 11:42:50	Victoria	Luchterhand	Mulino	97042	1victoriamarie@gmail.com
255	2020-12-17 11:52:22	Janice	Eiler	Salem	97306	janmarieeiler@yahoo.com
256	2020-12-17 11:53:51	jeffrey	snyder	Mount Hood Parkdale	97041	lavanursery@aol.com
257	2020-12-17 11:57:47	Heidi	Kupitz	Klamath Falls	97601	hmkupitz@gmail.com
258	2020-12-17 12:08:10	Patricia	Barger	Portland	97242	xorsrainstar@gmail.com
259	2020-12-17 12:11:45	Christina	Magnuson	Rogue River	97537	clmagnut@gmail.com
260	2020-12-17 12:15:23	Julia	Weinberg	Seaside	97138	juliaweinberg@live.com
261	2020-12-17 12:24:01	Christopher	Richter	Eugene	97405	chris021293@gmail.com
262	2020-12-17 12:31:42	Scott	Grimes	Scio	97374	7mmmagsg@gmail.com
263	2020-12-17 12:34:17	SUSAN	EGGER	Lowell	97452	walkaloosas@gmail.com
264	2020-12-17 12:44:50	Janet	Lundberg	Albany	97321	janlund31317@gmail.com
265	2020-12-17 13:03:52	Jerome	Chetock	Salem	97305	g5jerryc@yahoo.com
266	2020-12-17 13:27:35	Douglas	littlejohn	Willamina	97396	littlejohndoug@aol.com
267	2020-12-17 13:33:12	ARNOLD	HOYT	Prineville	97754	tropescape@aol.com
268	2020-12-17 13:41:45	Samuel	Gallia	Portland	97228	samgallia@gmail.com
269	2020-12-17 14:02:52	Dennis	Parker	Roseburg	97471	caseyparker2110@yahoo.com
270	2020-12-17 14:05:21	Russell	Gallup	Grants Pass	97526	russ@oregoncaliforniasupply.com
271	2020-12-17 14:22:21	David	Russell	Eugene	97405	rustyrussll@yahoo.com
272	2020-12-17 14:28:30	DEAN	GLYCENFER	Portland	97206	docygly@yahoo.com

	A	B	C	D	E	F
273	2020-12-17 14:41:06	Sandy	Harbison	St. Helens	97051	sandy.h@q.com
274	2020-12-17 14:49:28	Jack	Sacrison		97493	sacjace@gmail.com
275	2020-12-17 15:19:08	Carol	Bancke	Molalla	97038	1dragonfly@molalla.net
276	2020-12-17 15:33:03	Jessica	Cook	Woodburn	97071	jesssha@hotmail.com
277	2020-12-17 16:20:32	Ken	Adams	Stayton	97383	kadams@wvi.com
278	2020-12-17 16:34:41	Edwin	Cochran	Dairy	97625	ekcochran@yahoo.com
279	2020-12-17 16:40:21	Debi	Denning	Brownsville	97327	edsdebi@yahoo.com
280	2020-12-17 16:43:42	James	Phelan	Boring	97009	jdphelan@msn.com
281	2020-12-17 17:27:24	Heath	Curtiss	Silverton	97381	heath@curtiss.email
282	2020-12-17 17:54:26	Charles	Volz	Springfield	97478	chuckvolz67@gmail.com
283	2020-12-17 18:28:43	Brock	Roberts	Portland	97210	robertsbrock4@gmail.com
284	2020-12-17 18:38:21	LeRoy	Knight	Medford	97504	tinyleroy@gmail.com
285	2020-12-17 18:41:09	Mike	Haasken	Silverton	97381	mahaasken@outlook.com
286	2020-12-17 20:54:20	Carla	Hervert	Eugene	97404	c.hervert@yahoo.com
287	2020-12-17 23:33:05	Karen	Stone	Eagle Point	97524	mamakstone@yahoo.com
288	2020-12-17 23:44:09	Carla	Porter	Scio	97374	portercarla011@gmail.com
289	2020-12-18 09:03:27	Keith	Sweeney	Bend	97701	keithsweeney2@gmail.com
290	2020-12-18 10:21:19	Tamsin	Russell	Yachats	97498	eugenekiwi@gmail.com
291	2020-12-18 11:22:37	Gloria	Robinson	Bandon	97411	gloriaj_robinson50@aol.com
292	2020-12-18 12:20:49	Tabetha	Chandler	Eugene	97402	rockstar2707@gmail.com
293	2020-12-18 12:32:01	Felicia	Elmore	Albany	97322	fifelmore@ymail.com
294	2020-12-18 12:32:02	James	Lusk	Sutherlin	97479	jrl1295@msn.com
295	2020-12-18 12:32:17	John	Vogel	Hood River	97031	johnvhope@gmail.com
296	2020-12-18 12:32:36	Sharon	Buller	Stayton	97383	sharonbuller@gmail.com
297	2020-12-18 12:32:53	Raymond	Agen	Salem	97304	snkbyt@hotmail.com
298	2020-12-18 12:33:00	John	Kendall	Cornelius	97113	johnkendall05@icloud.com
299	2020-12-18 12:33:02	Anne	ONEILL	Portland	97201	aoneillo@outlook.com
300	2020-12-18 12:33:51	Troy	Vanderhoof	Camas Valley	97416	troy@tvdesignllc.net
301	2020-12-18 12:34:06	Rikki	Wellman	Eugene	97440	rikki@oregonloggingconference.com
302	2020-12-18 12:34:07	richard	Ackerman	Stayton	97383	acksacres@gmail.com
303	2020-12-18 12:34:21	LaDonna	Pollard	Albany	97322	jp97321@aol.com
304	2020-12-18 12:34:50	Cabe	Johnson	Harrisburg	97446	cabe.spothogg@comcast.net
305	2020-12-18 12:35:26	Susan	Marsh	Lake Oswego	97035	sunseeker56@hotmail.com
306	2020-12-18 12:35:39	Steve	Lyublanovits	La Pine	97739	lyublanovits@hotmail.com

	A	B	C	D	E	F
307	2020-12-18 12:36:30	James	Pollard	Albany	97322	jimpollard46@gmail.com
308	2020-12-18 12:37:09	BRADLEY	RHOADES	Klamath Falls	97603	bigbkfalls@yahoo.com
309	2020-12-18 12:38:59	John	Burritt	Independence	97351	jonbro1335@gmail.com
310	2020-12-18 12:39:11	wayne	johnston	Glide	97443	waynefromwinston@yahoo.com
311	2020-12-18 12:39:32	Carol	Munro	St. Helens	97051	scrgtmunro@comcast.net
312	2020-12-18 12:41:10	Kathleen	Samsel	Seaside	97138	ksamsel44@gmail.com
313	2020-12-18 12:41:33	Aura	Wright	Myrtle Point	97458	rjandaura@gmail.com
314	2020-12-18 12:42:31	Theresa	Teigland-March	Salem	97317	tmarch8357@msn.com
315	2020-12-18 12:42:34	Sue	Brawner	Sweet Home	97386	samjas15@hotmail.com
316	2020-12-18 12:45:24	Mark	Cusick	Salem	97317	markacusick37@gmail.com
317	2020-12-18 12:46:44	Sandra	Bautista	Scappoose	97056	sandibautista11@gmail.com
318	2020-12-18 12:46:52	Clifford	Mead	Shady Cove	97539	madmead57@yahoo.com
319	2020-12-18 12:47:13	KIMBERLY	BEELER	Lake Oswego	97034	kim@beelermarketing.com
320	2020-12-18 12:47:17	Allen	Combs	Falls City	97344	alcofc1@msn.com
321	2020-12-18 12:47:26	Hector	Garcia	Salem	97304	hectorlgarcia@comcast.net
322	2020-12-18 12:48:32	Nancy	Brock	Florence	97439	brockna@yahoo.com
323	2020-12-18 12:48:41	Dirk	Thomas	Eugene	97402	dirkthomas95@yahoo.com
324	2020-12-18 12:48:42	Kathy	Kalina	Albany	97322	donkathykalina@msn.com
325	2020-12-18 12:49:28	Daniel	Green	Oregon City	97045	greentreefarm@msn.com
326	2020-12-18 12:50:00	Julie	Krevanko	Forest Grove	97116	juliekrevanko61@gmail.com
327	2020-12-18 12:51:05	John	ivanoff	Astoria	97103	jivanoff61@hotmail.com
328	2020-12-18 12:51:14	Don	Mcwhorter	Trail	97541	sugarkat@hughes.net
329	2020-12-18 12:54:08	Dave	Miller	Silverton	97381	dlmconstruction@live.com
330	2020-12-18 12:58:49	Bernard	Quiring	Eagle Point	97524	bcquiring@yahoo.com
331	2020-12-18 13:00:33	Edith	Curtis	Tigard	97224	dee2847@gmail.com
332	2020-12-18 13:00:34	Karl	Niemeyer	Hermiston	97838	nemokarl@yahoo.com
333	2020-12-18 13:03:21	Linda	McCarver	Springfield	97477	mccarv50@msn.com
334	2020-12-18 13:03:21	Dale	Weise	Gates	97346	roofguy57@yahoo.com
335	2020-12-18 13:07:00	Heather	Thomas	Keizer	97303	heatherthomashlthomas@hotmail.com
336	2020-12-18 13:07:56	kevin	urbanc	La Pine	97739	lapinekevin@yahoo.com
337	2020-12-18 13:08:24	Kathy	Peterson	Bandon	97411	kathylynpet72@outlook.com
338	2020-12-18 13:10:09	Judy	Black	Portland	97230	judith38@comcast.net
339	2020-12-18 13:11:19	David	Hahn	Riddle	97469	delta531@yahoo.com
340	2020-12-18 13:11:23	Jannee	Morley	Albany	97321	mymillaura@yahoo.com

	A	B	C	D	E	F
341	2020-12-18 13:11:36	Darren	Smith	Hillsboro	97124	darren.m.smith@comcast.net
342	2020-12-18 13:13:36	Leon	Kimsey	Lyons	97358	leonkimsey@outlook.com
343	2020-12-18 13:15:50	Susan	Wood	Astoria	97103	sj_wood1@hotmail.com
344	2020-12-18 13:16:28	Mark	Baumgartner	Albany	97321	mark.baumgartner@weyerhaeuser.com
345	2020-12-18 13:18:11	Jeff	Henry	Bend	97701	jefferylhenry@aol.com
346	2020-12-18 13:18:36	Grace	Mayer	Medford	97501	gsmayer541@yahoo.com
347	2020-12-18 13:18:40	Linda	Harper	Keizer	97303	harper7761@gmail.com
348	2020-12-18 13:19:24	Peter	Hoffman	Warrenton	97146	picog40@charter.net
349	2020-12-18 13:19:52	Julie	Moran	Stayton	97383	juliemoran@aol.com
350	2020-12-18 13:20:30	Elsie	Sodano	Eagle Point	97524	elsiesodano@icloud.com
351	2020-12-18 13:20:35	Steven	Duchscherer	Coos Bay	97420	sdpropco2000@yahoo.com
352	2020-12-18 13:20:58	pat	gefre	Cloverdale	97112	fishingwith@nestuccariveroutfitters.com
353	2020-12-18 13:21:01	Lorinda	Gayl	Warrenton	97146	lorindagayl@gmail.com
354	2020-12-18 13:21:16	Will	Walton	Stayton	97383	ww.ecosol@gmail.com
355	2020-12-18 13:22:12	Anne	Fitzelle	Portland	97213	outofpdx@gmail.com
356	2020-12-18 13:25:31	Candy	Fullaway	West Linn	97068	candyfullaway@gmail.com
357	2020-12-18 13:29:49	Larry	Wall	Bend	97702	cybear1959@yahoo.com
358	2020-12-18 13:32:27	Michael	Jones	Salem	97304	mjones4771@gmail.com
359	2020-12-18 13:32:49	Sharon	Daniels	Lebanon	97355	koffeesam@gmail.com
360	2020-12-18 13:33:25	Glenda	Serex	Salem	97304	glendserex@gmail.com
361	2020-12-18 13:34:36	Keri	Hanke	Albany	97322	keriore5@aol.com
362	2020-12-18 13:34:36	Charles	Harper	Newberg	97132	caharpo@yahoo.com
363	2020-12-18 13:35:03	Guy	Grimsley	Brookings	97415	cruzo1113@yahoo.com
364	2020-12-18 13:35:23	Jim	Butterfield	Cornelius	97113	jimbutterfield@yahoo.com
365	2020-12-18 13:39:05	Chris	Jones	Salem	97302	hammrhed@gmail.com
366	2020-12-18 13:39:32	John	Curnutt	Madras	97741	johncurnutt@msn.com
367	2020-12-18 13:39:35	Sherman	Lackey	Woodburn	97071	shermanlackey@hotmail.com
368	2020-12-18 13:39:49	Irv	Beeson	Eugene	97408	irvinbeeson@comcast.net
369	2020-12-18 13:42:31	richard	winner	Bend	97702	richardwinner@msn.com
370	2020-12-18 13:43:59	James	Kelley	Roseburg	97470	petek1433@gmail.com
371	2020-12-18 13:44:50	Linda	Yellin	Cottage Grove	97424	remaincalm108@gmail.com
372	2020-12-18 13:51:19	Lee	Montgomery	Monmouth	97361	tenaciouslee76@gmail.com
373	2020-12-18 13:51:56	Danielle	Anderson	Portland	97213	anderson.danielle11@yahoo.com
374	2020-12-18 13:56:39	Lisa	Basalto	Salem	97306	lisa.basalto@gmail.con

	A	B	C	D	E	F
375	2020-12-18 14:01:37	Rick	Skaggs	Gaston	97119	rickskaggs@yahoo.com
376	2020-12-18 14:05:04	Judith	Dickerson	Azalea	97410	clay.dickerson@frontier.com
377	2020-12-18 14:08:28	David	Versteeg	Turner	97392	david44mag@aol.com
378	2020-12-18 14:09:32	Chase	Carlson	Coquille	97423	chasecarlson@webenet.net
379	2020-12-18 14:09:57	Karen	Rogers	Terrebonne	97760	dalerogers1@msn.com
380	2020-12-18 14:11:00	Lorenzo	Pace	Gold Beach	97444	lorenzopace@yahoo.com
381	2020-12-18 14:12:41	Bill	McCorkle	Portland	97220	bill.mccorkle@gmail.com
382	2020-12-18 14:18:04	Mary	Parham	Tigard	97223	maryp61@live.com
383	2020-12-18 14:18:26	Shirley	Killam	Brookings	97415	shirleyealykillam@yahoo.com
384	2020-12-18 14:18:31	Rodney	Beebe	Prineville	97754	rodneyb492@msn.com
385	2020-12-18 14:19:37	Gerald	Palanuk	Sweet Home	97386	jernuk01@yahoo.com
386	2020-12-18 14:25:59	Lynn	Churchill	Eagle Point	97524	peach39@charter.net
387	2020-12-18 14:27:35	Craig	Randall	Lyons	97358	cvrandall@yahoo.com
388	2020-12-18 14:28:42	James	Miller	Brookings	97415	mochagirl2002@hotmail.com
389	2020-12-18 14:36:35	Linda	Kitchens	Glendale	97442	lindakitche@gmail.com
390	2020-12-18 14:45:58	Laura	Harvey	Roseburg	97471	sevenhlinc@outlook.com
391	2020-12-18 14:52:33	Larry	Grone	Waldport	97394	bildr22@yahoo.com
392	2020-12-18 14:52:55	Therese	MacGregor	Central Point	97502	theresem@cbprowest.com
393	2020-12-18 14:58:12	Debbie	McMillan	Salem	97302	debbiemcmillan@bhhsrep.com
394	2020-12-18 15:09:01	Harold	Still	Redmond	97756	grgrstill@yahoo.comm
395	2020-12-18 15:09:07	Claudette	Hills	Brookings	97415	claudettehills@hotmail.com
396	2020-12-18 15:21:03	sue	Awmiller	The Dalles	97058	saw@qnect.net
397	2020-12-18 15:30:42	Kathryn	Anthony	Charleston	97420	crystalcreek9@frontier.com
398	2020-12-18 15:34:11	Leota	Arguello	Hillsboro	97124	mbag2017@yahoo.com
399	2020-12-18 15:45:20	Mari Ann	Andrieux	Springfield	97477	pookyjnz12@hotmail.com
400	2020-12-18 16:09:37	AMY	ALLISON	La Grande	97850	boohoobluedog@gmail.com
401	2020-12-18 16:16:55	Paul	Haddock	Roseburg	97471	phaddock@douglasfast.net
402	2020-12-18 16:24:46	Gregory	Ellsworth	Portland	97223	ellsworth2359@comcast.net
403	2020-12-18 16:26:33	William	Mansfield	Milwaukie	97267	williamrmansfield@hotmail.com
404	2020-12-18 16:28:59	Lisa	Brown	Salem	97317	warren.brown@comcast.net
405	2020-12-18 16:48:26	Katherine	Hubbard	Wilderville	97543	91046kh@frontiernet.net
406	2020-12-18 17:13:32	Mary	Palmer	Boring	97009	jerry.chris@comcast.net
407	2020-12-18 17:36:22	Cynthia	Cessnun	Philomath	97370	cyncss@casco.net
408	2020-12-18 18:02:20	Ward	Bouslough	Florence	97439	wardb@live.com

	A	B	C	D	E	F
409	2020-12-18 18:05:14	EDWARD	SHARP	Central Point	97502	pveduardo@charter.net
410	2020-12-18 18:09:02	Michele	Dougherty	Florence	97439	mjdlcsw54@aol.com
411	2020-12-18 18:10:45	Bill	Munsell	Medford	97501	billmunsell@hotmail.com
412	2020-12-18 18:17:21	Cindy	Smith	Vida	97488	cindysmckenzie@msn.com
413	2020-12-18 18:22:54	Judith	McLean	Portland	97212	judmcl51@gmail.com
414	2020-12-18 18:34:29	Harold	Tiernan	Dallas	97338	hstiernan@charter.net
415	2020-12-18 18:46:43	Robert	Soderberg	Bend	97702	qsilver2@bendcable.com
416	2020-12-18 18:49:33	Arthur	Waugh	Lebanon	97355	waugh1198@gmail.com
417	2020-12-18 18:53:44	Jim	Geear	Medford	97504	jimgeear@charter.net
418	2020-12-18 19:08:49	Shawn	Zielinski	Canby	97013	bigangryfarmer@gmail.com
419	2020-12-18 19:14:25	Bill	Stone	Corvallis	97330	bill.stoney@comcast.net
420	2020-12-18 19:16:59	Joyce	Harris	Portland	97230	joycepdx@q.com
421	2020-12-18 19:23:12	Pamela	Collord	Milwaukie	97267	earthgal49@gmail.com
422	2020-12-18 19:27:54	Heidi	Leib	Albany	97321	heidileib@bc.com
423	2020-12-18 19:37:21	David	Kirkpatrick	Lowell	97452	ryankirkpatrick99@gmail.com
424	2020-12-18 19:53:49	Jake	Mote	Independence	97351	jakemote13@gmail.com
425	2020-12-18 19:59:18	Daniel	Terrel	Roseburg	97470	proudvet46@msn.com
426	2020-12-18 20:20:06	Patricia	Phillips	Ontario	97914	190pat711@gmail.com
427	2020-12-18 20:20:44	Adeline	Miller	Silverton	97381	dannangi@frontier.com
428	2020-12-18 20:25:40	larry	spielbusch	Sutherlin	97479	kaybritbub@charter.net
429	2020-12-18 20:29:07	Anne	Parkhurst	Roseburg	97470	parkhurst.trucking@gmail.com
430	2020-12-18 20:53:07	Brent	Klumph	Sweet Home	97386	bklumph@hotmail.com
431	2020-12-18 20:58:50	Elaine	McCoy	Creswell	97426	elajomc@centurylink.net
432	2020-12-18 21:43:20	Lois	Churchward	Roseburg	97471	loiscee@hotmail.com
433	2020-12-18 21:47:46	Teresa	Tyler	Mount Hood Village	97067	thtyler@yahoo.com
434	2020-12-18 21:49:51	Gregory	Stratton	Klamath Falls	97601	gstratton64@yahoo.com
435	2020-12-18 22:05:35	Sue	Christenssn	Cornelius	97113	suechristensen2929@yahoo.com
436	2020-12-18 22:05:37	Theodore	DeVore	Klamath Falls	97601	tbdevore22@gmail.com
437	2020-12-18 22:13:40	Kourtnee	Chapin	Ontario	97914	kourtneekemble@gmail.com
438	2020-12-18 22:29:09	Donna	Marchetti	Ashland	97520	dmarc@q.com
439	2020-12-18 22:34:52	Ellen	Nieminen	Clatskanie	97016	reniemin@clatskanie.com
440	2020-12-18 22:49:20	Kathleen	Jimenez	Sublimity	97385	noaharclvr@msn.com
441	2020-12-18 22:50:42	Gregory	Moniz	Canyonville	97417	gmoniz1953@gmail.com
442	2020-12-18 22:52:34	Carol	Marx	Rickreall	97371	camarx@aol.com

	A	B	C	D	E	F
443	2020-12-18 22:56:52	Tonya	Buzzard	Myrtle Creek	97457	crittermom88@gmail.com
444	2020-12-18 22:59:55	James	Mahaffy	Roseburg	97471	mahaffyj13@yahoo.com
445	2020-12-18 23:24:46	Pam	Cartwright	Salem	97302	pcpoetplace@yahoo.com
446	2020-12-18 23:56:43	Ted	Meier	Sublimity	97385	ted40mary42@gmail.com
447	2020-12-19 00:30:23	James	Morton	Sweet Home	97386	jcsalpacas@aol.com
448	2020-12-19 00:33:14	Debbie	Swenson	Tangent	97389	coconuts@peak.org
449	2020-12-19 00:48:35	Nicole	Zedwick	Scio	97374	nicole.zedwick@gmail.com
450	2020-12-19 01:15:38	JUDY	Caldwell	Mulino	97042	naturesima@bctonline.com
451	2020-12-19 02:10:31	Darcy	Blackman	La Grande	97850	dblackmanrx@gmail.com
452	2020-12-19 03:09:38	Sandy	Wilson	Wilsonville	97070	smwilson68@yahoo.com
453	2020-12-19 03:31:06	Nancy	Farquhar	Eugene	97404	nancyfarquhar@charter.net
454	2020-12-19 06:52:59	Betty	Ledbetter	Baker City	97814	bledbettr@msn.com
455	2020-12-19 07:57:32	Estella	Kissell	Coquille	97423	kissinoak@aol.com
456	2020-12-19 09:49:00	David	miller	Central Point	97502	gbm102119@outlook.com
457	2020-12-19 11:14:12	Eric	Bufka	Dallas	97338	ebufka@aol.com
458	2020-12-19 11:19:17	Kenneth	Swartout	Newberg	97132	lastlather@gmail.com
459	2020-12-19 11:43:32	Mary	Lucht	Eugene	97405	aljoemary@hotmail.com
460	2020-12-19 11:48:06	Kathy	Heitz	Baker City	97814	kjheitz750@q.com
461	2020-12-19 12:03:09	greg	heyne	Prineville	97754	gregheyne@yahoo.com
462	2020-12-19 12:10:55	Robert	Myers	Ontario	97914	daddibob@hotmail.com
463	2020-12-19 13:15:38	Jean	Lofy	Portland	97267	jeanlofy@gmail.com
464	2020-12-19 13:26:56	Jackalyn	Barker	Oakland	97462	wanderingjackie@gmail.com
465	2020-12-19 13:39:53	Gary	Commons	Grants Pass	97527	grcommons63@gmail.com
466	2020-12-19 13:42:17	Carl	Holland	Coos Bay	97420	hollandcarlr@msn.com
467	2020-12-19 14:40:01	Sharon	Foster	Woodburn	97071	roseofsharon930@hotmail.com
468	2020-12-19 14:52:09	Sydney	Herbert	Portland	97267	psydneyh1@msn.com
469	2020-12-19 15:04:40	Kedric	Brissette	Brookings	97415	kedder@live.com
470	2020-12-19 15:11:08	Julie	Wimberly	Stayton	97383	juliebowen2@outlook.com
471	2020-12-19 16:01:30	Susan	Petterson	Portland	97267	suepet40@gmail.com
472	2020-12-19 18:42:02	Dennis	Chapman	Cottage Grove	97424	dfcbiz@hotmail.com
473	2020-12-19 20:49:30	Julie	Giffen	Willamina	97396	jigiffen@centurylink.net
474	2020-12-19 22:06:56	Roger	Lord	Aloha	97007	ptaeda@comcast.net
475	2020-12-19 23:26:54	Jane	Salamone	Florence	97439	janeis50@msn.com
476	2020-12-19 23:54:37	Sandra	Nelson	Beaverton	97008	sandran1949@gmail.com

	A	B	C	D	E	F
477	2020-12-20 08:11:37	Kevin	R.Maden	Redmond	97756	kevinr.maden@hotmail.com
478	2020-12-20 08:22:26	Kathy	Robitsch	Florence	97439	wkrobitsch@gmail.com
479	2020-12-20 11:07:41	Desiree	Housley	Jefferson	97352	desiraerae@yahoo.com
480	2020-12-20 13:20:24	Denise	Smith	Eugene	97402	wrigleybigley@gmail.com
481	2020-12-20 14:25:01	Kassi	Bass	Gresham	97030	kassi.bass@hotmail.com
482	2020-12-20 14:25:50	Bryan	Cornell	Corvallis	97330	bryancornell7014@msn.com
483	2020-12-20 14:26:45	Tara	Bamburg	Vernonia	97064	tara@apswest.net
484	2020-12-20 14:26:55	Elena	latch	Portland	97229	latch0809@msn.com
485	2020-12-20 14:27:02	David	Officer	Lake Oswego	97034	doffs@aol.com
486	2020-12-20 14:27:42	Carin	Robinson	Depoe Bay	97341	carjimrob19@gmail.com
487	2020-12-20 14:27:49	julia	Bajovich	Depoe Bay	97341	juliarenner57@yahoo.com
488	2020-12-20 14:28:02	Larry	Butler	Eugene	97402	larryjbutler1@msn.com
489	2020-12-20 14:29:43	Nicole	Courser	Beaverton	97007	nicolejanicecourser@live.com
490	2020-12-20 14:30:08	Gregor	Hinckley	Hillsboro	97123	hinckley.gregor@gmail.com
491	2020-12-20 14:30:37	Pamela	Berndt	Port Orford	97465	pamela@wildriverslandtrust.org
492	2020-12-20 14:33:37	Karen	von Borstel	Corbett	97019	karenvb@cyocamphoward.org
493	2020-12-20 14:34:05	Jackie	Yung	Salem	97304	jackiesueyung99@live.com
494	2020-12-20 14:36:17	Daniel	Poole	Beaverton	97007	bastion.cat@comcast.net
495	2020-12-20 14:36:46	Kate	Bolinger	Bend	97701	katebolinger@gmail.com
496	2020-12-20 14:37:45	Gary	Strean	Molalla	97038	gadedaro@molalla.net
497	2020-12-20 14:41:45	Donna	Holm	Glide	97443	donna.holm51@yahoo.com
498	2020-12-20 14:45:30	Rosemary	Tucker	Happy Valley	97086	rosemary.tucker@yahoo.com
499	2020-12-20 14:48:28	Stephen	Snyderr	Eugene	97404	w7cm@hotmail.com
500	2020-12-20 14:48:37	Karon	Ziegler	Coos Bay	97420	kpz1012@gmail.com
501	2020-12-20 14:53:39	Michael	Miller	Canby	97013	michaelj25@msn.com
502	2020-12-20 19:53:59	Hattie	Mead	Portland	97219	kehame@aol.com
503	2020-12-20 20:01:13	Sheila	Pakkala	Medford	97501	sheilapakkala@gmail.com
504	2020-12-20 20:03:35	Richard	Lindstrom	Bend	97702	richardlindstrom@me.com
505	2020-12-20 20:06:51	Angela	West	Springfield	97477	westa.2k17@gmail.com
506	2020-12-20 20:07:38	Doreen	Murphy	Corvallis	97333	ratmom5@gmail.com
507	2020-12-20 20:08:41	dorinda	kelley	Portland	97213	dorindask@gmail.com
508	2020-12-20 20:09:45	Linda	Cook	Nehalem	97131	lindacookphotography@gmail.com
509	2020-12-20 20:10:48	Anne	Campbell	Myrtle Point	97458	cinnamonredhead1@gmail.com
510	2020-12-20 20:21:28	Judith	Lesan	Junction City	97448	jlesan@live.come

	A	B	C	D	E	F
511	2020-12-20 20:24:33	Charles	Rice	Tigard	97223	chkr8989@aol.com
512	2020-12-20 20:25:36	Thane	Beers	Swisshome	97480	tbeers44@gmail.com
513	2020-12-20 20:26:02	linda	walling	Oakridge	97463	lindawalling831@gmail.com
514	2020-12-20 20:26:36	Karen	Bones	Prineville	97754	kbones1186@yahoo.com
515	2020-12-20 20:27:09	Jerry	Erkenbeck	St. Helens	97051	erkenbeck0361@msn.com
516	2020-12-20 20:34:17	Barbara	Lastfogel	Salem	97303	safewarm@aol.com
517	2020-12-20 20:34:56	Greg	culver	Eagle Point	97524	bucmaster300@yahoo.com
518	2020-12-20 20:36:28	Tracy	Colgan	Canby	97013	tcolgan289@yahoo.com
519	2020-12-20 20:40:41	Mary	Sward	Corvallis	97330	maryannsward@msn.com
520	2020-12-20 20:41:06	Terry	Hart	Salem	97317	hartlinc@hotmail.com
521	2020-12-20 20:45:00	Ryan	Showerman	Estacada	97023	highline27@icloud.com
522	2020-12-20 20:52:15	John	Wiles	Newport	97365	ewiles@actionnet.net
523	2020-12-20 20:57:21	Sally	Cadonau	Aloha	97007	cadhawks9883@icloud.com
524	2020-12-20 21:11:35	Robert	Palmer	Salem	97305	palmerstrees@yahoo.com
525	2020-12-20 21:17:48	wesley	van de warker	Redmond	97756	wvandewarker@hotmail.com
526	2020-12-20 21:20:56	Melissa	Hathaway	Portland	97230	infomavn@teleport.com
527	2020-12-20 21:26:51	Maile	Anthopoulos	Beaverton	97008	manthopoulos@icloud.com
528	2020-12-20 21:35:54	Alex	Reutov	Molalla	97038	reu113@hotmail.com
529	2020-12-20 21:37:33	Mark	Epps	Roseburg	97470	landwarrior1@icloud.com
530	2020-12-20 21:39:39	Adam	McAfee	Albany	97321	adammcafee@gmail.com
531	2020-12-20 21:40:02	Dana	Belisle	Columbia City	97018	dananjim11@gmail.com
532	2020-12-20 21:40:47	Jerry	Anderson	Klamath Falls	97603	sycaneagle@aol.com
533	2020-12-20 21:43:42	MARY	JARVIS	Ashland	97520	mary_lynne_jarvis@yahoo.com
534	2020-12-20 21:55:20	Daniel	Martin	Beaverton	97007	dmarti3742@aol.com
535	2020-12-20 21:56:49	Brandi	Hatch	Boring	97009	brandiahatch@gmail.com
536	2020-12-20 22:00:30	Kenneth	Lemley	Madras	97741	lemlelymadras56@yahoo.com
537	2020-12-20 22:07:56	sara	duncan	Lake Oswego	97034	sara.e.duncan@gmail.com
538	2020-12-20 22:26:10	Paul	Keim	Portland	97266	pmk453@hotmail.com
539	2020-12-20 22:31:15	Tom	McCarty	Trail	97541	tomosarus@hotmail.com
540	2020-12-20 22:41:10	Danielle	Smith	Beaverton	97005	supermarketshuffle@gmail.com
541	2020-12-20 22:49:23	Ginnie	Stonesifer	Milwaukie	97267	ginniestonesifer@gmail.com
542	2020-12-20 22:55:18	James	Benvie	Springfield	97478	forestryinspections@comcast.net
543	2020-12-20 23:20:29	Jane	Olsen	Portland	97267	olsenjane50@gmail.com
544	2020-12-20 23:29:36	Patricia	Long	St. Helens	97051	sallyforth00@yahoo.com

	A	B	C	D	E	F
545	2020-12-20 23:31:29	Cecil	BRIDGE	Sweet Home	97386	cmbridge@comcast.net
546	2020-12-20 23:43:05	donna	johnson	Dallas	97338	eighttoesone@msn.com
547	2020-12-20 23:57:32	Judith	Mercer	Roseburg	97471	dosgatos438@msn.com
548	2020-12-21 00:07:21	Deborah	Gesner	Lincoln City	97367	ryden@mac.com
549	2020-12-21 00:19:05	Karen	Roldan	St. Helens	97051	tkroldan17@gmail.com
550	2020-12-21 00:27:04	Clarence	Cullop	Medford	97501	papaskip55@yahoo.com
551	2020-12-21 00:29:53	Darcy	Campbell	Roseburg	97470	dlynn_45@yahoo.com
552	2020-12-21 00:51:49	Karla	McMorran	Gold Beach	97444	karla0413@yahoo.com
553	2020-12-21 01:15:14	Linda	Andersen	Warrenton	97146	lsuemont2@hotmail.com
554	2020-12-21 01:41:44	Virginia	Pabst	Sisters	97759	vpabst@hotmail.com
555	2020-12-21 02:17:38	Lisa	Read	Sandy	97055	lisaread9@gmail.com
556	2020-12-21 04:29:06	Judith	Bentley	Dallas	97338	judbentley@aol.com
557	2020-12-21 05:40:46	Neila	Whitney	Molalla	97038	pasoneila47@gmail.com
558	2020-12-21 06:14:56	Patricia	Durkin	Cannon Beach	97110	pldurkin@theoregonshore.com
559	2020-12-21 06:17:36	Tadd	Held	Oakland	97462	taddheld@gmail.com
560	2020-12-21 08:00:43	Joycelyn	Wilbourn	Cave Junction	97523	joycelynwilbourn@yahoo.com
561	2020-12-21 09:19:02	Michaelle	Robardey	Portland	97203	mlr.bpbr@gmail.com
562	2020-12-21 11:22:35	Harry	Pollard	Sisters	97759	hpollard311@yahoo.com
563	2020-12-21 14:00:23	Chris	Silbernagel	La Grande	97850	chris@silbernagelinc.com
564	2020-12-21 14:04:08	Rick	Kriege	Prineville	97754	rkriege@qwestoffice.net
565	2020-12-21 15:27:43	Carleton	Lloyd	Newberg	97132	clloyd@georgefox.edu
566	2020-12-21 15:34:01	Alex	Dunn	Philomath	97370	dunnal12345@yahoo.com
567	2020-12-21 16:02:09	Kathryn	Olson	Astoria	97103	kkeim_04@hotmail.com
568	2020-12-21 16:13:09	Kathy	Sperle	Gold Hill	97525	kathysperle@bc.com
569	2020-12-21 16:52:07	Becky	Whitener	Mill City	97360	whitener@frontier.com
570	2020-12-21 16:57:34	Judy	Hixson	Seaside	97138	dennis.judyh@gmail.com
571	2020-12-21 17:42:54	David	Webb	Dallas	97338	davidwebb343@msn.com
572	2020-12-21 17:43:19	Sally	McEldowney		97458	sallymc1@yahoo.com
573	2020-12-21 17:59:25	Curtis	Wright	Willamina	97396	orwrights@hotmail.com
574	2020-12-21 17:59:43	Jeffrey	Whalen	Beaverton	97007	jeffwwhalen@yahoo.com
575	2020-12-21 18:34:29	Jeri	Dodge	Sweet Home	97386	ljd@centurytel.net
576	2020-12-21 19:03:03	Sharon	Maribona	Lincoln City	97367	sharonmarie23@yahoo.com
577	2020-12-21 19:38:41	Michele	Jones	Eagle Point	97524	michelenbobbyj@aol.com
578	2020-12-21 21:21:47	John	Buss	Salem	97305	jdbuss@comcast.net

	A	B	C	D	E	F
579	2020-12-21 22:24:43	JEAN	Olney	Lebanon	97355	organplayer3@live.com
580	2020-12-21 23:58:03	Jeffrey	Frank	Mill City	97360	jeff@franklumberco.com
581	2020-12-21 23:59:21	STEPHEN	BOQUIST	Tillamook	97141	sboquist60@gmail.com
582	2020-12-22 02:17:01	Ms	Bochsler	Mount Angel	97362	robinbochsler@gmail.com
583	2020-12-22 02:37:54	Marlene	Acker	Nehalem	97131	marlene@nehalemtel.net
584	2020-12-22 13:23:26	Tony	Geiger	Glide	97443	argeiger@icloud.com
585	2020-12-22 13:32:41	Mari	Harpur	Sweet Home	97386	marihillharpur@me.com
586	2020-12-22 14:33:37	Melissa	Fulerton	Summerville	97876	melissa.fullerton@yahoo.com
587	2020-12-22 15:50:13	Elizabeth	Anderson	Powell Butte	97753	ragingangel61@yahoo.com
588	2020-12-22 15:57:08	Kim	Kotter	La Grande	97850	kkotter@woodgrain.com
589	2020-12-22 16:51:24	Robert	Teran	Tillamook	97141	teran56@hotmail.com
590	2020-12-22 17:10:48	Susan	Yraguen	Roseburg North	97495	jaime@bascologging.com
591	2020-12-22 17:28:36	Michael	Bryant	Beavercreek	97004	bryantlogging@bctonline.com
592	2020-12-22 17:37:49	Don	Hardwick	Cottage Grove	97424	donhardwick@rosboro.com
593	2020-12-22 18:01:30	Kathryn	Pritchard	Astoria	97103	pritchard297@gmail.com
594	2020-12-22 18:54:51	Mark	Dreyer	Rainier	97048	mdreyer51@msn.com
595	2020-12-22 21:45:25	Shirley	Beebe	Myrtle Creek	97457	grannygg74@gmail.com
596	2020-12-23 03:44:46	Joshua	Lester	Klamath Falls	97603	bagheerasshadow@gmail.com
597	2020-12-23 06:18:34	Glenn	French	Otis	97368	estherfrench2@gmail.com
598	2020-12-23 17:33:17	Gina	Pilgreen	Corbett	97019	ginapilgreen@yahoo.com
599	2020-12-23 17:33:33	Lise	Hull	Bandon	97411	castlesu@aol.com
600	2020-12-23 17:33:39	John	MeeK	Hillsboro	97123	jmeek50540@aol.com
601	2020-12-23 17:36:33	John	Ganzer	Mcminnville	97128	jganzer@frontier.com
602	2020-12-23 17:36:54	Treeca	Adams	Milton-freewater	97862	terriadams64@gmail.com
603	2020-12-23 17:37:57	Richard	De Witt	Prineville	97754	livnlife4him@hotmail.com
604	2020-12-23 17:38:41	Dale	Stephens	Nyssa	97913	stephens.dale@gmail.com
605	2020-12-23 17:39:45	Philip	Hubert	Portland	97214	phubert62@gmail.com
606	2020-12-23 17:40:45	Kay	Haskell	Eugene	97401	haskellkay9@hotmail.com
607	2020-12-23 17:42:54	Harold	Huntington	Baker City	97814	family2talk@yahoo.com
608	2020-12-23 17:48:00	Vicki	Saily	Myrtle Creek	97457	vicki_saily@hotmail.com
609	2020-12-23 17:53:13	Brian	Whalen	Eugene	97401	bdwhalen@msn.com
610	2020-12-23 17:53:44	Kenneth	Guerra	Grants Pass	97526	ken@investmentresourcesinc.com
611	2020-12-23 17:54:10	Jan	Eide	Tigard	97224	eide.family@live.com
612	2020-12-23 17:54:47	Kenneth	Jones	Burns	97720	davejones95@yahoo.com

	A	B	C	D	E	F
613	2020-12-23 17:55:13	Bruce	Alber	Portland	97203	bpalber@gmail.com
614	2020-12-23 17:58:39	James	Dudley	Roseburg	97471	jim.dudley@swansongroup.biz
615	2020-12-23 17:59:44	Greg	Schmitz	Silverton	97381	schmitztimber@gmail.com
616	2020-12-23 18:01:12	Mark	Goddard	Estacada	97023	mark.goddard@comcast.net
617	2020-12-23 18:09:31	Jeffery	Stultz	Eugene	97402	jefferylstultz@gmail.com
618	2020-12-23 18:11:47	SANJANA	SACHDEVA	Portland	97229	sanjana.sdeva@gmail.com
619	2020-12-23 18:17:01	Karen	McCarthy	Portland	97230	klmoboe@yahoo.com
620	2020-12-23 18:28:41	Jennifer	Bach	Beaverton	97008	bachj69@gmail.com
621	2020-12-23 18:29:52	Judi	Mosteller	Portland	97223	judimosteller@comcast.net
622	2020-12-23 18:30:52	Linda	Haga	North Bend	97459	lin.griffy@gmail.com
623	2020-12-23 18:32:25	Lisa	Mellinger	Scotts Mills	97375	lisanm2001@yahoo.com
624	2020-12-23 18:34:50	Pam	Mitchell	Prineville	97754	pammitchellcg@gmail.com
625	2020-12-23 18:36:00	Janice	Allen	Willamina	97396	jana_461@yahoo.com
626	2020-12-23 18:39:08	Rayola	Calvert	Roseburg	97470	racalvert@sbcglobal.net
627	2020-12-23 18:40:04	David	Beatty	Woodburn	97071	banzai_beagle@yahoo.com
628	2020-12-23 18:52:08	John	Meissner	Scotts Mills	97375	jameissner39@gmail.com
629	2020-12-23 19:05:34	Robert	Sharp	Newberg	97132	bdausa@gmail.com
630	2020-12-23 19:11:27	Ann	Walker	Portland	97230	annwalkerconsulting@yahoo.com
631	2020-12-23 19:11:40	Cara	Johnson	Oregon City	97045	caram_johnson@yahoo.com
632	2020-12-23 19:12:38	Susan	Roper	Mcminnville	97128	woodygoatpress@gmail.com
633	2020-12-23 19:21:51	Robyn	Wells-McLeroy	Springfield	97478	rmqh2011@gmail.com
634	2020-12-23 19:24:11	John	Garland	Waldport	97394	johngarland49@gmail.com
635	2020-12-23 19:41:55	WILLIAM	HAGERTY	Cloverdale	97112	whagerty@hotmail.com
636	2020-12-23 19:44:07	Joyce	Meyer	Springfield	97477	joycemeyer50@yahoo.com
637	2020-12-23 20:07:17	Daniel	olson	Bend	97702	dnilsonny@msn.com
638	2020-12-23 20:12:09	Joanne	Bixler	Oregon City	97045	joeykbixler@gmail.com
639	2020-12-23 20:12:59	Judith	Light	Cannon Beach	97110	judith@moonsong.com
640	2020-12-23 20:26:26	Sudha	L.	Portland	97219	toothaby1@gmail.com
641	2020-12-23 21:10:37	Courtney	Reid	Salem	97301	pku_courtney@hotmail.com
642	2020-12-23 21:15:58	Pat	Bognar	Portland	97205	bognar@up.edu
643	2020-12-23 21:22:08	Leslie	Anderson	Coquille	97423	leslieanderson713@yahoo.com
644	2020-12-23 21:50:42	Walter	Kennick	Independence	97351	walt_kennick@yahoo.com
645	2020-12-23 22:16:08	Donna	Handegard	La Grande	97850	donnahandegard@yahoo.com
646	2020-12-23 23:05:41	Quincy	Powers	Eugene	97401	powersranch@outlook.com

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647	2020-12-23 23:17:12	Taomi	Reynolds	Port Orford	97465	taomireynolds@outlook.com
648	2020-12-23 23:47:10	Albert	Miller	Silverton	97381	alkb7rw@live.com
649	2020-12-24 00:15:29	Samuel	Rogers	Roseburg	97471	buzzardtree@gmail.com
650	2020-12-24 00:29:07	KRISTIN	YRAGUEN	Winchester	97495	kris@bascologging.com
651	2020-12-24 01:29:13	Heather	Schiffke	Milwaukie	97222	heatherschiffke@mac.com
652	2020-12-24 01:42:07	Karen	Parkison	Salem	97301	karenparkison@gmail.com
653	2020-12-24 02:14:08	Leslie	Stewart	Mill City	97360	leslie@keytooregon.com
654	2020-12-24 03:01:18	Lois	Kincaid	Portland	97210	lekincaid@hotmail.com
655	2020-12-24 04:12:09	Tim	shiel	Cornelius	97113	7of8oshiel@gmail.com
656	2020-12-24 04:15:18	Thomas	Wimberly	Roseburg	97471	wimbo@mcsi.net
657	2020-12-24 06:20:37	Paulette	Switzer-Tatum	Aloha	97078	pswitzertatum@frontier.com
658	2020-12-24 07:26:46	Rita	Castillo	Springfield	97478	itouchedthewire@yahoo.com
659	2020-12-24 08:13:50	Janell	Morgan	Florence	97439	janellbmorgan@yahoo.com
660	2020-12-24 09:29:33	Cheryl	Hopkins	Newberg	97132	shaniasmom06@yahoo.com
661	2020-12-24 11:26:15	Elyce	Benham	Portland	97217	elyce.benham@yahoo.com
662	2020-12-24 13:48:42	Carly	Baker	Keizer	97303	curlycar@comcast.net
663	2020-12-24 14:55:16	Michael	Boquist	Mcminnville	97128	brainfarth@gmail.com
664	2020-12-24 14:57:25	Ralph	Crilly	Cave Junction	97523	motog69@hotmail.com
665	2020-12-24 14:59:08	Karen	Edmonds	Meacham	97859	theblues234@gmail.com
666	2020-12-24 16:13:43	Ali	Crevola	Philomath	97370	boogiesan4@hotmail.com
667	2020-12-24 17:33:04	Merrie-Jo	Rodriguez	Winston	97496	mojo95451@yahoo.com
668	2020-12-24 20:29:56	Christina	Castle-Rey	Eugene	97405	christina@satelliteresearch.net
669	2020-12-25 03:26:22	Sheila	Larson	Eugene	97405	shebee.l.12@gmail.com
670	2020-12-25 08:11:39	Glenn	Koteen	Bend	97701	colon101@aol.com
671	2020-12-25 17:22:49	Todd	Hopkins	St. Helens	97051	dt.hopkins7@gmail.com
672	2020-12-27 22:15:11	James	Pardee	Aloha	97007	james.d.pardee@gmail.com
673	2020-12-28 16:05:53	Cynthia	Kessler	Port Orford	97465	kesslc@icloud.net
674	2020-12-28 18:35:23	John	Smets	Aurora	97002	johns@smetco.com
675	2020-12-28 18:36:03	Ellie	Hilger	Bay City	97107	erhilger1780@gmail.com
676	2020-12-28 18:36:17	Dan	Barnett	Bandon	97411	dhbolts@gmail.com
677	2020-12-28 18:37:55	Joseph	Kovich	Columbia City	97018	jtkshk@comcast.net
678	2020-12-28 18:38:13	Terence	Nolan	Salem	97301	me.2still@gmail.com
679	2020-12-28 18:44:13	Chris	Johnson	Bend	97702	chris.johnson@shanda.com
680	2020-12-28 18:44:59	Lawrence	Crook	Eugene	97402	catfish_crook@yahoo.com

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681	2020-12-28 18:45:09	Fred	Smith	Silverton	97381	fl.smith@frontier.com
682	2020-12-28 18:46:53	KB	Farmer	Shedd	97377	kglaser@dswebnet.com
683	2020-12-28 18:49:53	SCOTT	MCCRAE	Wallowa	97885	scott.mccrae@yahoo.com
684	2020-12-28 18:50:11	Michael	Elsberry	Mcminnville	97128	melsberry@4security.org
685	2020-12-28 18:50:24	Lee	Bennett	Oregon City	97045	lounlee5969@gmail.com
686	2020-12-28 18:55:05	Cathie	Price	Lake Oswego	97035	catprice56@gmail.com
687	2020-12-28 18:55:17	Richard	Blake	Molalla	97038	blakefarm2@gmail.com
688	2020-12-28 18:59:44	Robert	Hamman	Salem	97317	rhamman@mtengineering.net
689	2020-12-28 19:02:44	Barbara	Van Kleek	Hillsboro	97124	barbvk@yahoo.com
690	2020-12-28 19:04:54	Adria	SpottedHorse	Newport	97365	adriaspottedhorse89@gmail.com
691	2020-12-28 19:07:27	Judy	Baugh	Bandon	97411	judydooandleebee@aol.com
692	2020-12-28 19:11:39	Deanna	Graham	Hermiston	97838	grahamdeanna@hotmail.com
693	2020-12-28 19:12:41	CJ	WILLIAMS	Portland	97269	kanawaksooma@hotmail.com
694	2020-12-28 19:13:06	Mike	kaplan	Hood River	97031	mikekaplan1@me.com
695	2020-12-28 19:15:13	Sally	Mackey	Troutdale	97060	amosmcfam@aol.com
696	2020-12-28 19:25:35	Lori	Norman	Portland	97267	byteboop@yahoo.com
697	2020-12-28 19:28:23	Joe	Smith	Clatskanie	97016	clerlogs6300@hotmail.com
698	2020-12-28 19:28:27	Owen	Oliver	Grants Pass	97526	scoutol@msn.com
699	2020-12-28 19:33:44	Iris	Butler	Roseburg	97471	iris.butler6@gmail.com
700	2020-12-28 19:34:35	Brad	Reding	North Plains	97133	breding@stimsonlumber.com
701	2020-12-28 19:38:54	Michael	Sadler	Philomath	97370	msadler4458@gmail.com
702	2020-12-28 19:39:35	Mary	Daley	Roseburg	97470	nanamdaley@gmail.com
703	2020-12-28 19:46:13	Doraly	Perez	Portland	97214	nearlovesl12@icloud.com
704	2020-12-28 19:59:10	Barbara	Taylor	Cloverdale	97112	barbbt@centurylink.net
705	2020-12-28 20:04:27	Kris	Shelton	Grants Pass	97527	cruisinwheels@hotmail.com
706	2020-12-28 20:06:45	Patty	Gooderham	La Grande	97850	gooderhams@charter.net
707	2020-12-28 20:20:33	Rick	Rolfe	Creswell	97426	rickrolfe@yahoo.com
708	2020-12-28 20:28:57	Sandra	Dye	Cloverdale	97112	sandycarbaugh@yahoo.com
709	2020-12-28 20:30:02	John	Schmidt	Woodburn	97071	mschmidt@oregonsbest.com
710	2020-12-28 20:34:16	Jan	Thompson	Coos Bay	97420	jan@koontzmachine.com
711	2020-12-28 20:36:57	Demi	Bollinger	Mill City	97360	demdog78@al.com
712	2020-12-28 20:47:22	Margaret	Taylor	Oregon City	97045	matnw2@msn.com
713	2020-12-28 20:53:43	Jesn	kughn	Monroe	97456	jkughn@aol.com
714	2020-12-28 20:56:44	Jerry	Fast	Dallas	97338	lefast@aol.com

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715	2020-12-28 20:59:39	Alison	Kingsberry	Lebanon	97355	lebanon000@centurytel.net
716	2020-12-28 21:24:16	Bambi	Brusco	Rainier	97048	bruscobarn@gmail.com
717	2020-12-28 21:34:14	Stephanie	Snyder	Hillsboro	97123	aloaflowr@yahoo.com
718	2020-12-28 21:35:55	Gail	Pickle	Roseburg	97471	swtpickle@msn.com
719	2020-12-28 22:00:18	Rich	Pauxtis	Grants Pass	97527	rpauxtis@hotmail.com
720	2020-12-28 22:03:51	Kimberly	Moseley	Springfield	97478	kjmoseley6@yahoo.com
721	2020-12-28 22:11:11	Linda	Goalder	Reedsport	97467	lingoald@aol.com
722	2020-12-28 22:16:37	Michael	TerBush	North Plains	97133	terbrat2@gmail.com
723	2020-12-28 22:54:57	Roland	Buehler	Myrtle Creek	97457	robucop@hughes.net
724	2020-12-28 23:12:27	Wayne	Bruck	Wilsonville	97070	waynebruck@yahoo.com
725	2020-12-28 23:16:08	Yvonne	Pappagallo	Deadwood	97430	ypappy@yahoo.com
726	2020-12-28 23:17:24	ANTHONY	KEIM	St. Helens	97051	thekeimclan@yahoo.com
727	2020-12-28 23:18:24	Michael	McAllister	Salem	97306	mjmcalli@q.com
728	2020-12-28 23:25:35	David	SUCHANEK	Springfield	97478	duce478@yahoo.com
729	2020-12-28 23:33:41	Adam	Clayton	Riddle	97469	guage2326@hotmail.com
730	2020-12-29 00:07:24	Kelly	Kennedy	Damascus	97089	northwkennedys@comcast.net
731	2020-12-29 01:34:22	Craig	Abercrombie	St. Helens	97051	craigabercrombie14@gmail.com
732	2020-12-29 02:16:48	Ronald	Sperling	Coquille	97423	ronald9@aol.com
733	2020-12-29 02:20:00	Ann	Jenkins	Jefferson	97352	4757raj@gmail.com
734	2020-12-29 02:35:43	Linda	Hartig	Beaverton	97008	lbhartig@gmail.com
735	2020-12-29 02:42:27	Sandra	Waltz	White City	97503	sawsdown@yahoo.com
736	2020-12-29 02:55:23	Gregg	Garstka	Newberg	97132	gpg225@outlook.com
737	2020-12-29 03:14:36	Kay	King	Florence	97439	kay@rrking.net
738	2020-12-29 03:20:01	Bob	King	Florence	97439	rkjng@rrking.net
739	2020-12-29 03:43:51	Lori	Casto	Albany	97321	lori.1963@netzero.com
740	2020-12-29 03:55:56	Josie	Lilly	Astoria	97103	daslillyj@yahoo.com
741	2020-12-29 04:41:04	Robert	Nix	Tualatin	97062	nixrw@comcast.net
742	2020-12-29 06:17:16	Daniel	Radke	Portland	97220	danielradke@aol.com
743	2020-12-29 08:39:59	Steve	Scott	Camas Valley	97416	dsscott@wildblue.net
744	2020-12-29 10:55:50	Ashley	Bean	Salem	97317	mrsbean2008@yahoo.com
745	2020-12-29 12:52:22	Sharon	Barr	Newport	97366	mocha4me@peak.org
746	2020-12-29 14:06:35	Adrienne	Kuykendall	Roseburg	97471	adriennekuykendall@yahoo.com
747	2020-12-29 14:14:22	SHAWN	MADDOX	Roseburg	97470	shawnm4575@gmail.com
748	2020-12-29 14:17:48	David	price	Myrtle Point	97458	wolffeycat@hotmail.com

	A	B	C	D	E	F
749	2020-12-29 15:01:05	Allen	Sitton	Carlton	97111	allennsitton@gmail.com
750	2020-12-29 16:05:50	Linda	Barrett	Bonanza	97623	barrettlinda11@gmail.com
751	2020-12-29 16:13:25	Donald	Shinpaugh	Wilsonville	97070	teamshinpaugh@aol.com
752	2020-12-29 16:26:08	Curtis	Curtis	Grass Valley	97029	bruennscorp69@aol.com
753	2020-12-29 16:30:34	Mark	Shepherd	Alsea	97324	mrkalshep@gmail.com
754	2020-12-29 17:41:54	Don	Silbernagel	Sublimity	97385	dwdon@wvi.com
755	2020-12-29 17:58:22	Teri	Zugor	Portland	97217	twaves@comcast.net
756	2020-12-29 18:05:14	Imogene	McDonald	Coos Bay	97420	imomac2@aol.com
757	2020-12-29 18:08:49	willis	owen	Lyons	97358	riverguy@wvi.com
758	2020-12-29 20:11:09	Sheri	Lenhardt	Damascus	97089	slenhardt60@gmail.com
759	2020-12-29 20:13:11	les	collar	Lyons	97358	lesnmarie@wvi.com
760	2020-12-29 20:47:30	Vineeta	Lower	Seaside	97138	vineetalower@gmail.com
761	2020-12-29 21:05:09	Fred	Guldager	Monroe	97456	fguldager@mail.com
762	2020-12-29 21:26:36	Velma	Springer	La Pine	97739	velmaok@frontier.com
763	2020-12-29 21:42:32	Dee	Gulpan	Eugene	97402	alndeegulpan@yahoo.com
764	2020-12-29 23:47:29	Bruce	dennis	Silverton	97381	newstint@gmail.com
765	2020-12-30 03:05:06	Velva	Warden	Lyons	97358	vcwarden@gmail.com
766	2020-12-30 04:13:36	Colleen	Anderson	Albany	97322	cstarranderson@hotmail.com
767	2020-12-30 20:16:23	Jen	Hamaker	Springfield	97478	jenhamaker1@gmail.com
768	2021-01-01 05:46:28	Jen	Hamaker	Springfield	97478	jenhamaker1@gmail.com
769	2020-12-31 00:45:06	Arwen	McGilvra	Halsey	97348	thetechchef@gmail.com
770	2020-12-31 03:51:08	Pamela	Wadsworth	Redmond	97756	pjw01@msn.com
771	2021-01-01 08:41:00	John	Luoto	Tillamook	97141	johnluoto@hotmail.com
772	2021-01-02 22:51:43	Nancy	Heater	Lyons	97358	nbh1963.nh@gmail.com
773	2021-01-04 21:08:16	David	Burns	Lyons	97358	djbur1776@wvi.com
774	2021-01-04 23:14:29	Janice	Burns	Lyons	97358	janicejw14@yahoo.com
775	2021-01-05 08:55:23	Deborah	Butler	Silverton	97381	abiquamom@yahoo.com

TO: Oregon Board of Forestry
CC: Oregon Global Warming Commission
DATE: 3/23/21
RE: Written testimony on post-fire management
Agenda Item: No. 6
Santiam State Forest Restoration and Recovery

Dear Oregon Board of Forestry members,

Thank you for the opportunity to submit written testimony for the Board of Forestry (Board)'s March 3rd, 2021 meeting. We, the undersigned organizations, are participants in the Oregon Climate Action Plan (OCAP) coalition's forest policy sub-table, tasked with coordinating stakeholder advocacy around implementation of Governor Brown's Executive Order 20-04 (EO 20-04). Responsibly managing forests in the context of wildfire is directly tied to the directives highlighted in EO 20-04,[1] specifically to *"prioritize actions that reduce GHG emissions in a cost-effective manner,"* and *"prioritize actions that will help vulnerable populations and impacted communities adapt to climate change impacts."* Therefore, we are submitting written testimony in response to Agenda Item No. 2 — the Santiam State Forest restoration and recovery efforts.

The Oregon Department of Forestry's (ODF) heavy focus on post fire logging operations highlights the agency's revenue-driven approach to forest management over other values such as habitat, water quality, recreation, and climate. The Board's mandate, to "secure greatest permanent value," of state forest lands does not properly incorporate the need to address climate change — through reducing emissions from logging and through increasing the amount of carbon stored on the landscape.

The Santiam State Forest covers approximately 50,000 acres across Clackamas, Marion and Linn counties, and during the 2020 Santiam complex fire nearly a quarter of the state forest burned. ODF's hyper focus on post-fire logging in order to generate revenue from burned trees and rapid replanting in order to support future logging demonstrates the imbalance of the agency's priorities. Many of the areas targeted for post-fire logging include older forests (which store the most carbon), and stands that are designated as HCA's under the HCP. The inadequate decision making process for the original Santiam post-fire recovery plan cast aside considerations for carbon storage, climate change, and biodiversity — all of which should be key factors in forest management decisions. We are pleased that the Board and ODF are working to revise the original plans, with better attention to these key considerations — but the plan still falls far short of maximizing objectives, with an ongoing overemphasis on post-fire logging. We would like to

[1] EO 20-04. https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf

encourage the Board to go further, and reconsider the underlying policies and practices that led to such a poorly constructed original plan.

ODF, with guidance from the Board, must modernize its approach to both managing forests for wildfire risk, and restoring forests following a wildfire. It is the Board's responsibility to ensure that ODF uses its management authority in a manner that is ecologically appropriate, watershed-wise, and climate responsible, with consideration for not just short-term revenue, but the enduring values of these forestlands. The following two sections in this testimony outline key considerations and specific policy recommendations for 1) post-fire, ecologically appropriate restoration, and 2) protecting communities from the threat of wildfire.

Ecologically appropriate post-fire restoration

Logging in general is a far more significant source of greenhouse gas emissions than wildfire, particularly on the west-side of Cascades. And while wildfire does cause carbon emissions, only 5-10 percent of stored carbon is emitted compared to over 50 percent emitted by logging.[2] In addition, fire is a natural process that supports a diversity of ecosystems across a landscape. Leaving burned trees on the landscape allows the carbon they contain to remain stored for decades, and released slowly through natural decomposition, often transferring the remaining carbon to the soil.

If partially burned trees are harvested for timber, very little of the stored carbon will be contained in long-lived wood products. Approximately half of harvested carbon is emitted to the atmosphere soon after logging.[3] In Oregon, 65 percent of wood carbon harvested since 1900 has returned to the atmosphere, 16 percent is in landfills, and only 19 percent remains in long-term products.[4] And because much of a forest's carbon is stored in the soil (nearly 50 percent on average in Oregon's forests), soil disturbance from logging operations can release additional carbon that is challenging to re-sequester.[5]

Allowing forests to recover naturally following a wildfire also ensures complex forest structure with diverse vegetation, which in turn supports increased biodiversity. Removing burned trees and snags and replanting the forest with monoculture Douglas-fir can prevent development of

[2] Law, B.E., Waring, R. 2015. Carbon implications of current and future effects of drought, fire and management on Pacific Northwest forests, Forest Ecology and Management. https://doi.org/10.1016/j.foreco.2014.11.023

[3] Harmon, M.E. 2019. Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. Environ. Res. Lett. 14 065008. https://iopscience.iop.org/article/10.1088/1748-9326/ab1e95

[4] Hudiburg, T.W., Law, B.E., Moomaw, W.R., Harmon, M.E. and Stenzel, J.E. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. Environ. Res. Lett. 14 095005. https://iopscience.iop.org/article/10.1088/1748-9326/ab28bb

[5] Christensen, G.A., et al. 2019. Oregon Forest Ecosystem Carbon Inventory: 2001-2016. https://www.oregon.gov/ODF/ForestBenefits/Documents/Forest%20Carbon%20Study/OR-Forest-Ecosystem-Carbon-2001-2016-Report-FINAL.pdf

this complex structure, harming fish and wildlife.[6] Further, if burned forests are allowed to keep their structural complexity, according to the Bureau of Land Management, they can develop old growth forest characteristics twice as fast[7] as dense, replanted forests, and old growth forests store far more carbon than young growth.

Burned landscapes are already at increased risk of sediment runoff, flooding, and landslides, but that risk is dramatically amplified by post-fire logging which disturbs the soil and removes standing trees that would otherwise help anchor soil until new vegetation regenerates. This can lead to even more sediment runoff which in turn can clog waterways, degrade fish habitat, and impact drinking water for local communities. Widespread planting of young, single aged, single species trees after large fires not only creates conditions that are conducive to future large fires,[8] but also leads to a significant increase in evaporative water demand which depletes summer streamflow and degrades fish habitat.[9] Overall, post-wildfire logging can hinder forest regeneration, does not reduce future fuel loads,[10] and can even increase future fire risk.[11]

However, while post-fire logging holds little ecological value, other post-fire restoration practices can help forests recover in an ecologically appropriate manner. Especially in dry forests, climate change is impacting fire regimes and leading to bigger fires and longer fire seasons. Combined with other ecological stressors, such as drought and invasive vegetation, and human caused stressors, such as fire exclusion, past timber harvest practices, livestock grazing, and water diversion, the ecological integrity of some forests can be undermined. Because resources for post-fire, ecologically appropriate restoration are limited, it is essential that managers use the best available science to determine when and where post fire recovery efforts are actually needed. For example, West of the Cascades there is little evidence that climate change is impacting the natural, infrequent fire regimes of our moist temperate rainforests.

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[6] Swanson, M.E., Franklin, J.F., Beschta, R.L., et al. 2010. The forgotten stage of forest succession: early-successional ecosystems on forest sites. Front Ecol Environ 2010; doi:10.1890/090157 https://www.fs.fed.us/pnw/pubs/journals/pnw_2010_swanson001.pdf and Donato, D.C., Campbell J.L, and Franklin J.F., 2012. FORUM Multiple successional pathways and precocity in forest development: can some forests be born complex? Journal of Vegetation Science 23 (2012) 576–584 http://people.forestry.oregonstate.edu/john-campbell/sites/people.forestry.oregonstate.edu.john-campbell/files/Donato_2012_JVS.pdf

[7] Bureau of Land Management 2008. Western Oregon Plan Revision Draft Environmental Impact Statement. https://www.blm.gov/or/plans/wopr/files/Science_Team_Review_DEIS.pdf

[8] Zald, H.S.J,. Dunn, C.J., 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications. Online Version of Record before inclusion in an issue. 26 https://phys.org/news/2018-04-high-wildfire-severity-young-plantation.html and Thompson, J.R, Spies, T.A., and Ganio L.M., 2007. Reburn severity in managed and unmanaged vegetation in a large wildfire. Proceedings of the National Academy of Sciences. PNAS. http://www.fs.fed.us/pnw/pubs/journals/pnw_2007_thompson001.pdf

[9] Perry, T. D., and Jones, J. A. 2016. Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA. Ecohydrology http://onlinelibrary.wiley.com/doi/10.1002/eco.1790/full

[10] Leverkus, A.B. et al 2020. Salvage logging effects on regulating ecosystem services and fuel loads. Frontiers in Ecology and the Environment. https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/fee.2219

[11] Donato, D. et al. 2006. Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk. Science 311(5759):352 https://www.researchgate.net/publication/7371922_Post-Wildfire_Logging_Hinders_Regeneration_and_Increases_Fire_Risk

Recommendations for post-fire recovery

1. Encourage fire-affected local communities to rebuild in a responsible, fire-wise manner that improves community safety and resilience to future wildfires.
2. Managers should focus efforts on the restoration or maintenance of essential ecosystem services, such as:
    a. Carbon storage and sequestration (e.g., promoting old growth forest characteristics),
    b. Water quality and quantity (e.g., preventing soil erosion and avoiding tree plantations),
    c. Soil productivity (e.g., ensure burned vegetation remains on the landscape), and
    d. Biodiversity (e.g., preserving habitat for at risk wildlife).
3. Focus on stabilizing watersheds by mitigating damage caused by past fire suppression (such as fire lines), limiting erosion using native fibers and native plants, and treating weeds. Other smart adaptations to deal with climate-driven shifts in precipitation and hydrology should include installing bigger culverts and decommissioning roads that increase the risk of erosion, mudslides, and peak stream flows.
4. Focus danger tree felling on imminent hazards located within 150 feet of high use areas, such as developed sites, parking lots, and paved roads. Do not remove felled danger trees from reserves, including the full extent of riparian reserves. If danger trees are removed, use them for restoration of streams and old clearcuts that lack large wood.
5. Retain all large wood to mitigate the shortage of snag habitat and for long-term ecological benefits and carbon storage. Fires create an apparent abundance of snags, but that is misleading because snags are ephemeral; the abundance of snags is short-lived and hides the fact that after those snags fall down, there will be a long-term shortage of snags that lasts until large trees regrow. Post-fire logging will exacerbate the expected shortage of snags.

Avoid the following post-fire practices:

1. Avoid post-fire logging. Post-fire logging can have significant negative impacts on water quality, fish and wildlife habitat, and forest successional trajectories. If post-fire logging is deemed necessary, managers should focus on removing trees that pose a threat to infrastructure, such as power lines and roads.
2. Avoid removal of live, green trees. Surviving trees can help to rebuild the ecosystem and can serve as a legacy structure and a recruitment pool for future large trees and snags.
3. Avoid road construction, including temporary roads, as they have long-term impacts on watersheds, soil, and vegetation, can introduce invasive weeds, and fragment habitat. Many watersheds are already damaged by hundreds of miles of hastily constructed firelines.

4. Avoid dense, monoculture replanting. Such practices can create hazardous fuel conditions and truncate development of a desired complex early seral forest. If replanting is deemed necessary, replant diverse species in patches, at low density, far from existing seed sources. In drought impacted areas of the state, selecting more drought-tolerant species to plant may help forests recover.

Protecting communities from the threat of wildfire

Most large fires are driven by extreme weather conditions – high temperatures, low fuel moisture, high winds and drought – and so our rapidly changing climate, coupled with a massive expansion of homes into fire-prone areas, will increasingly influence the extent and impacts of fire in the West. To address these issues, studies suggest focusing on treatments in the home ignition zone is a more effective strategy than logging operations in more distant forested regions.[12] Factors such as the type of materials homes and buildings are made of and the design and maintenance of our infrastructure are huge factors in determining residential losses,[13] and addressing these factors is the best use of limited funding.

While some small-diameter tree thinning can reduce fire intensity when coupled with burning of slash debris under appropriate conditions,[14] recent evidence shows intensive forest management characterized by young trees and homogenized fuels burn at higher severity.[15] Reduced forest protections and increased logging tend to make wildland fires burn *more* intensely.[16] Studies have clearly demonstrated that increased wildland logging is *not* an effective strategy for reducing a community's wildfire risk. The extremely low probability (less than 1 percent)[17] of thinned sites encountering a fire especially limits the effectiveness of such activities to forested areas near homes.

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[12] Calkin, D.E., et al. 2014. How risk management can prevent future wildfire disasters in the wildland-urban interface. Proc. Nat. Acad. Sci. 111: 746-751. https://www.pnas.org/content/111/2/746

[13] Calkin, D.E., et al. 2014. How risk management can prevent future wildfire disasters in the wildland-urban interface. Proc. Nat. Acad. Sci. 111: 746-751. https://www.pnas.org/content/111/2/746

[14] Perry, D.A., et al. 2004. Forest structure and fire susceptibility in volcanic landscapes of the eastern High Cascades, Oregon. Conservation Biology 18: 913-926. http://www7.nau.edu/mpcer/direnet/publications/publications_p/files/Perry_et_al_2004.pdf and Strom, B.A., and P.Z. Fulé. 2007. Pre-wildfire fuel treatments affect long-term ponderosa pine forest dynamics. International Journal of Wildland Fire 6: 128-138. https://www.fs.fed.us/rm/pubs_other/rmrs_2007_strom_b001.pdf

[15] Zald, H.S.J., and C.J. Dunn. 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications 28:1068-1080. doi: 10.1002/eap.1710. https://pubmed.ncbi.nlm.nih.gov/29698575/

[16] Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? Ecosphere 7: article e01492. https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.1492

[17] Schoennagel, T., et al. 2017. Adapt to more wildfire in western North American forests as climate changes. Proceedings of the National Academy of Sciences of the USA 114: 4582–4590. https://www.pnas.org/content/114/18/4582

Further, to make thinning operations economically attractive to logging companies, commercial logging of larger, more fire-resistant trees often occurs across large areas. This is an ecologically inappropriate strategy for thinning, as it can severely degrade the resilience of ecosystems already stressed by the impacts of climate change — such as heat waves and more frequent drought. The shade and healthy root system provided by large mature trees helps retain moisture in the soil, and keep rivers and streams cool as fish also contend with more severe impacts.

Mechanical thinning also results in a substantial net loss of forest carbon storage, and a net increase in carbon emissions that almost always exceed those of wildfire emissions.[18] As an example, logging in U.S. forests emits 10 times more carbon than fire and native insects combined.[19] And, unlike logging, fire cycles nutrients and helps increase new forest growth. Thinning across broad landscapes is costly, by some estimates $2,000 per acre, and also causes collateral damage to the ecosystem from increased road building, creating pathways for the introduction of invasive species and more human entry and more ignitions.[20]

ODF should align its actions with sound strategies for wildfire risk reduction

1. Increase emergency planning and preparedness for rural communities located in and near forested areas. Well established evacuation routes, designated "safe" areas where people can shelter in place, and established channels of communication where residents can go for trusted information can save lives and property.
    a. Wildfire information should be made available in Spanish and other Indigenous Latin American languages to ensure that our most vulnerable populations, including migrant and Latinx communities living and working in rural areas, are prepared for fire emergencies. ODF could coordinate with and provide financial and technical support to community-based organizations already serving Latinx populations to disseminate information and increase preparedness.[21]
2. Increase fire-wise home hardening and retrofitting (i.e., application of construction design and materials that are fire resistant). Hardening homes to fire can be > 95% effective at preventing structure loss. Wind-driven fire events can ignite homes from

[18] Hudiburg, T.W., et al. 2013. Interactive effects of environmental change and management strategies on regional forest carbon emissions. Environmental Science and Technology 47: 13132-13140. https://europepmc.org/article/med/24138534 and Campbell, J.L., M.E. Harmon, and S.R. Mitchell. 2012. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? Frontiers in Ecology and Environment 10: 83-90. https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1890/110057

[19] Harris, N.L., et al. 2016. Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance Management 11: Article 24. https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-016-0066-5

[20] Balch et al 2017. Human-started wildfires expand the fire niche across the United States. National Academy of Sciences. https://doi.org/10.1073/pnas.1617394114

[21] Alai Reyes Santos. Oct. 22, 2020. Fires shed light on marginalized groups. Available at https://www.registerguard.com/story/opinion/columns/2020/10/22/fires-shed-light-marginalized-groups/5999702002/.

flying embers miles ahead of the fire front, and there are examples of home burning even though the actual fire was never in direct contact with the buildings.

3. Reduce fuels in the home ignition zone. Reducing fuels in close proximity to houses (within 200 feet of the home) can help protect property from damage in the event of a fire.
4. Limit new development in high-risk areas. It is critical that land use planners account for the increased risk of wildfire. Building homes in fire adapted ecosystems carries risk, and developers and landowners need to be made aware of this risk.
5. Ensure disadvantaged communities have equal access to resources. It is the most vulnerable populations that carry the highest costs when a fire impacts a community. Investing in air filtration systems for disadvantaged communities is an affordable and effective way to ensure vulnerable people have a safe space to shelter from smoke inhalation and the associated health impacts.
6. Use ecological fire management to restore natural fire regimes in appropriate areas. In the West, the health of some forest ecosystems has declined as a result of past fire suppression. Restoring natural fire regimes, through a place-specific combination of ecologically appropriate thinning and prescribed fire, should be a priority for land managers as they seek to restore ecological health.
7. Avoid or minimize actions that increase fire hazard such as clearcutting and dense monoculture replanting. Encourage more thinning and longer rotations on plantations as these forest management strategies will reduce the proportional area of forest in the most vulnerable dense, young fuel conditions.

We hope that the Board and ODF will strive to implement near-term policy solutions that position Oregon as a world leader in climate-smart forest management and carbon sequestration and storage — including climate-smart management of our forests in the context of wildfire. In order to confront the threat of climate change, we must ensure the scope and scale of our solutions match the magnitude of the challenge.

Sincerely,

Lauren Anderson
Forest Climate Policy Coordinator
Oregon Wild

Felice Kelly, Ph.D.
Co-lead, Forest Defense Team
350PDX

Joseph Vaile
Climate Program Director
KS Wild

Grace Brahler
Oregon Climate Action Plan & Policy Manager
Beyond Toxics

Catherine Thomasson, MD
Chair Environmental Caucus
Democratic Party of Oregon

Roseburg

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March 2nd, 2021

To the Oregon Board of Forestry:

Thank you Board for the opportunity to provide comments regarding the ODF North Cascades Draft Implementation Plan Revision. My name is Tiffany Roddy and I am the Government Affairs Manager for Roseburg Forest Products. I am a professional Forester that has practiced silviculture in Oregon for over a decade; I've been involved in fighting many wildfires throughout my career and have also managed their rehabilitation through salvage and reforestation.

Roseburg is no stranger to large fires: we were severely impacted by the Archie Creek fire last year, the Milepost 97 Fire in 2019, the Horse Prairie Fire in 2017, the Stouts Creek Fire in 2015, and the Douglas Complex in 2013, just to name a few. The combined impact of these fires on our ownership is just shy of 48,000 acres. Each time, we salvaged the burned merchantable timber and replanted everything that had burned, whether it was logged or not. Harvest of these standing dead trees and reforestation is vital for quick stabilization of soil, protection of clean water, and restoration of vital habitat for fish and wildlife for decades to come. Reforestation also re-starts the clock on carbon sequestration.

Lack of fire salvage on public lands does not solely impact those lands, as leaving standing dead trees and brush serves as a source of dry fuel should another fire happen. We all know that fire does not respect property lines. While examples of past large fires re-burning are easy to cite, we would be remiss to not bring to light our own experience with a large fire that has *not* re-burned – perhaps the *only* large fire in Oregon that has not re-burned – the Oxbow Fire of 1966.

Most of Roseburg's lands in western Oregon are "checkerboarded" with public lands, and after the 42,000+ acre Oxbow Fire had been stopped, both sides of the property lines, public and private alike, where promptly salvaged and reforested. These management activities reduced the remaining fuels and quickly re-established forests, which has resulted in no major re-burn of this area. All fires within the original burn area have been extinguished at a small size and without worry of fuel loading or hazards from standing dead timber. It is perilous for a landowner to set themselves up for an uncontrollable fire along with the safety hazards that come from disregarding these well-proven management practices.

Again, thank you for the opportunity to provide comments on this Implementation Plan. We urge the Board to prioritize management and salvage on as many acres as possible to both accelerate wildfire rehabilitation and prevent a large re-burn from happening again.

Respectfully submitted,

Tiffany Roddy
Manager of Government Affairs
Roseburg Forest Products

Oregon Board of Forestry
2600 State Street
Salem, Oregon 97310

March 10, 2021

State Forester Daugherty and Members of the Board:

The Santiam State Forest Revised Implementation Plan makes it obvious that in the hands of the State Forester and State Forest Division leadership conservation commitments aren't worth the paper they are written on.

Areas designated for DFC: Layered/Complex/Older are being subjected to regenerative harvest rather than allowed to continue to develop into complex structured stands. We are told that these stands no longer fit the definition of Layered/Complex. The intention of this designation is to provide a certain degree of habitat richness and diversity. The revised plan ignores the spirit of the designation and emphasizes the letter of the law: sterile metrics like tree diameter, number of limbs, canopy closure, etc. These actions are the result of the maximum staff discretion currently allowed under the FMP. Regenerative harvest is clearcutting regardless of minor changes to the green-trees definition or the number of snags left in the stand. Regenerative harvests that use a single species for replanting is not reforestation; it is monoculture agriculture. The Department has indicated that while aerial reseeding will include a mix of species where it will be used, all other replanting will be done with Douglas fir seedlings. According to staff this is not ODF's fault – nurseries just do not grow anything else. Obviously, this is because the department and timber industry do not buy anything else.

We are told to look not at these designated areas but at the landscape as a whole and to see that these regeneration harvests are but a tiny fraction of the disturbed areas. We do look the whole and see that even-aged, monoculture plantations dominate the Oregon landscape. Operations under the revised implementation plan for the Santiam State Forest will replace more complex layered stands with even-age monoculture plantations. We take no solace in being told this will only happened to something less than 3% of the burned acreage. Any reduction of forest structure that more closely matches a naturally occurring forest, a rarity on state lands, is still a reduction.

We are told that fuel reduction is critical now to make sure fires of this nature never happen again. Fuel reduction is important to the future but these operations must from this point forward, focus on protecting lives, communities, and critical infrastructure. Obviously this has not been the case in the past and folks in the Santiam Canyon paid an immense cost. Significant long-term drought has become the norm and east wind events will recur with greater frequency. Failure to plan accordingly is negligence.

The Santiam State Forest Revised Implementation plan is just the latest demonstration that to Oregon Department of Forestry, strategic plans and goals for state forests are not worth the time, money, and effort put into them. Forest reserve designations that make claims of habitat conservation, species protection, or biodiversity are nothing more than pencil lines on a map - easily erased. Rapidly shrinking goals of 60%, then 30-50%, and now 17-20% complex forests demonstrate a track record of degrading standards. The Department has failed to demonstrate they place any value on water quality, threatened and endangered species, biodiversity, or forest resilience in the face of a rapidly changing climate. Lack of leadership is at the core of this failure.

Respectfully,

Joseph Youren
Salem Audubon Society

Salem Audubon Society
338 Hawthorne Ave NE
Salem, OR 97301

February 26, 2021

State Forester Peter Daugherty;
Oregon Board of Forestry
2600 State St
Salem, OR 97310

Mr. Daugherty and Members of the Board:

We would like to express our concern with the following actions taken by the Oregon Department of Forestry:

1. Board members have asked that written testimony be provided to them 72 hours prior to the meeting so they might be able to read and think about information put before them. We feel this a perfectly reasonable request and appreciate Board members who read and do their homework. We find it unacceptable however when the agenda for a Board meeting to be held on a Wednesday is not posted until the Friday before and then only after specific requests were made to do so.
2. Denying public testimony on issues of great public interest. Progress or the lack thereof in addressing our state's failure to meet water quality standards is very definitely a public issue, especially for communities like Salem where domestic water supplies have been cut off or threatened. Denying public testimony on the revised implementation plan for the Santiam State Forest is also inappropriate and deals serious damage to the Department's recent efforts to improve communication, increase transparency, and build trust.
3. The decision to conduct salvage logging operations in portions of the Santiam State Forest that have been designated either as Older Forest Reserve HCAs under the proposed HCP or as DFC Complex-layered under the current management plan is biologically indefensible. Restoration that turns these

areas into even-age, single species plantations is just wrong. These areas are intended to provide a certain type and quality of habitat. Complex layered structure is very hard to find on state lands and any diminution is unacceptable. Even-age plantation structure is vastly over-represented. We do not need more. The current forest management plan allows these operations but does not require them. Volume first decision-making is not consistent with Greatest Permanent Value.

4. It has already been pointed out that refusing to even consider effects on the carbon economy when developing the plan is short-sighted at best and at worst demonstrates the Department's willingness to ignore Board direction and the Governor's executive order. Concern for climate change and carbon management must be at the heart of decision making for our forests. It is time for the Department to step into this century and become proficient in ecological forest management. Business-as-usual forestry must end.

Respectfully,

Joseph Youren
Conservation Committee
Salem Audubon Society

Cc: Governor Kate Brown

February 17, 2021

Dear Chair Imeson and Board Members,

I am writing this letter on behalf of the Oregon Department of Forestry's State Forests Advisory Committee (SFAC). The SFAC is comprised of citizens and representatives of timber, environmental and recreation groups, and tribes. The purpose of the SFAC is to provide an open forum to discuss issues, opportunities and concerns, and offer advice and guidance to ODF on the implementation of the Northwest Oregon State Forests Management Plan.

On January 12, ODF staff presented the proposed revisions to the North Cascade District Implementation Plan. The committee felt it was appropriate to provide a summary of the discussion that took place given the importance of this revision. The fires that ravaged the district not only changed the landscape but the need to look at management during the recovery period. The committee was unanimous in its support for ODF staff and the speed in which they are working to address restoration of this forest post-wildfire.

The effects of this fire reach across multiple ownerships and ecosystems. Collaboration between state, federal, industrial, and private landowners will be critical in restoration efforts. ODF is balancing these considerations into its revision and general planning processes. There are a number of tools that are available that can assist with restoration, economic benefits, and public use. Ensuring that the State forest is safe for users to venture back in is paramount and a primary responsibility of ODF. ODF is targeting its salvage logging focused on roads, trails, and recreation facilities while at the same time looking at the ecosystem functions. ODF is also proposing an aggressive reforestation plan using a diverse array of species that will not only improve diversity but also resiliency within the forest. This resiliency will become increasingly important as precipitation patterns shift, population growth continues and expanding land uses impact resource lands.

Salvage logging was an area that raised the majority of concerns from both an ecosystem perspective, including multiple species' needs, and an economic perspective. Understanding that salvage logging would apply to approximately 20% of the burnt landscape with a focus around, although not limited to, infrastructure, particularly access, is important. Another area of concern was the strong desire to ensure habitat diversity. Managing for multiple species is a critical consideration in the re-seeding of the landscape.

The committee also recognized that this situation presents an opportunity for outreach and education and as a part of that effort, involving the public in on-the-ground work reminiscent of the Tillamook Burn. As we move forward, transparency and public engagement will be critical to ensure the long-term success of the restoration efforts.

We understand this is a complex situation and that the Board has to balance multiple perspectives and interests. I believe the SFAC is a body that is comprised of many of those perspectives and would encourage you to consider the committee as sounding board and

resource for this and other issues surrounding the implementation of managing our state forests.

Thank you for your consideration,

Lisa M Phipps
SFAC Chair

From:	Laura Wilkeson
To:	ODF_DL_Board of Forestry
Cc:	DAUGHERTY Peter * ODF; DENT Liz F * ODF
Subject:	BOF Meeting Testimony - Santiam Restoration
Date:	Wednesday, March 03, 2021 7:54:27 AM
Attachments:	image001.png Hampton Lumber comments - North Cascade Draft IP.pdf

Dear Board of Forestry Members:

Thank you for the opportunity to provide testimony on the Santiam State Forest Restoration and Recovery. Hampton Lumber submitted the attached comments on the draft North Cascade District Implementation Plan Major Revision (IP) during the public comment period in December 2020. These comments still apply to the final IP that was approved in February. I would like to reemphasize the following comments:

- The identified post-fire harvest acres only amount to 18 percent of burned acres (roughly 3,000 acres of the 16,600 total acres burned). Of the remainder, it is highly unlikely that 82% of the burned acreage would be inoperable or unmerchantable, meaning the Oregon Department of Forestry (ODF) is very likely electing to forego restoration of a meaningful acreage of the State Forest land base and a volume of wood harvested that would generate revenue for the ODF, counties and supply the milling capacity in the region.
- Post-fire harvest sales that have been offered and awarded so far have gone for higher market prices than ODF minimums. A substantial portion of that revenue goes to the communities most impacted by the fires and to the restoration efforts that will go on for decades. ODF should offer as many post-fire sales as possible in order to accelerate restoration and provide revenue where it is most needed.
- As noted in the final IP, some trees will continue to die due to stress from the fire. These trees need to be identified and included in post-fire harvests before they lose their value. Waiting until FY22 or FY23 to harvest these trees assuredly risks losing merchantable value.
- The final IP says wood recruitment and stream buffers will exceed Forest Management Plan (FMP) Riparian Management Area (RMA) requirements. There is no obvious reason FMP RMA rules would be insufficient, and the public deserves a better explanation why ODF is planning to create larger buffers than is required. Leaving more dead trees standing could pose safety concerns to those working in the forest.
- Several sections of the final IP note the need to vacate or block roads. The Labor Day fires last year are an example of exactly why we shouldn't be reducing the road systems within the forest.
- As evidenced by other burns on federal lands in the vicinity of the Santiam State Forest, failure to restore burned acreage condemns the land to decades if not centuries of lost productivity and environmental degradation. We strongly encourage ODF to take a more proactive and aggressive role in restoring the Santiam State Forest.

This historic fire and wind event needs a historic response, much like the Tillamook Burn and reforestation efforts in the 20th century. We encourage ODF to keep the momentum moving forward and not take options off the table.

Thank you.

Sincerely,
Laura Wilkeson

Laura Wilkeson
State Forest Policy Director
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December 23, 2020

Via Email: odf.sfcomments@oregon.gov

Oregon Department of Forestry
2600 State St.
Salem, OR 97310

RE: North Cascade District Draft Implementation Plan Major Revision

Dear State Forester Daugherty,

Thank you for the opportunity to provide comments on the draft North Cascade District Draft Implementation Plan Major Revision (IP). This draft is a good start to what will be a long process to restore the Santiam State Forest and the communities that surround it.

There is no doubt that wildfires are increasing in size, frequency, and severity every year, but the Labor Day fires that raged across the western side of Oregon were intensified by a historic windstorm, creating a once-in-a-generation event. The resources, structures, and lives lost to these fires will weigh heavy on Oregonians for years to come.

The Oregon Department of Forestry (ODF) should act quickly to offer restoration timber sales and continue to survey the affected acres to identify additional treatment and harvest opportunities. Active management in the affected areas will accelerate landscape and site specific restoration work including reforestation, development of aquatic and terrestrial habitat, and water quality protection. Timber salvage can assist in the hastening of complex mature conifer forests on burnt landscapes[1]. This work is vital to the overall health of the Santiam State Forest and surrounding communities. Industry can be helpful in these efforts, but will need more detail on the specific acres identified within the fire perimeter and the prescribed treatments described in the draft IP.

Maximizing restoration of the forest must be a priority and we encourage ODF to offer as many restoration timber sales and as much merchantable volume as possible. Dead and dying trees on the Santiam State Forest that are not harvested prior to the onset of degradation will result in immediate and future financial loss to ODF and local communities. We understand there is a concern that markets may saturate in the near term due to an influx of salvage harvesting from private and other public land. While this may be a consideration, the markets are currently performing well and have adaptive capacity to support restoration of the Santiam State Forest.

[1] Sessions, J, Bettinger P, Buckman R, Newton M, Hamann J. Hastening the return of complex forests following fire; the consequences of delay. *Journal of Forestry.* April/May 2004, pp 38-45.

The current Annual Operation Plan target of 21.2 MMBF for the North Cascade District will be exceeded to accommodate the harvest resulting from necessary restoration work. The corresponding increase in revenue will provide financial resources for restoration work within the fire perimeter, as well as standard treatments in green stands. Post fire harvesting can significantly reduce future surface woody fuel levels in forests regenerating following wildfires[2]. The immediate focus will be on the burned areas, however ODF should continue to manage green stands in the forest to mitigate and reduce future fire risk. This increased harvest level for the North Cascade District also should not impact harvest levels in other districts.

We hope that you will consider the following questions, comments, and concerns as you move forward in the process.

Harvest

ODF should provide maps that specifically show the high severity, low severity, and unburned areas within the fire perimeter. These maps should include an overlay of riparian management areas (RMAs) within each affected area. ODF reported early estimates of approximately 275 MMBF burned within the fire perimeter. A table should be included detailing the Stand Level Inventory acres and merchantable volume in five-year age classes, in each of the high and low severity, and unburned areas within the perimeter.

Active forest management is essential for recovery efforts. ODF should prioritize management on as many acres as possible. Table 3 outlines the prescriptions for 14,000 acres of burn, but additional details are needed to better understand these prescriptions. Specifically,

- 3,600 acres are identified as stands aged 0-30 years that were completely lost to the fires. Do these acres overlay with the other stands in the same age category?

- 1,500 acres of 18-40 year old stands have been identified as in need of treatment, but only calls for non-commercial tree removal. The older stands in that broad age range will need treatment, and likely also have a merchantable value to produce additional revenue. These acres should be included in harvest proposals.

- 5,400 acres have been identified as not warranted for management for a myriad of reasons from operability to low value. This is a sizable portion of the burned acres and should be included in reforestation plans. We'd appreciate more detail on these acres and they should be included in the maps as requested.

Table 6 identifies 0-1,200 acres for partial cut, but no other details are provided. Can you explain what this means and where this prescription will be applied?

[2] Peterson, David W, Dodson, Erich K, Harrod, Richy J. Post-fire logging reduces surface woody fuels up to four decades following wildfire. *Forest Ecology and Management.* 338 (2015) 84-91.

Habitat

Harvesting dead standing trees and replanting native tree seedlings is vital to stabilize soils and banks along streams, promote clean water, and restore vital fish and wildlife habitat for generations to come. Studies have shown that sediment yields were lower on areas that were salvaged and that post-fire management resulted in lower rates of erosion and sediment delivery[3].

There are 174 miles of streams identified within the fire perimeter, and 101 miles of those streams are within the high burn severity acres. ODF plans to require RMA buffers to all harvest operations. If a majority of streams are within high severity acres, how will leaving large buffers of dead and decaying trees help to restore streambeds, aquatic and terrestrial habitat, and water quality? Shouldn't ODF actively manage those areas to accelerate restoration and improve water quality conditions?

The draft IP states ODF will design and implement a management plan consistent with the draft Western Oregon Habitat Conservation Plan (HCP) as an objective to restore the forest in the context of the Greatest Permanent Value rule. However, the HCP is still in draft form and has not been submitted to the federal agencies who will be reviewing the plan. We continue to encourage ODF to consider alternative management prescriptions that would support an HCP, as the Board of Forestry (BOF) anticipated when they voted to direct ODF staff to move forward on the current draft. In the meantime, how can ODF be applying aspects of a draft HCP that has not been finalized and adopted by the BOF and federal agencies?

Safety

Hazardous trees along roads create safety concerns for crews working on harvest and restoration projects and the public visiting the forest. Seventy-nine miles of roads have been identified as having hazardous tress that need to be removed. Are these trees included in the prescriptions identified in Table 3? How far from the road will hazardous trees be removed?

Harvesting standing dead trees will create a safer and more vibrant forest for the protection and benefit of communities. The draft IP states that harvest prescriptions near or within recreation areas will focus on providing for safety, but also maintain or enhance legacy structure retention where possible. This seems contradictory and we would expect ODF to provide specifics of how to achieve this goal within each harvest sale.

Monitoring and Adaptive Management

There are a variety of monitory activities outlined in the draft IP. While it is beneficial to understand how the forest is responding to post-fire treatments, we ask that findings and research be made available to the public and that any changes in management be subject to a public process.

Again, we think this draft is a good first step in identifying the work needed to restore the Santiam State Forest land that was impacted by the historic Labor Day fires. Harvesting standing dead trees

[3]Cole RP, Bladon, KD, Wagenbrenner, JW, Coe Drew B.R. Hillslope sediment production after wildfire and post-fire forest management in northern California. *Hydrological Processes.* 2020;1-18

and promptly reforesting these lands will help create jobs in the short term that will aid the recovery in local communities while helping to restore the forest in the short and long-term.

We ask that ODF consider all opportunities to be flexible and adapt current business practices to work with industry to maximize achievement of the draft IP goals. This flexibility should include extensions for existing timber sales held by purchasers. Allowing flexibility will contribute to overall financial viability and allow industry to support restoration work. We welcome the opportunity to work directly with ODF staff to identify stands that can be treated over the next several months to accelerate restoration to the forests and communities in the Santiam Canyon.

Sincerely,

Laura Wilkeson
State Forest Policy Director
Hampton Lumber

Natural and Working Lands Emissions Reduction and Sequestration Goal Setting Update

Presentation to Board of Forestry Meeting, 3.3.2021 by Catherine Macdonald, Chair OGWC

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Oregon Global Warming Commission

Steps to Developing a N&WL Proposal

1. Engage stakeholders and technical experts on natural and working lands emissions and sequestration.
2. Identify existing land sector inventory data and priority inventory improvements.
3. Establish the methods for tracking emissions and sequestration from the land sector.
4. Develop a baseline and a Business-as-Usual projection.
5. Identify potential investments, programs and policies that could be advanced to reduce emissions and increase sequestration on Natural and Working Lands.
6. Develop proposed goals and a process for including Natural and Working Lands in Oregon's climate mitigation plan.

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Activities to Date

- Briefed State and Tribal Natural Resource Managers
- Briefed OWEB, Board of Forestry, and the Board of Agriculture
- Created a Webpage to Host Information on our Natural and Working Lands Efforts
- Convened Technical Advisory Groups on Blue Carbon, Forests Carbon and Agricultural Carbon
- Hosted a Questionnaire for Landowners, Technical Assistance Providers, Landowner Associations and Conservation Organizations
- Posted a Second Broader Questionnaire for Ongoing Input from Stakeholders

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Oregon Global Warming Commission

Planned Activities

- Host Focus Groups to Follow up on Stakeholder Input
- Gather Recommendations Regarding Improvements to Inventory data
- Evaluate How Other States have Approached their Land Sector Inventories and Goal Setting
- Synthesize Information from Agencies and Stakeholders to Inform the Investment, Program, Policy Section of the Report.
- Develop a Baseline and a Business-as-Usual projection.
- Draft the Recommendations and Finalize the report

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Oregon Global Warming Commission

Commission Meeting Dates and Deliverables

January 29th	Hear Preliminary Survey Results and Review the Current Status of Land Sector Inventory Data
March 5th	Discuss Decisions the Commission will Need to Make to Establish and Manage a Natural and Working Lands Goal
April 16th	Hear from Experts on the Potential of the Land Sector in Oregon, and an Update on Outreach to Key Stakeholders
May 7th	Discuss Draft Recommendations
June 4th	Finalize the Proposal and Recommendations

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Characteristics of Land Sector Emissions

- Carbon fluxes from natural and working lands can be affected by both natural processes as well as land use and management changes.

- The national land sector inventory has a much higher degree of uncertainty (+34% to -26 percent) than the other combined sectors (-2 percent to +5 percent) at the 95 percent confidence interval.

- In addition, the land sector sink varies year to year (-10 to + 9) more than emissions from the other sectors combined (-3 to +2).

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Decisions the Commission will Need to Make

1. **What is the purpose for the land sector goal?** Do we want to simply track emissions and sequestration, or do we want the goal to help us evaluate the effectiveness of investment, program, and policy decisions?

2. **What type of goal should we recommend?** Should we propose an emissions reduction/sequestration goal, an activity goal or both?

3. **How detailed do we want the land sector goal to be?** Should we include all lands and all activities or a subset of lands and activities? Do we want to have a single goal for the land sector or a goal for each major type of natural and working lands (forest, grasslands/shrub steppe, agricultural lands, wetlands, etc.)?

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Decisions the Commission will Need to Make

4. **How shall we treat emissions from anthropogenic activities versus emissions from natural causes like wildfire and pests and pathogens?** The IPCC has two methods for treatment of anthropogenic versus fluxes due to natural disturbances. However, they can be reported separately through either methodology.

5. **What is the relationship between the land sector goal and the state's existing emission reduction goals?** Should the land sector goal be additive to the goals for other sectors or part of meeting the state's emission reduction goals?

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Decisions the Commission will Need to Make

6. **How frequently should we update the goal and the inventory and what criteria should we use to inform any such change?**

7. **What consequences do we want to recommend if we are not meeting the goal goal?** How do we hold ourselves accountable for achieving our land sector goal(s)?

Contact Information:

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503-475-6782

TO: Oregon Board of Forestry
CC: Oregon Global Warming Commission
DATE: 3/23/2021
RE: Written testimony on revision of Goal G and climate-smart forestry
Agenda Item: No. 7
Oregon Global Warming Commission – Natural and Working Lands Goal Update

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Dear Oregon Board of Forestry members,

Thank you for the opportunity to submit written testimony for the Board of Forestry (Board)'s March 3rd, 2021 meeting. We, the undersigned organizations, are participants in the Oregon Climate Action Plan (OCAP) coalition's forest policy sub-table, tasked with coordinating stakeholder advocacy around implementation of Governor Brown's Executive Order 20-04 (EO 20-04). Our submission therefore focuses on the Board's work plan for 2021, updating Goal G in the Forestry Program for Oregon, and the need for concrete agency actions beyond Goal G. These actions include policy development, rulemaking proposals, and incentive programs. We are disappointed in the progress the Board has made to date in implementing EO 20-04, especially the following aspect of the Board's work plan:

> *"Commensurate with the work plan item relating to the analysis of statutory authority, the plan entails a review and revision of Goal G in the Forestry Program for Oregon. Goal G reflects the Board's carbon and climate interests through the Forestry Program for Oregon. Revisiting this goal allows for the integration of new scientific information and contemporary values of the Board to guide the analysis of Departmental policies."*[1]

It is critical that the Board take action to slow the most dire impacts of climate change and safeguard against ongoing climate impacts. This requires a re-thinking of many of Oregon's land-management practices, especially the management of our carbon rich temperate forest ecosystems.

The Oregon Department of Forestry's (ODF) response to the directives in EO 20-04 could enable the state to harness the globally significant carbon sequestration and storage potential of Oregon's forests, and restore the ecological health and climate resiliency of our state's landscapes, the fate of which is intertwined with that of our forests and climate. It is essential that the greenhouse gas (GHG) emissions reduction targets stipulated in EO 20-04, as well as the directive to "[p]rioritize actions that will help vulnerable populations and impacted communities

[1] Agenda item 2. See, e.g. attachment 2, page 2 of 5. https://www.oregon.gov/odf/board/bof/20210106-bof-agenda.pdf

adapt to climate change impacts,"[2] are embedded in all aspects of agency planning. This necessarily includes revision of the Forestry Plan and specifically Goal G.

Revision of Goal G, however, is not and should not be a substitute for meaningful policy. While an updated climate change goal can set an intention for Oregon to be a world leader in climate-smart forest management and carbon sequestration, this must be followed up with concrete agency actions to protect our forest ecosystems and communities for present and future generations of Oregonians.

The Best-available Science: How Oregon's Forests Can Address Climate Change

The two biggest steps Oregon can take to confront the global threat of climate change are to protect and grow its forests to sequester and store more carbon on the landscape, and reduce its greenhouse gas emissions from logging — its largest source of carbon emissions.

A growing scientific consensus has developed around two aspects of Oregon's ecosystems: (1) that they have an incredible potential for sequestering and storing atmospheric carbon; (2) that this potential is being significantly underutilized due to outdated forest management practices.

In its draft biennial report, the Oregon Global Warming Commission cites several of the leading studies in support of these propositions, which we summarize and supplement below:

- Diaz et al. 2018: Expanded riparian protections, increased green tree retention, and the extension of rotation ages can translate into substantially higher carbon storage than contemporary common practice for Douglas-fir management in the Pacific Northwest. The combination of forest practices required for FSC certification always stored more carbon than business-as-usual.
- Fain et al. 2018: On private forest lands west of the Cascades, extending harvest rotations,[3] maximizing utilization of harvested biomass, focusing on production of durable and long-lived wood products, and altering harvest practices to retain more live trees on-site, all could result in significant net carbon gains.
- Law et al. 2018: Reforestation, afforestation, lengthened harvest cycles on private lands, and restricting harvest on public lands in Oregon is projected to increase net ecosystem carbon balance by 56% by 2100, with the latter two actions contributing the most.
- Harmon 2019: Half of harvested carbon is emitted to the atmosphere almost immediately after logging.

[2] EO 20-04. https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf
[3] 80-120 years depending on assumptions about product longevity and substitution.

- Hudiberg et al. 2019: 65% of the forest carbon removed by logging Oregon's forests in the past 115 years has been returned to the atmosphere, just 19% is stored in long-lived products and 16% is in landfills.
- Houghton and Nassikas 2018: Letting forests grow and halting land conversions would bring carbon dioxide removal rates closer to current emission rates globally.
- Graves et al. 2020: Changes in forest-based activities including deferred timber harvest, riparian reforestation, and replanting after wildfires have the highest GHG reduction potential (76 to 94% of the overall potential annual reductions) among natural climate solutions (i.e., changes in land management, ecosystem restoration, and avoided conversion of habitats) in Oregon.
- Mildrexler et al. 2020: Large-diameter (≥21″ dbh) trees in eastside Oregon forests store disproportionately large amounts of carbon.

Based on a review of these studies and others, we have established a set of principles for developing climate-smart forest policy.

OCAP Forest Table's Guiding Principles for Climate-Smart Forest Policy

1. Use the best available science[4] for all forest management decisions, and focus on climate solutions that are durable and within each agency's control. Agencies should ensure all studies referenced during the decision-making process come from reputable academic and research institutions, have been subject to rigorous peer review, and that the funding for referenced studies remains independent of timber industry interests.
2. Ensure that vulnerable, disadvantaged and other impacted communities, including communities from geographic regions with a population largely composed of individuals who are low income, very low income, or persons of color, are given fair and equal access to the decision-making process.
3. Ensure that equity, justice and inclusion are considered alongside desirable environmental outcomes in any forest policy, and that agencies apply a climate and equity lens to budget and resource allocation requests.
4. Ensure forest management policies account for lifecycle greenhouse gas emissions. For example, policymakers have argued in the past that biomass is a carbon neutral fuel source, but the scientific literature demonstrates that near-term emissions from burning

[4] To achieve high-quality science, scientists should conduct their studies using what is known as the scientific process, which includes the following elements: a clear statement of objectives; a conceptual model, which is a framework for characterizing systems, making predictions, and testing hypotheses; a good experimental design and a standardized method for collecting data; statistical rigor and sound logic for analysis and interpretation; clear documentation of methods, results, and conclusions; and peer review. See, e.g. https://www.fws.gov/wafwo/fisheries/Publications/Fisheries3109.pdf

biomass undercut the validity of this argument and can directly hinder climate change mitigation efforts.[5]

5. Ensure forest management policies promote both near-term and long-term ecological health. Climate-smart forest management[6] should not be adopted as "one-size-fits-all" practices, but should be tailored for each climate and geographic sub-region. For example, some management, such as ecologically appropriate prescribed fires in Oregon's dry forests (preceded where necessary by thinning of small-diameter trees, may result in near-term emissions), but if done correctly could ensure ecological health[7] and better climate resilience in the long-term.
6. Ensure that the carbon benefits of any policy recommendation are quantifiable and account for both direct and indirect impacts to the carbon pool, including soil carbon, carbon in dead biomass, carbon in wood products and waste material from logging and processing.
7. Ensure that forest management practices optimize net carbon sequestration, storage, and stocks. Efforts to enhance carbon sequestration and grow Oregon's forest carbon sinks should be compatible with other ecological values, such as clean water, watershed protection and biodiversity conservation. Management practices must also benefit public health values such as clean drinking water, clean air and community safety from landslides and flooding. Agency cost-benefit analyses and other decision-making processes should incorporate a social cost of carbon that reflects Oregon's high vulnerability to climate change (i.e. assume both a social cost of carbon at the high-end of estimates and a low-range discount rate).[8]

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[5] See, e.g. Mark Jacobson, 2014. Effects of biomass burning on climate, accounting for heat and moisture fluxes, black and brown carbon, and cloud absorption effects. Journal of Geophysical Research-Atmospheres. https://doi.org/10.1002/2014JD021861

[6] Climate-smart forest management integrates the challenges and opportunities of climate change mitigation and adaptation into forest policy, planning and practices, aiming to optimize carbon storage and sequestration in a manner that accounts for the worsening impacts of climate change. See, e.g. Stein, B.A., P. Glick, N. Edelson, and A. Staudt (eds.). 2014. Climate-Smart Conservation: Putting Adaptation Principles into Practice. National Wildlife Federation, Washington, D.C. https://www.nwf.org/~/media/PDFs/Global-Warming/Climate-Smart-Conservation/NWF-Climate-Smart-Conservation_5-08-14.pdf, David D. Diaz, Sara Loreno, Gregory J. Ettl and Brent Davies 2018 Tradeoffs in Timber, Carbon, and Cash Flow under Alternative Management Systems for Douglas-Fir in the Pacific Northwest. Forests 9 (8) 447 https://www.mdpi.com/1999-4907/9/8/447, OGWC 2018 Forest Carbon Accounting Project Report 2018. Keep Oregon Cool, Oregon Global Warming Commission. https://static1.squarespace.com/static/59c554e0f09ca40655ea6eb0/t/5c2e415d0ebbe8aa6284fdef/1546535266189/2018-OGWC-Biennial-Report.pdf

[7] Although ecosystem health cannot be defined precisely, ecologists have identified a number of specific components that are important in this concept. These include the following indicators: (1) an ability of the system to resist changes in environmental conditions without displaying a large response (this is also known as resistance or tolerance); (2) an ability to recover when the intensity of environmental stress is decreased (this is known as resilience); (3) relatively high degrees of biodiversity ; (4) complexity in the structure and function of the system; (5) the presence of large species and top predators; (6) controlled nutrient cycling and a stable or increasing content of biomass in the system; and (7) domination of the system by native species and natural communities that can maintain themselves without management by humans.

[8] See, e.g. Institute for Policy Integrity 2020. https://policyintegrity.org/documents/Policy_Integrity_EO_20-04_report_comments_2020.06.15.pdf

These principles are consistent with Governor Brown's Executive Order 20-04 and emphasize an equity- and science-based decision-making framework as the Board develops near-term policy solutions to the threat of climate change. The following section offers specific policy recommendations for the Board as it moves forward with revision of Goal G.

Policy Recommendations for Revision of Goal G

As noted in the Board's "Report on Proposed Actions for Executive Order No. 20-04," the Board intends to focus on revising the specific objectives within Goal G with opportunities for public engagement.[9]

Currently, Goal G states that ODF will work to: *"Improve carbon sequestration and storage and reduce carbon emissions in Oregon's forests and forest products."*[10] While this is a promising starting point, the Board is missing a broader opportunity to protect and expand upon Oregon's globally significant carbon stores in a manner that positions the state as a world leader in science-based natural climate solutions. Instead, the goal should read: "*Establish the state of Oregon as a world leader in climate-smart forest management and significantly increase carbon storage and sequestration*[11] *in Oregon's forests.*" If defined correctly, climate-smart forest management[12] can encompass the full scope of challenges and opportunities associated with climate change mitigation and adaptation. The Board should update forest policy, planning and practices to optimize carbon storage and sequestration in a manner that accounts for the worsening impacts of climate change and enables Oregon's forest managers to grow the state's natural carbon sinks as much as possible in order to maximize sequestration in an ecologically appropriate manner.

Currently, the objectives outlined in Goal G call for the Board to:

1. Encourage maintaining and increasing Oregon's forestland base and promote the maintenance and expansion of urban forests.

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[9] See, e.g. Oregon Department of Forestry 2020. Report on Proposed Actions for Executive Order No. 20-04. https://www.oregon.gov/gov/Documents/2020%20ODF%20EO%2020-04%20Implementation%20Report.pdf

[10] See, e.g. Oregon Board of Forestry 2011. Forestry Program for Oregon — A Strategy for Sustaining Oregon's Public and Private Forests. https://www.oregon.gov/ODF/Board/Documents/BOF/fpfo_2011.pdf

[11] See, e.g. USGS What is carbon sequestration? Excerpt: "Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide." https://www.usgs.gov/faqs/what-carbon-sequestration?qt-news_science_products=0#qt-news_science_products

[12] Climate-smart forest management integrates the challenges and opportunities of climate change mitigation and adaptation into forest policy, planning and practices, aiming to optimize carbon storage and sequestration in a manner that accounts for the worsening impacts of climate change. See, e.g. Stein, B.A., P. Glick, N. Edelson, and A. Staudt (eds.). 2014. Climate-Smart Conservation: Putting Adaptation Principles into Practice. National Wildlife Federation, Washington, D.C. https://www.nwf.org/~/media/PDFs/Global-Warming/Climate-Smart-Conservation/NWF-Climate-Smart-Conservation_5-08-14.pdf, David D. Diaz, Sara Loreno, Gregory J. Ettl and Brent Davies 2018 Tradeoffs in Timber, Carbon, and Cash Flow under Alternative Management Systems for Douglas-Fir in the Pacific Northwest. Forests 9 (8) 447 https://www.mdpi.com/1999-4907/9/8/447, OGWC 2018 Forest Carbon Accounting Project Report 2018. Keep Oregon Cool, Oregon Global Warming Commission. https://static1.squarespace.com/static/59c554e0f09ca40655ea6eb0/t/5c2e415d0ebbe8aa6284fdef/1546535266189/2018-OGWC-Biennial-Report.pdf

2. Promote increased public and forest landowner understanding of the potential contributions of trees, forests, and forest products in sequestering and storing carbon.
3. Ensure that carbon-offset markets as well as emerging markets for other ecosystem services provide easily accessible sources of revenues and do not discriminate against forest landowner participation based on regulatory requirements exceeding those for other land uses.
4. Encourage greater consumer awareness of the environmental advantages of using Oregon forest products and their use as substitutes for more energy intensive building materials.
5. Advocate for public and private forestland biomass to be considered on an equal basis with other renewable energy sources and as a key component of Oregon's strategy for meeting state greenhouse gas reduction and renewable energy portfolio standard policy goals.
6. Continue to support research and develop policies and incentives that will drive the growth of the biomass/ bioenergy/ bio-based products industry in the state.
7. Promote research and innovation towards increasing energy efficiency and reducing the use of fossil fuels in the Oregon forest sector.

These objectives may have been useful for framing the conversation in the past, but they are insufficient to inform the specific policy outcomes the Governor is seeking in EO 20-04. There are also several key considerations that either misrepresent the carbon benefits of certain policy outcomes, such as the efficacy of biomass as a climate solution, or are otherwise missing from the list of objectives. Decades of scientific study — including research from world leaders in forest climate science from Oregon State University[13] — demonstrates the need for action. While some climate-smart[14] opportunities will be more challenging and time-consuming to fully implement, the Board has the authority to act quickly on other fronts even as it continues to facilitate further research.

The following policy opportunities represent "low-hanging fruit" for the Board and ODF to adopt as the Oregon's decision-makers work to *"prioritize actions that reduce GHG emissions in a cost-effective manner,"* and *"prioritize actions that will help vulnerable populations and impacted communities adapt to climate change impacts"* as directed in EO 20-04.[15]

1. **<u>Lengthen logging rotations</u>** *(EO 20-04, ss. 3.A, 3.C.(1), 12.A).* The best available science[16] has made clear that current standard logging rotations (often as short as 35

[13] See, e.g. Terrestrial Ecosystem Research and Regional Analysis group (TERRA-PNW) publications: http://terraweb.forestry.oregonstate.edu/publications

[14] Refer to footnote 12.

[15] EO 20-04. https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf

[16] See, e.g. Beverly E. Law, Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte, Mark E. Harmon 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. Proceedings of the National Academy of Sciences DOI: 10.1073/pnas.1720064115 https://web.archive.org/web/20180727130028/http://www.pnas.org/content/pnas/115/14/3663.full.pdf

years) undermine the ability of forests to optimize carbon stored.[17] By allowing trees to grow for longer time periods, managers can improve carbon stocks while also increasing timber yield and timber quality. Studies suggest that rotations of 80 years in Coastal Douglas fir may provide optimal carbon storage benefit, depending on assumptions about product longevity and substitution.[18]

2. **Increase green tree retention on the land during harvest and promote diversity of species as opposed to monoculture plantations** *(EO 20-04, ss. 3.A, 3.C.(1)-(3), 12.A).* Greater retention of standing trees (especially bigger and older trees) after logging will keep more carbon on site, help to make regrowing forests more resilient to natural disturbance, increase availability of native seed stock for future restoration efforts, and provide for more higher-quality habitat for native species.
3. **Eliminate logging in biologically significant, carbon-rich mature and old growth forests, and in forests with the highest carbon sequestration potential** *(EO 20-04, ss. 3.A, 3.C.(1), 12.A)*
   Mature and old growth forests store and sequester immense amounts of carbon. Wherever native stands of large trees exist, they should be protected as climate reserves. Further, decision makers should work to identify additional areas of the highest carbon storage potential that should also be protected as part of this carbon reserve. These same stands also provide high quality habitat for salmon and other at-risk wildlife, helping managers achieve two objectives at once.
4. **Manage forests for clean water as a climate adaptation tool.** *(EO 20-04, s. 3.C.(2))*
   Healthy forests protect clean water resources for people and wildlife. Clearcuts increase the risk of mudslides and sediment runoff, negatively impacting Oregon's rivers and streams. Further, pesticide spraying can also pose a risk to local communities. As the impacts of climate change worsen (including drought, heat waves, and more extreme precipitation events), Oregon's forests need to also be managed for clean water quality and quantity, and flood prevention as an adaptation tool.
5. **Seek climate-smart provisions in the upcoming Habitat Conservation Plan (HCP) process** *(EO 20-04, ss. 3.A, 3.C.(1), 12.A)*. Upcoming negotiations based on the passage of SB 1602 in 2020 will focus on modernizing the Oregon Forest Practices Act in order to benefit aquatic and riparian-dependent species. These negotiations should also optimize potential climate co-benefits outlined in EO 20-04, along with other key environmental concerns including science-based standards for riparian buffers, chemical-based vegetation management, steep slope logging, and cumulative impacts.

[17] See, e.g. Mark E. Harmon, 2019. Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. Environmental Research Letters https://doi.org/10.1088/1748-9326/ab1e95

[18] See, e.g. Stephen J. Fain, Brian Kittler, Amira Chowyuk, 2018. Managing Moist Forests of the Pacific Northwest United States for Climate Positive Outcomes. Multidisciplinary Digital Publishing Institute. DOI: 10.3390/f9100618. https://www.researchgate.net/publication/328229114_Managing_Moist_Forests_of_the_Pacific_Northwest_United_States_for_Climate_Positive_Outcomes

6. **<u>Ensure better incentives for small family forest owners to implement climate-smart forestry on their lands</u>** *(EO 20-04 s. 3.C(1))*
    a. Agencies should prioritize promoting stronger incentives and market development for small family forest owners willing to implement climate-smart forest management[19] on their lands (such as protection of larger stream buffers and late successional characteristics), including better state incentives for the production of FSC certified wood products.
    b. Small family forest owners should be allowed to aggregate small acreage into larger more impactful projects.
    c. Agencies should develop accountability standards to ensure incentives are awarded to forest owners who are currently practicing verifiable climate-smart forestry or will adopt verifiable, high standards of climate-smart forestry.
7. **<u>Focus wildfire defense investments on preparing communities for increased risk, and ensure post-fire recovery efforts account for equity concerns.</u>[20]** *(EO 20-04, ss. 3.C(2)-(3))*
    a. Increase emergency planning and preparedness for rural communities located in and near forested areas,
    b. Increase fire-wise home hardening and retrofitting (i.e. application of construction design and materials that are fire resistant),
    c. Reduce fuels in the home ignition zone,
    d. Limit new development in high risk areas, and
    e. Ensure disadvantaged communities have equal access to resources.
8. **<u>Elevate best practices in post-disturbance management, focused on ecological restoration</u>** *(EO 20-04, s. 3.C(2))*
    a. Reduce aerial and ground pesticide spraying. Longer rotations, greater tree retention and promoting biodiverse tree species are practices that will immediately reduce the need for chemical-based vegetation management and will help maintain the groundcover needed to retain soil carbon and increase soil stability and productivity .
    b. Ensure post-fire logging is focused on trees that pose a high risk to communities and their infrastructure, such as power lines and public roadways.

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[19] Climate-smart forest management integrates the challenges and opportunities of climate change mitigation and adaptation into forest policy, planning and practices, aiming to optimize carbon storage and sequestration in a manner that accounts for the worsening impacts of climate change. See, e.g. Stein, B.A., P. Glick, N. Edelson, and A. Staudt (eds.). 2014. Climate-Smart Conservation: Putting Adaptation Principles into Practice. National Wildlife Federation, Washington, D.C. https://www.nwf.org/~/media/PDFs/Global-Warming/Climate-Smart-Conservation/NWF-Climate-Smart-Conservation_5-08-14.pdf, David D. Diaz, Sara Loreno, Gregory J. Ettl and Brent Davies 2018 Tradeoffs in Timber, Carbon, and Cash Flow under Alternative Management Systems for Douglas-Fir in the Pacific Northwest. Forests 9 (8) 447 https://www.mdpi.com/1999-4907/9/8/447, OGWC 2018 Forest Carbon Accounting Project Report 2018. Keep Oregon Cool, Oregon Global Warming Commission. https://static1.squarespace.com/static/59c554e0f09ca40655ea6eb0/t/5c2e415d0ebbe8aa6284fdef/1546535266189/2018-OGWC-Biennial-Report.pdf

[20] See, e.g. National Fire Protection Association 2020. https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Preparing-homes-for-wildfire

c. Reduce slash burning in industrial timber lands and increase R&D investment into alternatives to slash burning. Slash burning immediately releases carbon to the atmosphere and puts significant quantities of smoke into local airsheds, exposing nearby residents to fine particulate matter and air toxics for multiple days. Incentivize projects to turn slash into biochar or soil nutrients.
d. Evaluate hiring practices for post-disturbance recovery crews through an equity lens. Consider inequitable toxics exposure when hiring workers of color for ground spraying or burning. Transition to hiring diverse reforestation crews that promote biodiverse forest landscapes to provide employment opportunities that are economically beneficial and non-toxic for workers of color.

9. **Establish new partnerships with Tribes, indigenous communities, and tribal climate activists**. *(EO 20-04, ss. 3.C.(2)-(3), 3.E)* Incorporate tribal climate mitigation and adaptation practices that can support increased carbon storage and sequestration in Oregon's forests, and seek to build bridges between Western (conventional) and Indigenous practices, including through use of prescribed fire in Oregon's eastern and southern forests.
10. **Establish a new Diversity, Equity and Inclusion (DEI) office within ODF** *(EO 20-04, ss. 3.B, 3.C(3)*. Climate-smart forest policy should also account for diversity, equity, and inclusion across all decisions the Board and ODF makes. A dedicated staff person will help ensure this need is met.

In addition to reframing the current list of objectives, the Board should also strive to ensure priorities are accurately focused on true carbon and climate benefits. For instance, most if not all commercial biomass facilities are not carbon neutral within a meaningful time frame for climate action. While fuel from wood is technically renewable (trees can be regrown), emissions from burning this product are released all at once, while the benefits of new sequestration can take decades, or even hundreds of years, to pull that same amount of carbon back out the atmosphere.[21] And because much of a forest's carbon is stored in the soil (nearly 50 percent on average in Oregon's forests), soil disturbance from logging operations can release additional carbon that is challenging to re-sequester.[22] Development of woody biomass for energy

[21] See, e.g. Mark Jacobson, 2014. Effects of biomass burning on climate, accounting for heat and moisture fluxes, black and brown carbon, and cloud absorption effects. Journal of Geophysical Research-Atmospheres. https://doi.org/10.1002/2014JD021861 and see, e.g. Searchinger, T. D, Beringer, T., Holtsmark, B., et al. 2018. Europe's renewable energy directive poised to harm global forests. Nature communications. Excerpt: "Unlike wood wastes, harvesting additional wood just for burning is likely to increase carbon in the atmosphere for decades to centuries. This effect results from the fact that wood is a carbon-based fuel whose harvest and use are inefficient from a greenhouse gas (GHG) perspective. Typically, around one third or more of each harvested tree is contained in roots and small branches that are properly left in the forest to protect soils but that decompose and release carbon. Wood that reaches a power plant can displace fossil emissions but per kWh of electricity typically emits 1.5x the CO2 of coal and 3x the CO2 of natural gas because of wood's carbon bonds, water content (Table 2.2 of ref. 17) and lower burning temperature (and pelletizing wood provides no net advantages) (Supplementary Note1)." https://www.nature.com/articles/s41467-018-06175-4

[22] Christensen, G.A., et al. 2019. Oregon Forest Ecosystem Carbon Inventory: 2001-2016. https://www.oregon.gov/ODF/ForestBenefits/Documents/Forest%20Carbon%20Study/OR-Forest-Ecosystem-Carbon-2001-2016-Report-FINAL.pdf

production is likely to increase logging since waste from thinning operations and logging is insufficient to provide a significant power source for the state. Biomass facilities also have significant direct air pollution impacts for neighboring communities.[23] A climate strategy that promotes the use of biomass is therefore counterproductive and inconsistent with EO 20-04, insofar as it runs counter to the need for urgent and immediate action to reduce GHG emissions and mitigate near-term climate impacts to the greatest extent possible, and creates direct pollution risks for already vulnerable populations and impacted communities.[24]

We hope that the Board and ODF will strive to implement near-term policy solutions that position Oregon as a world leader in climate-smart forest management and carbon sequestration. In order to confront the threat of climate change, we must ensure the scope and scale of our solutions match the magnitude of the challenge and are sufficient to contribute substantially to meeting the interim target and final goal of Governor Brown's Executive Order 20-04.

Sincerely,

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[23] See, e.g. Gilman, J.B, Lerner, B.M., Kuster, W.C. et al. 2015. Biomass burning emissions and potential air quality impacts of volatile organic compounds and other trace gases from fuels common in the US. Atmos. Chem. Phys. https://acp.copernicus.org/articles/15/13915/2015/acp-15-13915-2015.pdf and Jayarathne, T., Stockwell, C.E, Yokelson R., et al. 2014. Emissions of Fine Particle Fluoride from Biomass Burning. https://pubs.acs.org/doi/full/10.1021/es502933j

[24] We will submit additional policy recommendations on biomass in a forthcoming letter to support better practices around this source of energy.

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350PDX

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Nora Lehmann
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Grace Brahler
Oregon Climate Action Plan and Policy Manager
Beyond Toxics

TO: Oregon Board of Forestry
CC: Oregon Global Warming Commission
DATE: 3/23/2021
RE: Written testimony on woody biomass for energy production
Agenda Item: No. 7
Oregon Global Warming Commission – Natural and Working Lands Goal Update

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Dear Oregon Board of Forestry members,

The below letter summarizes the most recent literature concerning the challenges of using woody biomass for energy production, and offers recommendations for best practices. We are concerned that the current objectives outlined in Goal G — the Oregon Department of Forestry's climate change goal — do not reflect the best available science on woody biomass and climate change mitigation.

Currently, Goal G directs ODF to:

- Advocate for public and private forestland biomass to be considered on an equal basis with other renewable energy sources and as a key component of Oregon's strategy for meeting state greenhouse gas reduction and renewable energy portfolio standard policy goals.
- Continue to support research and develop policies and incentives that will drive the growth of the biomass/ bioenergy/ bio-based products industry in the state.

These objectives misrepresent the carbon benefits of using woody biomass for energy production, and fail to account for the numerous environmental and equity challenges associated with biomass. An updated review of the best available science invalidates the case for treating all woody biomass "on an equal basis with other renewable energy resources" and the need for agency incentivization of biomass.

These issues with biomass *must* be addressed in the revision of Goal G, in order to ensure that the burning of woody biomass does not exacerbate the climate crisis, endanger vulnerable communities, or degrade ecosystems and biodiversity in Oregon. We recommend that the agency take the following policy recommendation into account with regards to biomass as they revise Goal G:

Do not define biomass as carbon neutral

Woody biomass emits significant amounts of carbon when burned to produce energy. A detailed analysis of biomass energy generation commissioned by Massachusetts, the Manomet Study, compared the lifetime greenhouse gas effects of a continuous harvesting and replanting scenario to burning natural gas to generate the same energy. This analysis showed that, considering the first 35 years of operation, the biomass plant would have one and a half times the net CO2 emissions of a natural gas plant generating the same amount of energy.[1] Based on this study and many others,[2] incentivizing biomass energy generation will put Oregon *further behind* on its current 2050 greenhouse gas goals, which aim to reduce greenhouse gas emissions in the state by at least 45 percent below 1990 levels by the year 2035, and by 80 percent by 2050.[3]

Advocates of the biomass-as-carbon-neutral policy claim that when biomass is removed from the forest and combusted for energy, the emitted carbon is eventually re-sequestered by the forest's regrowth; however, this stance does not account for the long time lag between the immediate short-term of release of carbon emissions from logging and combustion of the wood products, and the long-delayed tree regrowth and recapture of carbon in the ecosystem. The carbon stocks of forests are a result of two factors: carbon capture by biomass growth and the duration of carbon in biomass.[4] Therefore, the longevity of trees in the forest matters a great deal in terms of maximizing carbon benefits.

Further, there is no guarantee that replanted trees will eventually reach the same maturity as those that were cut down — drought, fire, insects, climate change, or land use conversion could prevent the same level of sequestration even in the long-term.[5] And because much of a forest's

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[1] Manomet Study 2018. https://www.manomet.org/wp-content/uploads/2018/03/Manomet_Biomass_Report_Full_June2010.pdf

[2] McKechnie J, Colombo S, Chen J, Mabee W and MacLean H L 2011 Forest bioenergy or forest carbon? Assessing trade-offs in greenhouse gas mitigation with wood-based fuels Environ. Sci. Technol. 45 789–95 https://pubs.acs.org/doi/abs/10.1021/es1024004,
Bernier P and Paré D 2013 Using ecosystem CO2 measurements to estimate the timing and magnitude of greenhouse gas mitigation potential of forest bioenergy *GCB Bioenergy* 5 67–72 https://onlinelibrary.wiley.com/doi/full/10.1111/j.1757-1707.2012.01197.x,
Walker T, Cardellichio P, Gunn J S, Saah D S and Hagan J M 2013 Carbon accounting for woody biomass from massachusetts (USA) managed forests: a framework for determining the temporal impacts of wood biomass energy on atmospheric greenhouse gas levels J. Sust. Forest 32 130–58 https://www.tandfonline.com/doi/abs/10.1080/10549811.2011.652019,
Stephenson A L and MacKay D J C 2014 Life Cycle Impacts of Biomass Electricity in 2020 (London: UK Department of Energy and Climate Change) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/349024/BEAC_Report_290814.pdf, and
Laganière J, Paré D, Thiffault E and Bernier P Y 2017 Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests GCB Bioenerg. 9 358–69 https://onlinelibrary.wiley.com/doi/full/10.1111/gcbb.12327.

[3] EO 20-04 https://www.oregon.gov/gov/Pages/carbonpolicy_climatechange.aspx

[4] Köhl M., Neupane P.R., Lotfiomran N. 2017. The impact of tree age on biomass growth and carbon accumulation capacity: A retrospective analysis using tree ring data of three tropical tree species grown in natural forests of Suriname. PLoS ONE 12(8): e0181187. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0181187

[5] Duffy, Moomaw, Schlesinger et al 2016. Scientists letter to Congress about carbon neutrality of biomass energy. 2-22-2016. http://whrc.org/letter-to-the-senate-on-carbon-neutrality/

carbon is stored in the soil (nearly 50 percent on average in Oregon's forests), disturbance can release additional carbon that is also challenging to re-sequester.[6] These near term greenhouse gas emissions are a serious problem from a climate change perspective. Even if the forest someday recovers the carbon emitted decades earlier by biomass combustion, there is no way to mitigate the warming that occurred during the lag period due to the excess CO2 released into the atmosphere.

Avoid impacts to vulnerable communities

EPA data shows that even the best-performing biomass plants produce as much or more air pollution as a similar-sized coal plant.[7] These pollutants include nitrous oxide that generates ozone, small particulate matter that drives lung inflammation, volatile organic compounds, and other harmful compounds. The American Lung Association "does not support biomass combustion for electricity production" and "strongly opposes the combustion of wood and other biomass sources at schools and institutions with vulnerable populations."[8]

Air pollution is clearly linked to decreased lifespan, causing more than 100,000 early deaths in the United States every year.[9] Power plants are often located in low income and minority neighborhoods, and so the effects of air pollution are unequally distributed in ways that perpetuate historical environmental injustices. Black Americans have the highest mortality rate from exposure to fine particle air pollution.[10]

Avoid negative impacts to forest carbon storage and biodiversity

An expansion of industrial biomass for energy production also would lead to an increased demand for biomass fuel. This demand could be disruptive to existing Oregon industries that currently rely on the same raw materials, as new demand may not be fully met by mill and logging residue alone. Many of these alternative uses of waste are better for the climate — for instance, making particle-board from wood chips can lead to long-term carbon storage in furniture and subfloors. If the demand for clean chips leads to increased harvest through shorter rotations, deforestation, or the conversion of native forests to timber plantations, it will reduce

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[6] Christensen, G.A., et al. 2019. Oregon Forest Ecosystem Carbon Inventory: 2001-2016. https://www.oregon.gov/ODF/ForestBenefits/Documents/Forest%20Carbon%20Study/OR-Forest-Ecosystem-Carbon-2001-2016-Report-FINAL.pdf

[7] Partnership for Policy Integrity (2011). Air pollution from biomass energy. https://www.pfpi.net/air-pollution-2

[8] American Lung Association (2019). Policy Principle on Energy. https://www.lung.org/policy-advocacy/public-policy-positions/public-policy-position-energy#:~:text=The%20American%20Lung%20Association%20does,as%20construction%20and%20demolition%20waste

[9] Fann, N et al. (2012). Estimating the National Public Health Burden Associated with Exposure to Ambient PM2.5 and Ozone. Risk Analysis (32) 81-95. https://doi.org/10.1111/j.1539-6924.2011.01630

[10] Maninder, PS et al. (2019). Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography. *Environmental Science and Technology* (53) 14010–14019. https://doi.org/10.1021/acs.est.9b02527

carbon storage on the landscape and degrade the forest habitats that support biodiversity and the survival of some of Oregon's most important species.

If biomass is associated with large tree removal, road building, commercial logging, or meeting timber targets, this can have far-reaching ecological impacts that can negatively affect the area's biodiversity. Mature and old forest habitats are still quite rare compared to the conditions necessary to sustain healthy populations of Oregon native fish and wildlife. Expanded biomass energy development will make it harder to restore mature and old forests and perpetuate the creation of young forests that are already vastly over-represented on the landscape.

Avoid displacement of zero-emissions energy and ensure better environmental outcomes

Zero-emission energy resources, such as wind, solar, and geothermal are critical for decarbonizing the power sector. Oregon's decision makers should be focusing the state's resources on supporting the growth of these industries. Continuing to encourage and subsidize biomass energy infrastructure will compete with wind, solar and other carbon free energy sources for scarce resources needed to advance these critical technologies. Using the same amount of land area,[11] solar panels produce up to 80-times as much electricity as wood burning with no point source emissions at all.[12]

Define the scope of "renewable" biomass appropriately

Given that the U.S. Energy Information Agency estimates that for each 1 percent of forest biomass electricity added to current U.S. electricity production an additional 18 percent increase in U.S. forest harvest is required,[13] strict limits on the role of biomass electricity generation from woody debris are needed to avoid destruction of intact ecosystems and loss of old growth and late successional reserves, which hold far more carbon than the reseeded monoculture that would replace them if harvested. The following examples, while not comprehensive, highlight renewable (and environmentally appropriate) categories for woody biomass:

- Byproducts of wood or paper mill operations;
- Woody matter removed from within 100-200 yards of any man-made structure or campground for the purposes of hazardous fuels thinning;
- Thinned small diameter trees (<12" dbh) that are removed to restore fire adapted ecosystems; and,

[11] All energy infrastructure should be sited in a manner that minimizes impacts to the environment. See, e.g, Defenders of Wildlife 2012. Smart from the Start. https://defenders.org/sites/default/files/publications/smartfromthestartreport12_print.pdf

[12] Duffy, Moomaw, Schlesinger et al 2016. Scientists letter to Congress about carbon neutrality of biomass energy. 2-22-2016. http://whrc.org/letter-to-the-senate-on-carbon-neutrality/

[13] Duffy, Moomaw, Schlesinger et al 2016. Scientists letter to Congress about carbon neutrality of biomass energy. 2-22-2016. http://whrc.org/letter-to-the-senate-on-carbon-neutrality/

- Logged residues such as slash piles that would otherwise increase wildfire risk or hinder ecologically appropriate restoration.

Use woody biomass for biochar production or as heating fuel locally

Some types of biomass, such as slash for logging operations, is too "dirty"[14] to be used in electricity generation, but can still be used to produce biochar. In addition to retrofitting existing biomass facilities, managers can also utilize biochar kilns[15] in the field to address the challenges of burning slash after logging operations. According to practitioners, "When compared to the pile burning method, this approach produces considerably less smoke, does less damage to the soil, is safer, extends the season possible for fuel reduction efforts, sequesters carbon, and yields biochar, a charcoal-like product made from organic material."

Where appropriate to reduce wildfire risk for communities, use wood waste as a source of biomass.

Oregon's communities that are in high wildfire risk areas should focus resources on community defense and emergency planning. Part of these defensible-space efforts can incorporate vegetation management near vulnerable infrastructure in order to establish a defensible zone for fire prevention. Vegetation waste can be transported to biomass facilities where it can be burned safely, or burned on site via biochar kilns. This vegetation removal should be focused in close proximity to infrastructure (specifically within 100-200 yards of a structure), as this is the most effective way to mitigate future wildfire risk.[16]

Conclusion

As the literature review and best practices above demonstrate, utilizing woody biomass for energy production in an environmentally responsible manner is challenging. In order for Oregon to meet its goals for reduction of near-term carbon emissions, preservation of intact forests for maximal carbon sequestration, water quality and quantity, wildlife conservation, and equity and justice, the state's decision makers must take a nuanced and cautious approach to any expansion of woody biomass energy production.

Sincerely,

[14] Forest residues are often unsuitable for use because of their high ash, dirt and alkali salt content. See: Brack, D. 2017. Research Paper Woody Biomass for Power and Heat Impacts on the Global Climate. Chatham House. https://www.chathamhouse.org/2017/02/woody-biomass-power-and-heat

[15] Utah State University 2019. https://forestry.usu.edu/news/utah-forest-facts/hazardous-fuels-reduction-using-flame-cap-biochar-kiln

[16] Cal Fire 2019. https://www.readyforwildfire.org/prepare-for-wildfire/get-ready/defensible-space/

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