

Oregon Board of Forestry – Virtual Public Meeting

Wednesday, September 9, 2020

With the current public gathering restrictions, the Board of Forestry will hold its September meeting virtually to allow interested persons to view the meeting and participate statewide without having to travel or assemble indoors. The Board of Forestry public meeting will be conducted online and streamed live.

September 8, 2020 Update - Based on the level of fire emergency around the state, the Board of Forestry meeting will be abbreviated. There will be no live public comment during this meeting. Instructions for providing testimony for the action and information item is included on the last page of this agenda and available on the department’s website: https://www.oregon.gov/ODF/Board/Pages/BOFMeetings.aspx. Written testimony may also be submitted before or up to two weeks after the meeting day to BoardofForestry@oregon.gov.

Link to view Board of Forestry Meeting available at https://www.oregon.gov/odf/Board/Pages/BOFMeetings.aspx

Prior meetings’ audio and this meeting’s written material available on the web www.oregon.gov/odf/board. The matters under the Consent Agenda will be considered in one block. Any board member may request removal of any item from the consent agenda. Items removed for separate discussion will be considered after approval of the consent agenda. Public comment will not be taken on consent agenda items.

Consent Agenda

- 9:00 – 9:01 A. July 22, 2020 Board of Forestry Meeting MinutesState Forester Peter Daugherty
9:00 – 9:01 B. Regional Forest Practices Committee Appointments and ReappointmentsJosh Barnard
9:00 – 9:01 C. Forest Practices Monitoring Unit Update Kyle Abraham, Terry Frueh, Paul Clements, and Adam Coble
9:00 – 9:01 D. Forest Health Unit Update Mike Kroon, Christine Buhl, and Wyatt Williams

Action and Information

- 9:01 – 9:30 1. Fire Season Update State Forester Peter Daugherty and Doug Grafe
Department will provide an update to the Board on the 2020 fire season for situational awareness.

Times listed on the agenda are approximate. At the discretion of the chair, the time and order of agenda items—including addition of an afternoon break—may change to maintain meeting flow. The board will hear public testimony [*excluding marked items] and engage in discussion before proceeding to the next item.* A single asterisk preceding the item number marks a work session, and public testimony/comment will not be accepted.

BOARD WORK PLANS: Board of Forestry (Board) Work Plans result from the board's identification of priority issues. Each item represents commitment of time by the Board of Forestry and Department of Forestry staff that needs to be fully understood and appropriately planned. Board Work Plans form the basis for establishing Board of Forestry meeting agendas. Latest versions of these plans can be found on the Board's website at: <https://www.oregon.gov/odf/Board/Pages/AboutBOF.aspx>

PUBLIC TESTIMONY: The Board of Forestry places great value on information received from the public. The Board will only hold public testimony at the meeting for decision items. The Board accepts written comments on all agenda items except consent agenda and Work Session items [see explanation below]. Those wishing to testify or present information to the Board are encouraged to:

- Provide written summaries of lengthy, detailed information.
- Remember that the value of your comments is in the substance, not length.
- For coordinated comments to the Board, endorse rather than repeat the testimony of others.
- To ensure the Board will have an opportunity to review and consider your testimony before the meeting, please send comments no later than 72 hours prior to the meeting date. If submitted after this window of time the testimony will be entered into the public record but may not be viewed by the Board until after the meeting.
- For in-person meetings, sign in at the information table in the meeting room when you arrive. For virtual meetings, follow the sign up instructions provided in the meeting agenda.

Written comments for public testimony provide a valuable reference and may be submitted before, during, or up to two weeks after the meeting for consideration by the Board. Please submit a copy to BoardofForestry@oregon.gov, and written comments received will be distributed to the Board. Oral or written comments may be summarized, audio-recorded, and filed as record. Audio files and video links of the Board's meetings are posted within one week after the meeting at <https://www.oregon.gov/odf/Board/Pages/BOFMeetings.aspx>

The Board cannot accept comments on consent agenda items or a topic for which a public hearing has been held and the comment period has closed.

WORK SESSIONS: Certain agenda topics may be marked with an asterisk indicating a "Work Session" item. Work Sessions provide the Board opportunity to receive information and/or make decisions after considering previous public comment and staff recommendations. No new public comment will be taken. However, the Board may choose to ask questions of the audience to clarify issues raised.

- During consideration of contested civil penalty cases, the Board will entertain oral argument only if Board members have questions relating to the information presented.
- Relating to the adoption of Oregon Administrative Rules: Under Oregon's Administrative Procedures Act, the Board can only consider those comments received by the established deadline as listed on the Notice of Rulemaking form. Additional input can only be accepted if the comment period is formally extended (ORS 183.335).

GENERAL INFORMATION: For regularly scheduled meetings, the Board's agenda is posted on the web at www.oregonforestry.gov two weeks prior to the meeting date. During that time, circumstances may dictate a revision to the agenda, either in the sequence of items to be addressed, or in the time of day the item is to be presented. The Board will make every attempt to follow its published schedule, and requests your indulgence when that is not possible.

In order to provide the broadest range of services, lead-time is needed to make the necessary arrangements. If special materials, services, or assistance is required, such as a sign language interpreter, assistive listening device, or large print material, please contact our Public Affairs Office at least three working days prior to the meeting via telephone at 503-945-7200 or fax at 503-945-7212.

Use of all tobacco products in state-owned buildings and on adjacent grounds is prohibited.

DRAFT Board of Forestry Meeting Minutes

July 22, 2020

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Items listed in order heard.

Complete audio recordings from the meeting and attachments listed below are available on the web at www.oregonforestry.gov.

- (1) Presentation, [2021-2023 Agency Biennial Budget Request](#), Agenda Item 2
- (2) Presentation, [Financial Update and Contractor Recommendations](#), Agenda Item 3
- (3) Presentation, [Fire Season Readiness](#), Agenda Item 4
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- (21) Handout, [Written testimony by Harrington for State Forests Habitat Conservation Plan Update](#), Agenda Item 8
- (22) Handout, [Continue smart, sustainable forestry campaign for State Forests Habitat Conservation Plan Update](#), Agenda Item 8
- (23) Handout, [Let newly replanted trees thrive campaign for State Forests Habitat Conservation Plan Update](#), Agenda Item 8
- (24) Handout, [Please protect our rural communities campaign for State Forests Habitat Conservation Plan Update](#), Agenda Item 8
- (25) Presentation, [Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
- (26) Handout, [Written testimony by Baylor for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
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- (29) Handout, [Written testimony by Donohoe for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
- (30) Handout, [Written testimony by Environmental Caucus of the Democratic Party of Oregon for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
- (31) Handout, [Written testimony by Frye for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9

- (32) Handout, [Written testimony by Gottfried for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
- (33) Handout, [Written testimony by Gwilym for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
- (34) Handout, [Written testimony by Harris, B for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9
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- (46) Handout, [Written testimony by Stackhouse for Recent and Ongoing Climate Change Work Update](#), Agenda Item 9

In accordance with the provisions of ORS 526.016, a meeting of the Oregon Board of Forestry was held virtually on July 22, 2020 and hosted at the Oregon Department of Forestry Headquarters on 2600 State Street, Salem, OR 97310.

All Board members joined online by 8:30 a.m. into Zoom webinar. Chair Imeson called the public meeting to order at 9:00 a.m.

Board Members Virtually Present:

Jim Kelly
 Cindy Deacon Williams
 Brenda McComb
 Joe Justice
 Mike Rose
 Tom Imeson

Board Members Absent:

Nils Christoffersen

CONSENT AGENDA:

- A. JANUARY 7, 2020 SUBCOMMITTEE ON FEDERAL FORESTS MEETING MINUTES
Approval of Board’s Subcommittee Meeting Minutes.
ACTION: The Board approved minutes from the January 7, 2020 Subcommittee on Federal Forests meeting.
- B. JUNE 3, 2020 BOARD OF FORESTRY MEETING MINUTES
Approval of Board Meeting Minutes.
ACTION: The Board approved minutes from the June 3, 2020 meeting.
- C. 2020 BOARD GOVERNANCE PERFORMANCE SELF-EVALUATION
Approval of the completed annual Board of Forestry self-evaluation for 2020, using its adopted governance performance measure.
ACTION: The Board proceeded with alternative one and approve the summary evaluation report as the conclusion of the 2020 self-evaluation process.
- D. COMMITTEE FOR FAMILY FORESTLANDS APPOINTMENT AND REAPPOINTMENTS
Approval of the appointments and reappointments for members of the Committee for Forestlands (CFF).
ACTION: The Board approved the appointment of Wendy Gerlach (Attachment 2) as the citizen at large category representative. The Department also recommends reappointing Mark Vroman as the Forest Industry category representative of the CFF.
- E. WILDLIFE FOOD PLOTS RULEMAKING
Directed by the legislature and the Board of Forestry, the Department developed rules to implement Oregon Revised Statute (ORS) 527.678 “wildlife food plots”. To close the Administrative Procedures Act (Chapter 183) process, the Board to approve adoption of the proposed final rules.
ACTION: The Board approved and adopted the Proposed Final Rule Language as submitted (Attachment 3).
- F. DEQ AND ODF COLLABORATION QUARTERLY UPDATE
Department of Forestry and the Department of Environmental Quality (DEQ) provided an update to the Board about the collaborative efforts the agencies are working towards to better understand and align their respective water quality programs.
INFORMATION ONLY.
- G. PERMANENT RULEMAKING FOR SALMON, STEELHEAD, AND BULL TROUT STREAMS IN SISKIYOU REGION
Adoption of rules to make the 2017 board rules regarding salmon, steelhead, and bull trout applicable for the Siskiyou Georegion, as directed by the Oregon Legislature (i.e., Senate Bill

1602). These rules shall be effective January 1, 2021. The rule would enact stream protections on small and medium fish bearing streams in the Siskiyou Georegion consistent with stream protection rules on salmon, steelhead, and bull trout streams already in effect in the rest of western Oregon.

ACTION: The Board,

- 1. Directed the Department to stop the Siskiyou salmon, steelhead and bull trout temporary rule making process.**
- 2. Determined the permanent rulemaking occur under ORS 527.714 (1) (b).**
- 3. Directed the Department to adopt permanent rules for salmon, steelhead and bull trout streams in the Siskiyou Georegion.**

Mike Rose motioned for approval of the consent agenda items. Cindy Deacon Williams seconded the motion. Voting in favor of the motion: Cindy Deacon Williams, Joe Justice, Jim Kelly, Brenda McComb, Mike Rose, and Tom Imeson. Against: none. With Board consensus Items A through G were approved, and the motion carried.

ACTION AND INFORMATION:

- STATE FORESTER AND BOARD MEMBER COMMENTS**
[Listen to audio](#) MP3 – (27 minutes and 18 seconds – 9.37 MB)

Chair Imeson commented on:

- Outlined Board proceedings for Board members, presenters, and the public.
- Noted the public meeting will be live streamed, recorded, and posted online.
- Announced Executive Session, pursuant to ORS 192.660 (2)(f) for public and media.
- Noted written public testimony can be submitted through August 5, 2020, and included with the meeting record.

State Forester Daugherty commented on:

- Overview of the State's response to systemic racism and inequality. Reviewed Governor Brown's and Department of Administrative Services (DAS) efforts to centralize budget and policy around racial justice, as well as address the inequalities existent in the COVID-19 pandemic. He reinforced the Department's dedication to diversity, equity, and inclusion by reviewing how agency leadership are reframing policy analysis. He provided an example illustrating how these issues tie to recent Department policy efforts.
- Described how he missed an opportunity to provide a strong vision statement that emphasized the Departments' commitment to be a leader in climate adaption and mitigation. Explained how Department staff, along with the guidance from the Governor's office, will reframe the climate vision and action plan using the lens of racial justice and social equity. Noted revisions will be brought in front of the Board as they consider revising Goal G from the Forestry Program for Oregon.
- Discussed the 42nd Special Session topics focused on COVID-19 response and police reforms, but passed Senate Bill (SB) 1602 regarding implementation of responsible forest management practices. He mentioned another special session may occur in August, with the focus on rebalancing the budget for the remainder of the 2019-2021

biennium. Listed and described the current agency reductions, and noted how this trend may prolong through two bienniums.

- Provided a high-level preview of fire season readiness topic by outlining the collaborative efforts of the Department staff, leadership and agency partners to prepare for COVID-19 on the ground. He described the coordinated response, operation mitigation measures, best management practices, and specific COVID-19 safety protocols in place. Thanked the health partners for their assistance to the Department in providing for the health and safety of the firefighters.
- Elaborated further on the enrollment of SB 1602 and what this meant for the Department's efforts in management of non-federal forests, highlighting the changes to protection requirements of these forests. He explained how the Department is excited by the strong collaborative effort taking place to develop long-term solutions for Oregon's forests. He reviewed the actions to be taken by the Governor's office, Leaders of the industry and conservation groups, the Department and Board of Forestry. Noted fund allocation for 2019-2021 and 2021-2023 biennium, as well as a shift to the Board's Private Forests work plan.
- Provided a fire finance update to the Board about the Department securing a one-year loan through the State Treasury, and explained the borrowing agreement conditions. Noted this resource places the Department in a better position for managing the 2020 fire season, but does not provide a solid financial solution for the Department, and reminded the Board about the cost-containment measures in effect until further notice.
- J.E. Schroeder expected to have the largest harvest ever, that equates to 30-40 million seedlings, and with tree improved seedlings, and timber harvest may yield an extra 30% per acre. NRCS partnership agreement signed for an additional five years that continues alignment of key landowner programs administered by Private Forest and Federal Forest Initiative programs.

Board Member Comments: None

Public Testimony: No provision made for public testimony.

Information Only.

2. 2021-2023 AGENCY BUDGET REQUEST

[Listen to audio](#) MP3 – (13 minutes and 19 seconds – 4.57 MB)

Presentation ([attachment 1](#))

Bill Herber, Deputy of Administration, introduced the main presenter James Short, Assistant Deputy Director for Administration. Short explained the four major phases of the agency budget process, described how the budget is designed within the various systems, and outlined when budget modifications are made. He reviewed the 2021 to 2023 current service levels by each program area, the policy option packages (POP) and the percentage of fund types for the enhancement packages proposed this biennium. He compared the 2021-2023 agency request budget to the 2019-2021 legislatively adopted budget, differentiating by fund amount, by position, and full-time equivalent (FTE) counts. Short reviewed the next phase of the budget process, listing next steps and who are involved with this phase. He closed by offering a staff recommendation.

Board members commented on the 2021-2023 Agency Budget Request Presentation.

- State Forester Daugherty explained how current service levels are technically calculated, and described how the Board can weigh in on the policy enhancement packages by offering insight on prioritization of what the agency may need to additionally invest in to become more successful. He reviewed the reasoning behind the current policy enhancement package order as presented, and noted this is the time for the Board to provide direction to the Department on re-prioritization.
- Board inquired clarity on the ratio of the budget split for the fire protection budget in 2021-2023 biennium, and the State Forester confirmed that our current service level is based on a 50/50 split. Board member expressed to focus on core business and what needs to be accomplished by the Department when prioritization is considered. Herber added that principally these enhancement packages are designed as a general fund request and not part of a typical split similar with the base budget.

Public Testimony: None

ACTION: The Board approved the 2021-2023 Agency Request Budget; reviewed and approved, in concept, the Board letter of transmittal to the Governor; and authorized the Board Chair to sign the letter following final drafting and directed the Department to submit both documents concurrently to the Department of Administrative Services by the August 31, 2020 deadline.

Joe Justice motioned for approval of the staff recommendation for the 2021-2023 agency request budget, as presented. Mike Rose seconded the motion. Voting in favor of the motion: Cindy Deacon Williams, Joe Justice, Jim Kelly, Brenda McComb, Mike Rose, and Tom Imeson. Against: none. With Board consensus the motion carried.

3. FINANCIAL UPDATE WITH DASHBOARD DESIGN REVIEW AND CONTRACTOR RECOMMENDATIONS

[Listen to audio](#) MP3 - (45 minutes and 19 seconds – 15.5 MB)
Presentation ([attachment 2](#))

Bill Herber, Director for Administration, outlined the predominant theme for the presentation, the Department's ever-evolving financial condition, improvements being implemented, and recommendations generated by external contractors. He noted that there are institutional challenges with an older financial system, and categorized the three pillars of this system as budget, finances, and accounting. He reviewed the intention for the biennial budget process, explained how the legislatively approved budget compares with the legislatively adopted budget, and described the budget pattern that takes place every short session to cover the costs of fire suppression. Explained how revenue authorities work, how they are tracked, and administered. He mentioned that understanding the financial condition of an organization is broader than looking at how a budget is executed.

Herber applied an accounting perspective to the biennial budget, by providing comparison overviews on gross revenue and expenditures to date. He discussed the finance aspect of the biennial

budget through accounts receivables, sharing how outstanding receivables contribute to triaging repayment to private, local government, state, and federal partners. He remarked on the new system that will track outstanding accounts receivable for more timely collection results. Discussed large fire cost recovery efforts over the last year, noting the largest invoiced amounts belong to the Federal Emergency Management Agency, but appreciated the stewarding done by the State Forester and Fire Protection Division Chief to facilitate these reconciliations. He reviewed the accounts payable duration and explained that OregonBuys system was implemented to automate the purchasing and payment processes in the Department.

Herber described the Department's cash availability condition, how the expenditures cycles and disbursements contribute to this condition, outlined the drivers for the expenditure and revenues by highlighting the large payments made in fiscal year 2019-2020. He introduced State Forests Division Chief to review the State Forests financial metrics. Dent highlighted five elements included in the metric: trends actual and projected, total revenue generated by division operations, county revenue dispersed, department revenue to operate, and division expenses. She described each metric element, outlined the drivers for projection development, explained how projected trends may require adjustment overtime, and noted the tools utilized by the Division to maintain financial certainty. She highlighted the forest development fund balance for fiscal year 2019-2020, remarked on timber market and contract trends, and how they influence this fund balance.

Herber reviewed the projected balance for the 2019-2021 biennium, described the financial and accounting elements overlaid to forecast financial position given the projected fire season costs. He described the range of fire season scenarios, costs associated, and the prudent balance needed to maintain core business operations through all scenarios. He reflected on the insight that can be provided by data, explained the struggle to track relevant data from disparate systems, and stated how a centralized, controlled system is ideal to manage the inoperability of the dissimilar systems. He described the online fiscal reporting system (OFRS), the function of this system, as well as its role in the Macias Gini O'Connell (MGO) recommendations. He updated the Board on recent production server installations that will be the backbone for all Department intelligence systems and help operationalize the various systems' components. Herber provided a sample dashboard, highlighted the projected information the real-time dashboard could provide, and stated the monthly reporting goal for these dashboards.

Herber offered a high-level summary of the recommendations set forth by MGO, explained how these recommendations overlap and have changed as MGO awareness of the Department's business increases. He explained how the contractor discovered that the recommendations outlined by MGO were already in process of being implemented by the Department, and changed their contractor role to support the Department as they continue their efforts in addressing the issues identified. He reported on the general themes of the MGO recommendations, listed the significant areas to focus on under each theme, and discussed the next steps with the Executive Team.

Board members commented on the Financial Update with Dashboard Design Review and Contractor Recommendations presentation.

- Congratulated the administrative team on their work completed for large fire cost collection. Suggested modifying the aging accounts receivable graph to include any outstanding costs greater than 180 days. Herber explained how the team is working with Federal partners to

better understand how they pay out revenue and are working to align the Department's data for developing more efficient processing practices, but noted how the current duration of time for repayment is two to four years. Board appreciated the thorough report on this topic.

Public Testimony: None

INFORMATION ONLY.

4. **FIRE SEASON READINESS**
[Listen to audio](#) MP3 - (38 minutes and 49 seconds – 13.3 MB)
Presentation ([attachment 3](#))

Ron Graham, Fire Protection Deputy Chief, provided an overview of the presentation and introduced fellow presenter Brett Weidemiller, Assistant Unit Forester, and described how the recent shift in weather has increased the fire potential in Oregon.

Graham reviewed drought monitoring across the state, the number of counties in drought, and the predicted temperature outlook for August 2020. He explained how above normal temperatures are projected for August through October 2020 with minimal outlook for precipitation. He described the conditions that indicate a significant wildland fire potential for the western part of the country over the next three months. He reviewed the fire stats year-to-date for July 2020, noting a 96% of fires were suppressed at 10 acres or less. Commented on the Department's large fire costs, that no fire has qualified for FEMA FMAG grant assistance to date, and acknowledged key leaders in the organization for their efforts towards process improvements on account cost recoveries. He highlighted the coordinated training efforts with the National Guard and DPSST to provide additional type two hand crew resources.

Weidemiller provided an overview of the COVID-19 preparedness and operationalization conducted by the Incident Management Team (IMT) Fire Camp subcommittee. He reviewed the subcommittee composition, purpose, and planning measures. He highlighted the COVID-19 prevention and response guidelines, the module structure, and coordinators' function. He noted that the subcommittee has concluded, for they have accomplished their objectives and believed what was produced will work for future camp scenarios, if COVID-19 continues to be a concern.

Graham thanked Weidemiller and Coos Forest Protective Association Manager for their contribution to this assignment. He explained the new strategic investments to help forestland protection, including night vision and infrared mapping systems have been implemented for aviation deployment. He reviewed the importance of the aviation program and resources as it partners with coordinated ground attack efforts. Graham shared the statewide briefing map, describing the suppression response for a few fires on the landscape, and stated no incident or interagency management teams has been deployed to date.

Graham highlighted a new joint project with the Department and Oregon State Fire Marshall (OSM) partnered developed by Intterra, a situation analyst product. He described who participated in beta-testing, who led the project, and how the product works. He appreciated how this tool is now available for statewide use by agencies and partners. Graham closed by showing the real-time

operation of the Intterra product to the Board, and listed the product's benefits as another part of the complete and coordinated fire system's toolkit.

Board commented on Fire Season Readiness presentation.

- Board Chair Imeson inquired whether the Department is appropriately resourced to implement the planned operations outlined in Weidemiller's report. Weidemiller expressed yes, describing the opportunities that helped develop and vet the system in place.
- Board mentioned the wildland fire protection act, the importance of strategic investments, and the unique relationships between agency partners and landowners in Oregon. Inquired about two items, what the resources are like across the west and how COVID-19 has impacted Federal partner's suppression tactics. Graham addressed resource availability proactive planning to retain Oregon-based resources as the state approaches severe fire potential in the coming months, and limited importing out-of-state teams. He explained how the Department is diligently tracking regional and national fire resources, to ensure they are available when Oregon fire crews needs them. Graham expressed that Federal partners have actively engaged in fighting fires, communication has been effective, and so far, committed to full suppression. State Forester Daugherty asked about the US Forest Service adding aviation resources housed in Oregon, and Graham confirmed that helicopters were added to the national inventory.

Public Testimony: None

INFORMATION ONLY.

5. *EXECUTIVE SESSION

Chair Imeson proceeded with the formal Executive Session announcement.

The Board of Forestry entered into Executive Session for the purpose considering information or records that are exempt from disclosure by law. [ORS 192.660(2)(f)].

No decisions were made during Executive Session. The Board exited the Executive Session at 12:18 p.m.

INFORMATION ONLY.

6. COMMITTEE FOR FAMILY FORESTLAND ANNUAL REPORT

[Listen to audio](#) MP3 - (27 minutes and 40 seconds – 9.49 MB)

Presentation ([attachment 4](#))

Josh Barnard, Private Forests Deputy Chief, introduced the presenters for the topic, Evan Barnes, Chair of Committee for Family Forestlands (CFF) and Barrett Brown, Northwest Landowner Committee Representative. Barnard provided an overview of the presentation, offered background on the Board's advisory committee function and goals, as well as how they work with the Department.

Barnes discussed the CFF report highlighting the committee's involvement with the Governor's Wildfire Council Report, explaining how fire is the nexus for much of family forestland owners

operations, and listed the issues behind securing funding for the report's recommendations. He noted other areas CFF has interest in, such as the passage of House Bill 2469 for succession planning on forest properties and the progress of the Memorandum of Understanding. Barnes closed by stating this was the last year of his term, and appreciates how vibrant CFF is becoming with new appointees joining the committee.

Brown reviewed a few initiatives undertaken by the committee over the past year, and reported on forest landownership generally. He mentioned how CFF has aligned their work plan with the Board's, to optimize timing and utility of the advice provided. He shared the key updates and work done to revise the committee's charter. He acknowledged fellow CFF member, Kaola Swanson, in helping define internal processes to provide formal advice to the Board, and he described the general process to the Board.

Brown provided an example of forestland ownership and management by describing his own tree farm located in Washington County, with 110 acres in an urban interface. He explained how forest management has changed over time and recognized that building a suite of values provides landowners options. He stated the importance in tracking how these values (e.g., recreation) may change over time, and how these values and management styles may be different across the spectrum of forestland owners. Brown shared data on forest ownership in Oregon, and presented a video about a stream restoration project called Restoring the Tualatin: East Fork that involved multiple landowners and agency partners ([link](#)).

Board commented on the Committee for Family Forestland Annual Report presentation.

- Board appreciated the presentation and commended the committee on their efforts in developing a process that forms substantive advice brought forward to the Board. Noted the role committees have in conjunction with the Board's work. Continued to thank the committee for their work on the charter, appreciated the clarity included, and key issues outlined by the committee. Commented on the narrative provided by Mr. Brown, appreciated how he linked the evolution of forestland ownership with his personal story.
- Board pinpointed the importance of recognizing the challenges that regulations put on small private forestlands.
- Board reflected on the CFF's interest to share data from the national survey conducted on family forest values, and encouraged the committee to return to the Board with this information.
- Board expressed concern for family forest viability in eastern Oregon. Encouraged working together to pinpoint the underlying causes, to better design appropriate policy and program responses towards addressing that issue. Barnes stated CFF is aware of the existing issues in eastern Oregon, and stated a goal to hold a meeting in the region in the future. Brown planned to bring some information to the next CFF meeting from Cascades to Coast Landscape Coalition on how to keep forests working, increasing forest viability, and consider landscape design to achieve habitat conservation values.
- Barnard confirmed with the Board whether they accept the CFF annual report and charter. The Board was prompted to take action on item #6 upon conclusion of item #7, Forest Trust Land Advisory Committee testimony. Board made motion to accept the CFF report and updated CFF Charter.

Public Testimony: None

ACTION: The Board accepted the CFF annual report and updated CFF Charter.

Cindy Deacon Williams motioned to accept the CFF Charter and annual CFF report. Mike Rose seconded the motion. Voting in favor of the motion: Cindy Deacon Williams, Joe Justice, Jim Kelly, Brenda McComb, Mike Rose, and Tom Imeson. Against: none. With Board consensus on approval, the motion carried.

7. **FOREST TRUST LAND ADVISORY COMMITTEE TESTIMONY**

[Listen to audio](#) MP3 - (10 minutes and 12 seconds – 3.5 MB)

Chair of Forest Trust Land Advisory Committee (FTLAC) did not attend the Board meeting, and did not provide written testimony.

Commissioner Testimony:

- Dick Schouten, Washington County Board of Commissioners, provided oral testimony under the Forest Trust Land Advisory Committee (FTLAC) topic. He offered some information on the county's size, timber production, and number of acres part of Tillamook State Forest. He appreciated the recent State Forests Division presentation delivered to the Commission. Aired support for the Greatest Permanent Value rule recognizing the importance of timber harvest and revenues, but also noted how county residents value recreation, habitat conservation and clean water. Recognized the County's Board of Commissioners actions taken in 2013, and endorsed the Department to implement conservation areas on state forest lands, as well as encouraged State policymakers to pursue sound forest policies that acknowledges the benefits and values of all forest resources. Noted that the Washington County Board of Commissioners support the Habitat Conservation Plan (HCP) and appreciated the benefits of certainty this plan could provide to the public and to timber harvests. Looked forward to engaging in FTLAC meetings, and encouraged Chair Yamamoto to start meeting again.
- Kathleen Sullivan, Commissioner for Clatsop County, provided oral and written testimony ([attachment 5](#)) on the Forest Trust Land Advisory Committee (FTLAC) testimony, stated she spoke as an individual commissioner. She continued to support the work on the Habitat Conservation Plan (HCP), understanding how this plan can bring certainty in revenue and conservation. She explained her position behind opting out of the Linn County lawsuit, and noted the continuing litigation. Commented that Clatsop County depends on revenue generated from state forests lands. Offered her perspective on the HCP and utility of the plan for the county. Thanked the State Forests Division team for providing ongoing information regarding the development and process for the HCP. She appreciated State Forester Daugherty and Board Chair Imeson's July 14th letter sent to all Commissioners of the Forest Trust Land Counties. Concerned about the lack of connection and communication between FTLAC and the Board of Forestry. She noted the difficulties and challenges all counties and their citizens are facing. Asked for open and transparent communication between Forest Trust Land Counties to conduct business in public. Thanked the Board members for their continued service.

Board commented on the Commissioners' testimony and the FTLAC processes.

- Board thanked each Commissioner for their comments, and encouraged them to come together with the other Commissioners to consider operationalizing the advice process FTLAC provides to the Board. Referred to CFF recent charter revision as an example of clear standard operating procedures, communication involved, and elevates utility of advice.

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State Forester Daugherty noted that there was a recommendation that the Board will need to consider and vote on, to accept the Committee for Family Forestlands charter and annual report, before the next topic is heard. He stated the revised charter provides new governance procedures. Motion and voting is included under topic item #6.

8. STATE FORESTS HABITAT CONSERVATION PLAN UPDATE
[Listen to audio](#) MP3 - (One hour, 54 minutes and 15 seconds – 39.2 MB)
Presentation ([attachment 6](#))

Liz Dent, State Forests Division Chief, outlined the planning work that will be presented to the Board for the Habitat Conservation Plan (HCP). Dent provided a background on the HCP phased approach, reflected on the phase completed, and commented on the next phase in the planning process. She explained the multitude of the work completed and collaborated on with the help of agency partners, consultants, contractors, staff, scoping team, and steering committee. She introduced the various presenters for the presentations, beginning with staff: Brian Pew, State Forests Deputy Division Chief, Mike Wilson, State Forests Resource and Information Unit leader, and Cindy Kolomechuk, State Forests HCP Project Manager. Dent proceeded to introduce contractors: Troy Rahmig from ICF and Brett Brownscombe from Oregon Consensus. She shared her appreciation for those involved in the scoping team and steering committees from state and federal agencies and concluded introductions by recognizing Paul Henson with US Fish and Wildlife (USFW), State Supervisor, and Kim Kratz with NOAA fisheries, Assistant Regional Administrator for the Oregon and Washington Coastal office, as additional presenters on this topic.

Henson shared his perspective on the Western Oregon HCP process and described his experience working on several HCPs across the State. He provided an overview of the general HCP process, explained how 'take' can be portrayed as timber harvesting, but can be interpreted as many other economic activities. Explained that the common theme for the HCP examples he listed is that they are laborious, challenging, and involve a public process with a lot of competing priorities discussed over time. He stated it is better to complete an HCP than to not, for the amount of time, work, and commitment dedicated to this open process. He commented on the USFW service grant program function, how the Department received two grants, and how the funds are utilized for the HCP planning process. He offered his thoughts on the Department's approach to this HCP process, shared foresight on future work, and believed the process could be completed and a permit could be issued within the timeframe outlined.

Kratz aired support on behalf of NOAA fisheries for the continued development of the Western Oregon HCP. He appreciated being apart of the collaborative and robust process, emphasized his commitment to the process, and noted how an HCP could support economic viability and promote

the conservation of species. He explained the process will be difficult, but the potential outcomes are worth it and could address the economic, social, and other environmental goals for the State of Oregon. He declared that collaboration remains a priority for NOAA fisheries, because of the significant value the biological and ecological security to habitat for salmonids within the geography of the HCP, as well as provide economic viability and stability for the management of Oregon's forests and communities.

Dent reviewed the geographic scope for the HCP, explained that many HCPs are being pursued or contemplated across Oregon, and it is important to not compare these plans because each one is based on a landowner's objectives, mandates, and management of land-based conditions. She provided an overview of the material to be presented, noting that some material included is preliminary, but has been shared with the public and appreciated their continuing engagement with this process. She shared her perspective on the growing complexity and challenge in managing state forestland base without a HCP, outlined some drawbacks if a HCP is not completed that could create future issues for the Department and Board.

Kolomechuk reflected on the collaborative work produced with the scoping team and steering committees in developing the first administrative draft of the HCP. She explained the focus and objectives for this work, how the drafted chapters lay the foundational elements for the HCP, and outlined the next steps with timelines for this work if the decision to proceed with the National Environmental Policy Act (NEPA) process is made by the Board. She commented that if the decision is made to move forward, these two teams will begin working on the refinement of the administrative draft and companion Forest Management Plan (FMP). She reminded the Board that the NEPA timeline operates within the confines of their process, but anticipated that the HCP will maintain its current trajectory for completion in June 2022. Kolomechuk spoke to the tribal engagement with the Department during this planning process, and dedication to honoring their interests in the lands that the Department is currently managing.

Brownscombe reviewed the external engagement process with stakeholders and counties. He provided an overview of the scheduled public engagement and additional efforts to engage stakeholders and advisory committee members to discuss the issues or components relevant to the potential HCP. He summarized the feedback received from these participants and listed the themes heard. Reviewed the coordinated efforts to engage the county commissioners and maintain working relationships. He explained the Forest Trust Land Advisory Council (FTLAC) venue was unavailable, and how outreach has evolved amidst COVID-19 to ensure Commissioners gain information about the HCP process. He relayed the importance to keep engagement pathways open for county leadership feedback throughout the process. He described how these meetings are scheduled, facilitated, and followed up on to ensure feedback received is clarified, and integrated into the process, working drafts, or planning the next steps. He reminded the Board about the purpose of the HCP, shared the diversity of perceptions and interpretations on the elements included with the HCP, and framed up the limitations that exist with accepting some of the feedback. Noted that NEPA will include a public engagement process separate from the Department's, and acknowledged the Department's robust outreach effort was not obligatory and represents additional commitments by the department to engage stakeholders. Brownscombe closed by listing the next steps for the planned outreach, who will be involved, and what will be discussed before the October 2020 Board meeting.

Wilson explained the purpose of the strategy and design for the riparian conservation strategy. He discussed the updates to the aquatic conservation strategy and addressed key processes of the strategy, as well as explained the function and objectives of riparian conservation areas (RCA). He provided additional details on the aquatic zones and the implementation of horizontal versus slope distance. He defined an RCA buffer, described the various buffer widths, and explained how they are differentiated by stream type, high energy or debris flow conditions, and fish presence or absence. He shared some examples of stream buffers to illustrate how buffers can vary by stream type across the landscape. He explained how ODF and ICF worked with Terrainworks on aquatic modeling to validate the adequacy of the RCA strategies. He outlined the objectives of aquatic modeling, listed the conditions modeled, the data points used, and the reason why each set of conditions were modeled. He also noted what was not modeled. Wilson stated the aquatic modeling results support the RCA's effectiveness for wood recruitment and temperature protection. Explained how the RCA's operate to recruit wood over the term of the permit and to protect streams from warming located in the permit area. He highlighted how road management and targeted restoration activities are important conservation strategies that will be included with the riparian conservation strategy. He outlined the management objectives, funding stability, and examples of the processes associated with these efforts.

Wilson discussed the terrestrial conservation strategy, listed the strategy's objectives, and defined habitat conservation areas (HCA). He explained the function of HCA's, how boundaries of HCA's are designated, and how HCA's objectives will be met with passive and active management. He noted the goal of this management in HCA's is to increase the quality and quantity of habitat over the permit term. He reviewed the silviculture treatments projected, why these activities were selected, and the anticipated outcomes from these treatments within the permit term. He remarked on how the management of HCA's varies, and listed some elements that are considered for a management plan. Described the process for modeling habitat suitability, referenced the data points used, and consulted with model authors. He discussed the compliment of RCA and HCA strategies, and how together they provide a robust conservation strategy to meet the biological goals and objectives for the covered species included in the HCP.

Pew reviewed the forest goals and objectives of the HCP. He commented on the utility of these goals and objectives as a way to ensure that greatest permanent value (GPV) is considered as the HCP is being developed, and will lay the foundation for the companion forest management plan (FMP). He outlined the three elements of GPV, defined each element's goals, and described how objectives will also be developed, if the companion FMP is decided on. He explained how these social, economic, and environmental forest goals were developed internally and with stakeholders as part of the HCP process.

Pew discussed policy level forest management modeling, described it as a technical tool used to test concepts, to help understand outcomes and support the decision making process. He expanded on how this modeling tool contributes to refining GPV concepts, approaches, and strategies as well. He commented on the upcoming comparative analysis, defined the analysis as a tool for business decisions, and outlined the preliminary work on the analysis. He explained that modeling will continue to be refined for a full range of GPV projected outcomes and will contribute to the HCP development effects analysis. He reviewed parameters for the modeling outputs, by listing what will be and will not be evaluated. Pew defined the geographic regions the HCP would apply to and

described the variables considered within these regions for determining the companion FMP. He familiarized the Board with terms and definitions that will be included in the comparative analysis. He provided an in-depth review of five modeling elements. He highlighted the projected process, frequency, and plan to report out on timber harvest volume outcomes over the permit's duration. Pew reviewed the projected harvest volume average, per permit area, within the 70-year permit term. He outlined the HCA design configuration, management activity refinement, model improvements, and silviculture practices work that will be completed over the next two months, which will inform the comparative analysis.

Dent reviewed the Division's work next steps on the draft Western Oregon HCP, the upcoming presentation on the draft revised Western Oregon FMP, as well as the county and public engagement planned before the October Board meeting.

Board commented on the State Forests Habitat Conservation Plan Update presentation.

- Board Chair Imeson thanked Henson and Kratz for their participation in the process and the discussion with the Board.
- Sought clarification on what approach was used for modeling the average timber harvest volume outside of the HCA and RCA, the draft revised FMP, or another approach. Pew stated the draft revised FMP approach was utilized but with less structure-based management, and offered examples of the elements considered for that approach.
- Board Chair Imeson inquired about the departure from the average annual growth over seven years, and when it will be anticipated to occur. Pew emphasized this will occur within seven-years but spread out over time. He explained that the HCP permits the take of the habitat which affects harvesting levels, but federal services do not permit the Department's harvest levels. He described when the harvest levels will be above average, level out, go below, and return to above average over the permit term as the goals for the species are fully achieved and Oregon's forests continue to grow.
- Asked whether the volumes include HCA restoration activities on HCA designated acres and whether these restoration efforts in increasing the quality of habitat are reflected in the numbers. Pew remarked yes, then referenced the management activities that were designed to benefit the species, but also produce volume. He anticipated that further modeling will refine the numbers. The board member further inquired about how the plan will define the scale and size of HCA designated acres for projected restoration activities. Pew explained these elements are being categorized broadly and provided restoration activity examples tied to geographic areas. Wilson offered a more specific example on a Swiss needle cast restoration activity and projected rehabilitated acres within a conservation area. He explained how the modeling is working on refining thresholds and frequency for management, but noted the modeling objective for the HCP was not designed to speak to potential volume production.
- The Board Chair asked whether the harvest numbers, as presented, are consistent with the anticipated numbers from the business case. Dent explained at the time of the business case several assumptions were made as the conservation strategies were not available to drive the model outcomes. Dent and Wilson outlined the main differences between the numbers presented now versus then and stated the business case was predicated from the current FMP but believed the trends were correct in the business case analysis overall. Dent stated that these trends are what was anticipated back in fall 2018, noted the main difference is between

the assumptions made, and explained considerations for managing the land base in a couple of different ways: restoration to further conservation objectives, and age-related framework, which is different from the structure-based management of the current FMP.

- Asked for a reminder on when the decision is scheduled for accepting the revised FMP as the companion to the HCP, relative to the final decision on an HCP. Kolomechuk reminded the Board that the draft revised FMP will be utilized as the base for the companion FMP for the HCP. She highlighted the portions of the draft revision that will be used for the companion FMP and outlined when this work will be brought in front of the Board for consideration and direction over the next two years. Board commended the Division in working with federal agencies on habitat restoration. Suggested for the companion FMP to include species that could be listed in the future and consider how to actively manage stands and harvest timber with minimal risk to species.
- Requested further clarification around how the lands were designated and the approach for this initial modeling. Pew expressed the sheer land base is large with well-managed forests and explained this land has a variety of age classes with older stands that means habitat for endangered species. He noted the Department is attempting to secure a permit for multiple species, some listed and some that are anticipated to be added to the endangered species list in the future. He reflected on the Department's commitment to supporting and surveying species, and how they house a strong data set on those species that speaks to their conservation work.
- Inquired further about the difference between the business case and preliminary analysis. Pew explained the trend lines look the same, but the numbers and assumptions have been recalibrated over the past two years as the HCP development progressed. He reviewed the quality and quantity of the habitat as it relates to the take permit, as well as the benefits to the species over time. He explained HCAs are set numbers but the habitats within the HCAs are not set numbers, and not all habitats are set within HCAs. He reviewed the benefits as it related to the quality of habitat and the tradeoffs as it related to the number of habitats with balancing management plans, implementing GPV, and services. Dent clarified that the comparative analysis will be a refined version of the business case. She clarified the trends are based on different assumptions, reviewed the differences between the business case and comparative analysis, and prepared the Board that these changes, as well as impacts, will be discussed at the October Board meeting.
- Confirmed the number of species included with the permit and number of them not currently listed. Kolomechuk noted 16 species are being considered in the modeling, but six of those species are not currently listed. Recommended to include with the comparative analysis the level of certainty gained by adding those six species versus using the current take-avoidance approach. Kolomechuk reinforced that this aspect is the cornerstone for the business case analysis to anticipate what those future encumbrances maybe, she explained further modeling is planned and noted how more information will be provided in the comparative analysis to help respond to the Board's questions. She closed by explaining this is a policy decision on balancing uncertainty and certainty in the management of our forests over the next 70 years. State Forester Daugherty appreciated Kolomechuk's clear explanation of the work presented, how it has changed over time and relative to the policy decisions in front of the Board. He refreshed the Board of the intent for the business case and how that contributed to the Board's decision to move forward with the HCP. He provided more context on the

decision that will be in front of the Board in October and was hopeful the information presented at that time will offer some insight that can help the Board with their decision.

Invited Testimony:

- Seth Barnes on behalf of Oregon Forest Industries Council (OFIC) provided written testimony ([attachment 15](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Noted involvement in the development process of the HCP, and shared concern of annual harvest volume projections difference from the business case analysis. Believed a better forest management plan can be produced to achieve the twin goals of conservation and financial viability. Stated OFIC does not support the HCP as proposed.
- Bob Van Dyk submitted written testimony ([attachment 19](#)) on behalf of Moskowitz et al on the State Forests Habitat Conservation Plan (HCP) Update. Stated support for the continued development of the HCP and asked that the HCP be a top priority for the Department. Requested maps of the habitat conservation areas for terrestrial species and the Board to direct staff to model the proposed HCP in comparison to the current forest management plan. Encouraged the Board to reach out to county commissioners for input on the HCP.

Public Testimony:

- Rex Storm on behalf of Associated Oregon Loggers provided written testimony ([attachment 7](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Stated opposition to the conservation measures and modeled outcomes in the proposed HCP for western Oregon state forests.
- Ron Byers provided written testimony ([attachment 8](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Stated support for the proposed HCP for western Oregon state forests and the reasons for his support.
- Clark Chesshir provided written testimony ([attachment 9](#)) on the State Forests Habitat Conservation Plan Update. Urged sustainable management to maintain habitat and provide ecosystem services.
- Kurt Englund on behalf of Englund Marine & Industrial Supply provided written testimony ([attachment 10](#)) on the State Forests Habitat Conservation Plan Update. Concerned about proposed nature reserves and urged support for rural communities.
- Heath Curtiss on behalf of Hampton Lumber provided written testimony ([attachment 11](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Raised questions on conservation measures, commitments, and annual harvest volume. Shared concern for the proposed HCP and potential losses to rural Oregon communities.
- Denise Harrington provided written testimony ([attachment 12](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Stated support for the proposed HCP for western Oregon state forests.
- Kim Kotter on behalf of Oregon Women In Timber provided written testimony ([attachment 13](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Noted the long-term impacts of the HCP and to consider jobs, sustainable fiber supply, and economic impacts.
- North Coast Communities for Watershed Protection provided written testimony ([attachment 14](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Appreciated the Department and Board's effort to create a more balanced plan for our state

forests. Listed a series of questions for the Board and Department to consider as this HCP is developed.

- W. Ray Jones and Scott Gray on behalf of Stimson Lumber Company provided written testimony ([attachment 16](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Shared concern for projected harvest volumes, habitat conservation areas, riparian conservation areas, and conversion of underproductive lands in the proposed HCP. Believed the HCP coupled with the forest management plan does not represent a balanced approach to managing the State forestlands' assets. Encouraged the Department to develop a comparison that demonstrated the costs and benefits of each plan that will provide transparency for stakeholders and inform the Board's decision.
- Eric C. Thompson on behalf of General Trailer Parts LLC provided written testimony ([attachment 17](#)) on the State Forests Habitat Conservation Plan Update. Shared concern for current proposed HCP. Urged a reconsideration of the plan to ensure obligations to counties and rural communities are met by enacting responsible harvest levels on State lands.
- Sara Todd provided written testimony ([attachment 18](#)) on the State Forests Habitat Conservation Plan (HCP) Update. Stated support for the proposed HCP for western Oregon state forests and the reasons for her support.
- Susan Walsh provided written testimony ([attachment 20](#)) on the State Forests Habitat Conservation (HCP) Update. Stated support for the proposed HCP for western Oregon state forests and the reasons for her support.
- Kathryn Harrington on behalf of Washington County Board of Commissioners provided written testimony ([attachment 21](#)) on the State Forests Habitat Conservation Plan Update. Stated continue support for the Greatest Permanent Value rule. Appreciated State Forest Division efforts in presenting information on the proposed HCP. Encouraged the Board to pursue forest policy that acknowledges the value and benefits of all forest resources, and support the adoption of an HCP for Oregon state forests.
- Campaign titled *Continue smart, sustainable forestry* provided written testimony ([attachment 22](#)) on the State Forests Habitat Conservation Plan Update and asked that the plan include timber harvest assurances.
- Campaign titled *Oregon Forests Forever* provided written testimony ([attachment 23](#)) on the State Forests Habitat Conservation Plan Update and asked that the plan include timber harvest assurances for Oregon revenue.
- Campaign titled *Please protect our rural communities* provided written testimony ([attachment 24](#)) on the State Forests Habitat Conservation Plan Update. Requested that the plan protect family-wage jobs, provide fiber for local mills, invest in healthy forest management that reduces the risk of catastrophic wildfire.

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9. RECENT AND ONGOING CLIMATE CHANGE WORK UPDATE
[Listen to audio](#) MP3 - (52 minutes and 5 seconds – 17.8 MB)
Presentation ([attachment 25](#))

John Tokarczyk, Planning and Analysis Unit lead, provided an overview of the presentation objectives, and introduced Danny Norlander, Forest Carbon and Forest Health Policy Analyst, as the main presenter.

Norlander reviewed the Department of Justice (DOJ) scope and status for the Board's request to evaluate their statutory authority towards policy. He outlined DOJ's next steps to fulfill request, how it will be presented to the Board, and when it will be fulfilled. He offered background on the Executive Order (EO) 20-04 enacted by Governor Brown in March 2020, described ten sections that have direct relevance to Department and Board work, and highlighted four areas that could relate to Department business or activities. He provided an overview of the Department's approach and process taken to respond to the Governor's request for reporting on agency reduction of greenhouse gas (GHG) emissions operationally and through policy, how agency plans to advance GHG reduction goals, and proposed actions. He summarized the Department's report submitted in May 2020, discussed the responses assembled to address these elements. Noted next steps for the Department, explained how this report generated a lot of questions from agencies to DOJ about statutory authorities, and remarked how this report is part of a larger process, highlighting how public input will be incorporated at a later time.

Norlander discussed the Harvested Wood Products (HWP) and Sawmill Energy Report origin, and connection to the forest carbon ecosystems report. He described the scope of the analysis, the HWP framework, and the partnerships established through this work. He shared sample graphs from the HWP report with the Board, and explained the full study will become available in August 2020 with a presentation planned for the Board in fall. He mentioned the Sawmill Energy Report may not be ready until the end of 2020.

Norlander described the collaborative work on the Statewide Climate Adaptation Framework coordinated by Department of Land Conservation and Development (DLCD). He outlined the scope of work, number of agencies involved, and the dominant themes associated with this work. He reviewed the key implementation recommendations and provided examples to describe the intent for each recommendation. He highlighted subgroups that originated from this framework to help research, coordinate, and deliver work that produced results that could be used by other agencies. He reviewed the next steps for the Climate Adaptation Framework and shared the expectations for the subgroups to continue their work. Norlander closed presentation by listing the short-term and long-term work for the Policy and Analysis unit to complete.

Board commented on the Recent and Ongoing Climate Change Work Update presentation.

- Inquired about the feedback received from the Governor's office about the report submitted for EO 20-04, whether the Department could share how they plan on responding. State Forester Daugherty responded by outlining the changes the Governor's Office would like to see. He acknowledged that additional comments were received from the public sphere, how it brought awareness to the Department on coordinating and communicating out the work we are involved in. He stated that the Department will be taking a strong stance in our vision statement and advancing our communication efforts.
- Inquired about whether carbon costs associated with managing, harvesting, transporting and milling for wood products are included. Norlander stated these are calculating the emissions of the wood products, not the energy that went into the production of these products.

Discussion on definition of “net” was explored, and State Forester Daugherty explained that the Intergovernmental Panel on Climate Change (IPCC) definitions of wood products pool is used for this report. Board member explained position and importance to account for the carbon spent in all of the processes that go into creating wood products. Tokarczyk concluded that the reports are done in a way that measures emissions, and explained how staff plan to explore this question at a deeper level with partners who can help determine the best parameters and methodology for an assessment. State Forester echoed the value for this question, which opens up other considerations, such as carbon cost of forest management and decarbonizing the forestry sector. He noted carbon emissions from management practices in Oregon alone would be worthwhile to study, but recognizes this applies to active management. Board member inquired about considering the transportation sector as part of this study, and the State Forester responded that he plans to work with Board as they draft the study to include parameters that they would like to see.

- Recognized the work completed by the Policy and Analysis Unit (PAU) and appreciated the chance to provide some feedback on this process. Expressed the need to focus on the short term more than we normally would in regards to the issue of climate change. Recommended a series of ideas to enhance the Department’s position on this issue:
 - Noted how the Department response lacked a statement of commitment or responsibility, so offered the following thoughts. “We acknowledge that climate change is a serious threat. We have less than a decade to alter behaviors if we want to avoid catastrophic impacts. We, as a Board and an Agency, accept responsibility to act quickly to provide effective leadership. We recognize that this will require a seismic shift in normal operations and mean a focus on innovation, imagination, and experimentation.”
 - Recognized this is a problem being worked on by people across the world, it would benefit the Department to not limit themselves with a regional lens but to consider working on identifying and implementing the best practices or ideas using a worldwide lens.
 - Board and Department consider an annual award for climate wise forestry, which could be a modified version of the existing Operator of the Year.
 - Considered reviewing the past indicators on sustainable forestry and determine if this work could be revived if determined salient to Department and Board work.
 - Encouraged State Forests to lead by example for private forestry management and show that we can reduce our dependency on fossil fuels and increase carbon sequestration.
 - Suggested staff review of the Forest Practices Act with a climate wise lense, to identify barriers for climate smart forestry and what changes could have significant but positive climate impacts, while keeping the industry viable. Consider working on how longer rotations may affect industry, identify support for rural communities, and develop options for industry and businesses.
 - State Forester thanked the Board member for providing these suggestions. He explained there are tradeoffs between short and long-term goals. He described the global supply and demand structure, discussed regional impacts if policy does not consider a balanced approach and transition for all those who rely on timber harvest. He appreciated the input, and will utilize these ideas as the Department works on revising their climate change and commitment goals.

- Board member encouraged the Department report to reflect urgency and commitment to doing things now as we learn to do more, referencing Washington State's Department of Natural Resources Climate Resiliency report. Asked to consider pointing out the work the Department can do to reduce GHG, sequester carbon, or manage forests differently to achieve these goals. Supported collaborative interagency work with partner agencies to study areas of concern with climate change but in a holistic way. Offered an idea to create real-time dashboard to track the Department's carbon footprint, now and how it changes overtime. Noted how this tool could set the way for all forests in Oregon to consider factors like management, carbon sequestration, emissions produced etc. State Forester explained the data is available and could be produced, but frequency of updating that data is undefined.
- Expressed concern for the small independent contractors with a smaller budget than larger industry companies to modernize or modify existing infrastructure or equipment to achieve these goals. Noted as the Board and Department moves forward on making these decisions, to consider the impact it will have on smaller, independent contractors who we rely on. Another Board member concurred with this point, and commented that any efforts in decarbonizing the industry can occur soon with positive impacts.
- State Forester believe the PAU team can bring a revitalized vision back to the Board in September, and will point out gaps in Goal G welcoming a robust discussion with the Board on this topic. He mentioned delaying the indicators review until Goal G is fully vetted and discussed with the Board. The Board agreed by gesturing a thumbs up. Board members were interested in what the Department plans to do now to respond to this issue, and the State Forester stated he plans to respond to the Governor's office directly before the next Board meeting, but will keep the Board in the loop with any progress.

Public Testimony:

- Barbara and Brett Baylor provided written testimony ([attachment 26](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Requested further work on the Department's plan, and include statewide public and stakeholders involved with plan development.
- Harriet Cooke provided written testimony ([attachment 27](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Urged Board to direct the Department to produce a plan that conforms to the Governor's orders and provide opportunities for public engagement.
- Linda Craig provided written testimony ([attachment 28](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Asked for more work to be done on the Department's report.
- Susan Donohoe provided written testimony ([attachment 29](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Urged the Board to include a process for carbon accounting, to propose concrete goals to enhance forest carbon sequestration, and to include public comment.
- Catherine Thomasson on behalf of the Democratic Party of Oregon provided written testimony ([attachment 30](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Shared concerned that the Department did not address policy concepts that would increase

forest carbon storage and uptake. Offered data and reports regarding the role of Oregon's Forest in addressing Climate Change and inform policymaking options. Provided feedback on the recent Board and Department actions, and recommended future actions for well-rounded public policy development.

- Daniel Frye provided written testimony ([attachment 31](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Requested the Board to direct the Department to produce a plan that is responsive to the Governor's order and listed five elements to fulfill this request.
- Jeffry Gottfried provided written testimony ([attachment 32](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Offered a personal perspective on Department, and urged the Department to collaborate with the Governor's Climate Change Commission to revolutionize the way state forests are managed.
- Gwen Gwilym provided written testimony ([attachment 33](#)) on the Recent and Ongoing Climate Change Work Update topic. Urged protection of Oregon's natural resources from timber harvesting and to reduce the impacts of climate change.
- Bill Harris provided written testimony ([attachment 34](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Stated the Department must consider the challenges and workable plans for forest management that contribute to the reduction in the production of GHG.
- Alexander Harris on behalf of Cascadia Wildlands provided written testimony ([attachment 35](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Urged the Department to work with Oregon Global Warming Commission and scientists at Oregon State University (OSU) to develop a set of policies that can incorporate climate objectives with the Department's management of State forestland. Offered a proposal and series of recommendations to grow carbon stocks and promote forest resilience on state-owned public forestlands managed by the Department.
- Wendy Lawton provided written testimony ([attachment 36](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Listed items the Department did not include in their response to the Governor's office. Asked the Board to hold the Department accountable for a report with concrete goals, evidence-based assessments, and public input considered.
- Rebecca Gladstone, et al on behalf of League of Women Voters, provided written testimony ([attachment 37](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Spoke to the Department's charge to manage state forestland in achieving the greatest permanent value (GPV), and recognized the complexity in balancing the needs of these six land-use goals. Discussed the need for a new funding mechanism for the Department, and suggested changes to taxing timber. Urged the Department to work with the Oregon Global Warming Commission to clarify priorities and to clearly define the Department's actions to increase carbon sequestration. Recommended to identify law changes, revise rules, and incentivize actions under the Forest Practices Act that result in the best outcomes for increasing sequestration and meeting targets. Suggested involvement from Legislature, the Board, and Oregon citizens to develop a business case to meet the desired outcomes.

- Rebecca Maloney provided written testimony ([attachment 38](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Asked for more work to be done on the Department's report, and listed elements that the report did not include.
- Mark McLeod on behalf of the Metro Climate Action Team provided written testimony ([attachment 39](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Asked for more work to be done on the Department's report, and listed elements the report did not include.
- Victoria Meier provided written testimony ([attachment 40](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Urged Board to include a process for carbon accounting, to propose concrete goals to enhance forest carbon sequestration, and to include public comment.
- Tyler Ernst on behalf of Oregon Forest Industries Council (OFIC), provided written testimony ([attachment 41](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. OFIC offered perspective on the potential of forest products for carbon storage, the regrowth capacity of harvested lands, the impacts to Oregon communities with harvest reductions and longer aged stands. Urged the Board to reject policy proposing climate-smart logging practices, as it would not promote the greatest permanent value.
- Steve Pedery on behalf of Oregon Wild, provided written testimony ([attachment 42](#)) on the Recent and Ongoing Climate Change Work Update topic and the Department's response to Governor Brown's Executive Order 20-04. Recommended that the Department improve forest conservation, to scrap the current set of proposed actions, to develop a package of policy proposals or initiatives. Urged the Department to develop a range of improvements to the Oregon Forest Practices Act and consider policy updates.
- Dylan Plummer on behalf of Cascadia Wildlands provided written testimony ([attachment 43](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Urged Board to include a process for carbon accounting, to propose concrete goals to enhance forest carbon sequestration and to include public comment. Asked for a report to include a timeline with a transparent process for public engagement.
- Rand Schenck provided written testimony ([attachment 44](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor Brown's Executive Order 20-04. Asked the Board to ensure the Department responds to the Governor's EO in a meaningful way and provided a list of what could be included in the report. Encouraged a thoughtful public engagement process to address the climate crisis.
- 350 Eugene, et al provided written testimony ([attachment 45](#)) on the Recent and Ongoing Climate Change Work Update topic. Shared concerns regarding the Department's response to Governor Brown's Executive Order (EO) 20-04. Provide five detailed recommendations for the Department to consider and incorporate, as they were formed to implement the directives of EO 20-04 and help reach the greenhouse gas emissions reduction targets.
- Jane Stackhouse provided written testimony ([attachment 46](#)) on the Recent and Ongoing Climate Change Work Update topic and regarding the Department's response to Governor

Brown's Executive Order 20-04. Offered a personal perspective on the timber industry and outlined three areas the Department's report failed to address.

INFORMATION ONLY.

10. **GOOD GOVERNANCE DISCUSSION**
[Listen to audio](#) MP3 - (14 minutes and 31 seconds – 4.98 MB)

Board Chair Imeson introduced the item and had the State Forester present the progress made on the good governance topic. State Forester Daugherty provided an overview of the governance work efforts by the Board, Department staff, and him. He reviewed how these documents originated, were updated, and repackaged for the Board's consideration. He explained the analysis associated with this work and listed three recommendations for the Board to take action on. He offered a high-level explanation for each recommendation, reviewed the purpose for each document associated with the recommendation, and noted any revisions made on the documents. He inquired how the Board would like to proceed with each recommendation, and the Board Chair recommended for the Board to consider the recommendations one at a time in sequential order, before making a motion.

ACTION: The Board adopted the Board Governance Policy (Attachment 1).

Joe Justice motioned for the adoption of the board policy document on governance policy. Mike Rose seconded the motion. Voting in favor of the motion: Cindy Deacon Williams, Joe Justice, Jim Kelly, Brenda McComb, Mike Rose, and Tom Imeson. Against: none. With Board consensus the motion carried.

ACTION: The Board confirmed the priorities governance topics and adopted the list (Attachment 2) to provide direction to the State Forester.

Mike Rose motioned for the confirmation of the prioritized governance topics and adopted the list of topics. Cindy Deacon Williams seconded the motion. Voting in favor of the motion: Cindy Deacon Williams, Joe Justice, Jim Kelly, Brenda McComb, Mike Rose, and Tom Imeson. Against: none. With Board consensus the motion carried.

Board member McComb inquired about the phrasing of a statement listed on the second page of the expectations document, second bullet. Expressed concern about the inclusion of the word and because it implies that respect and support are mutually exclusive. Stressed the value for Board members to voice their support or opposition for a Board decision. The Board Chair agreed with this perspective and stated how this wording could infer a limitation to Board members vocalizing why they voted against something. Board discussed the implications of not allowing each other to share their positions and explored the benefits of having different views on the Board. Board member Justice noted that disagreements will occur with a diverse Board, but after a decision is made the Board collectively should respect the process and move forward. The Board Chair offered a revision to the expectation listed by removing 'and support' and leaving the remainder of the sentence as presented.

ACTION: The Board modified and approved the set of Expectation of Board of Forestry Members (Attachment 3).

Cindy Deacon Williams motioned for the approval of the set of expectations for the Board of Forestry, as presented with modification. Joe Justice seconded the motion. Voting in favor of the motion: Cindy Deacon Williams, Joe Justice, Jim Kelly, Brenda McComb, Mike Rose, and Tom Imeson. Against: none. With Board consensus the motion carried.

Public Testimony: None

11. **BOARD CLOSING COMMENTS AND MEETING WRAP UP**
[Listen to audio](#) MP3 - (17 minutes and 59 seconds – 6.17 MB)

Board Chair, Tom Imeson, reviewed the agenda items in sequential order with Board members and Department staff, and welcomed any closing comments or follow-up questions on topic items.

- Consent agenda items and item one, no follow-up requested on items.
- Item two, Board Chair asked if there was any other considerations around the decision item for the agency request budget and if any clarifications are required. Board members made no comments. State Forester Daugherty mentioned as part of the decision, a letter of support by the Board accompanies the Department's budget request, and walked through the general process with the Board. He asked if the Board was comfortable with that approach and members nodded heads or gave thumbs up as agreement.
- Item three, Board Chair remarked how helpful the financial dashboard discussion was with the inclusion of the external contractor's work. He inquired if any questions or comments, Board members had no additional feedback.
- Board member Kelly offered an observation regarding the stakeholder and public comment that is sent into the Board on key issues but with minimal time for the members to review the information. He inquired if there was a way to better frame how to submit testimony or comment to afford more time for the Board members to review public input. Board Chair mentioned how the Board can encourage the public to provide written input prior to a board meeting, perhaps notate how all input received a week before a meeting can be organized and sent in a binder to the Board. Other Board members considered including a time limit or outline a specific timeframe to guarantee the testimony will be sent to the Board and to include that if not received within the window of time the testimony may not be reviewed by the Board before the meeting. Board Chair reminded the Board members that at any time, public comment can be submitted. Other members noted that it can take time to produce testimony, and depends on when the materials are made available online. State Forester commented that part of this dynamic is whether the item is an informational or decision item, reviewed what the Board historically has outlined for public to provide comment or testimony, and described the current parameters in place to ensure real-time testimony is provided on decision items. He paraphrased what he heard from the Board and outlined the proposed expectation. The Board agreed with his summary. Board members mentioned the value of having an open door for comment, but noted the importance to establish some

guidance to the public on how to make their testimony more effective and to increase the likelihood that they will be heard by the Board prior to making a decision.

- Item four, No follow-up requested and Board members made no comments.
- Item five, Board Chair noted no comments are made for Executive Session.
- Item six, Board Chair commented no follow-up appeared to be requested, and State Forester stated he would like to clarify two items for the record. Noted the suggestion that Committee for Family Forestland (CFF) to return to the Board and share data on CFF landowner values. He commented that the CFF values have been shared with the Board in past years, but will look into if any has changed and determine when this item can be brought back to the Board. He also stated he will continue to work on the eastern Oregon CFF viability issue.
- Item seven, Board Chair remarked on the letter sent by him and the State Forester, open to discuss the letter or this item with the Board. Board member hoped for a positive outcome.
- Item eight, Board Chair listed when the State Forests Division will report to the Board on the Habitat Conservation Plan and Forest Management Plan. No other comments were made.
- Item nine, Board Chair recalled the extensive discussion by the Board on this topic, and asked for any additional input for the good of the order. No Board comments were made.
- State Forester brought up an item for the good of the order regarding the Board's comfort level with engaging in-person. He recapped on the virtual meeting experience, and noted how Board events scheduled for the remainder of 2020 will be planned for online participation, unless otherwise specified as an exception. He inquired with the Board if there were any concerns with moving forward with this approach. Board members gave a thumbs up in agreement with his recommendation. State Forester also mentioned the self-evaluation comment about the Board's desire to go on tours, but given the current conditions he inquired about each member's comfort level with field participation and social distancing measures in place. Some Board members did not believe this is a good time to engage in-person with Oregon's COVID-19 cases trending upwards, and questioned the logistical feasibility to conduct a tour with public access. Other Board members were open to touring individually or in smaller groups, but would transport themselves and prefer to not meet in counties that have high rates of confirmed cases. Board Chair reinforced that anyone who is not comfortable would not need to attend. State Forester thanked the Board for providing input on this topic, recognized that constraints exist, and understood that a cautious approach is preferred.

Information Only.

Board Chair Imeson adjourned the public meeting at 5:14 p.m.

Respectfully submitted,
/s/ Peter Daugherty



Peter Daugherty, State Forester and
Secretary to the Board

STAFF REPORT

Agenda Item No:	B
Work Plan Title:	Private Forests
Topic:	Annual topic, Regional Forest Practices Committee
Presentation Title:	Regional Forest Practices Committee Appointments and Reappointments
Date of Presentation:	September 9, 2020
Contact Information:	Josh Barnard, Deputy Chief Private Forests Division 503-945-7493 Josh.W.Barnard@oregon.gov

SUMMARY

The purpose of this agenda item is to recommend the appointment of one new member and re-appointment of eight existing members to the Regional Forest Practice Committees.

CONTEXT

ORS 527.650 requires the Board to establish a forest practice committee for each forest region. Each such committee shall consist of nine members, a majority of whom must reside in the region. Members of each committee shall be qualified by education or experience in natural resource management and not less than two-thirds of the members of each committee shall be private landowners, private timber owners or authorized representatives of such landowners or timber owners who regularly engage in operations.

ORS 527.660 states “[E]ach forest practice committee shall review proposed forest practice rules in order to assist the Board in developing rules appropriate to the forest conditions within its region.” Regional committees have provided a forum for the public; at each meeting members of the public may participate and offer information and suggestions. The Private Forests Deputy Chief serves as the secretary for all three committees.

BACKGROUND

The last reappointments to the regional committees occurred in September 2019. The regional committees are set with staggered terms so only one-third of committee members come up for reappointment in a given year. This approach ensures continuity of committee work over time. The Department recently contacted committee members whose terms expire in 2020, regarding their interest in reappointment. Eight members wished to continue on the respective committees. Two existing members of the Eastern Oregon Regional Committee were unable to continue with their previously appointed terms and elected to discontinue their membership. One new committee member nomination was put forth from the Eastern Oregon Area, Bobby Douglas (attachment 2). There are two additional vacancies on the Eastern Oregon Regional committee and the search is underway for new member nominations.

Attachment 1 shows current and new members and their term expiration dates. The recommended expiration column shows the term expiration date set to maintain the staggered term approach.

RECOMMENDATION

The department recommends the Board make the following eight reappointments and one new appointment:

Northwest Oregon Region:

Wendell Locke	term expiring September 2023
Steve McNulty	term expiring September 2023
Randy Silbernagel (p)	term expiring September 2023

Southwest Oregon Region:

Dana Kjos (Chair)	term expiring September 2023
Dan Fugate	term expiring September 2023
Darin McMichael	term expiring September 2023

Eastern Oregon Region:

Vacant	term expiring September 2022
Bobby Douglas (New)	term expiring September 2022
Vacant	term expiring September 2023
Patrick Marolla	term expiring September 2023
Chris Johnson	term expiring September 2023

(p) Public Member

ATTACHMENTS

- (1) Current Regional Forest Practice Committee Membership
- (2) Biography for Bobby Douglas

CURRENT REGIONAL FOREST PRACTICE COMMITTEE MEMBERSHIP
September 2020

NORTHWEST OREGON REGION

Member Name	Current Term		Recommended
	Began	Term Expires	Expiration
Scott Gray	11/2014	09/2021	_____
Jim Hunt	09/2011	09/2021	_____
Jon Stewart	09/2006	09/2021	_____
Mike Barnes (Chair)	09/2007	09/2022	_____
Tally Patton (p)	09/2007	09/2022	_____
Candace Bonner (p)	09/2011	09/2022	_____
Wendell Locke	09/2005	09/2020	<u>09/2023</u>
Steve McNulty	09/2017	09/2020	<u>09/2023</u>
Randy Silbernagel (p)	09/2005	09/2020	<u>09/2023</u>

SOUTHWEST OREGON REGION

Member Name	Current Term		Recommended
	Began	Term Expires	Expiration
Jay Christensen	09/2015	09/2021	_____
Mikaela Gosney	09/2019	09/2021	_____
Adam Stinnett	09/2016	09/2021	_____
Eric Farm	09/2013	09/2022	_____
Dave Erickson	09/2013	09/2022	_____
Garrett Kleiner	09/2016	09/2022	_____
Daniel Fugate	09/2005	09/2020	<u>09/2023</u>
Dana Kjos (Chair)	09/2005	09/2020	<u>09/2023</u>
Darin McMichael	09/2019	09/2020	<u>09/2023</u>

EASTERN OREGON REGION

Member Name	Current Term		Recommended
	Began	Term Expires	Expiration
Irene K. Jerome (p)	09/2006	09/2021	_____
Bob Messinger (Chair)(p)	09/2006	09/2021	_____
Elwayne Henderson	09/2011	09/2021	_____
Vacant	_____	09/2022	_____
Paul Jones	09/2013	09/2019	_____
Bobby Douglas (New)	09/2020	09/2022	<u>09/2022</u>
Vacant	_____	09/2023	_____
Patrick Marolla	01/2019	09/2020	<u>09/2023</u>
Chris Johnson	09/2014	09/2020	<u>09/2023</u>

(p) Denotes public member

Biography for Bobby Douglas

Hello, my name is Bobby Douglas. I've worked in the forestry industry for thirteen years. I started in wildlife and transitioned to forestry. I received my Bachelor's Degree from the University of Idaho in 2006 and became a Registered Professional Forester in 2014 while working for Timber Products Company in Yreka, California. I've worked for Green Diamond Resource Company for a little over three years out of their Klamath Falls, OR office. I only have two more classes at Southern Oregon University to obtain my MBA, which I have been working towards for the last two years. My wife and I have been married for almost ten years and we enjoy the quiet small town community living in Merrill, Oregon.

Agenda Item No.:	C
Work Plan:	Private Forests
Topic:	Board Updates
Presentation Title:	Forest Practices Monitoring Unit Update
Date of Presentation:	September 9, 2020
Contact Information:	Kyle Abraham, Chief, Private Forests Division, 503-945-7473, Kyle.Abraham@Oregon.gov Terry Frueh, Monitoring Coordinator, Private Forests, 503-945- 7392, Terry.Frueh@Oregon.gov Paul Clements, Training and Compliance Coordinator, Private Forests, 503-945-7475, Paul.R.Clements@Oregon.gov Adam Coble, Monitoring Specialist, Private Forests, 503-945- 7317, Adam.Coble@Oregon.gov

SUMMARY

This agenda topic provides an update on Private Forests Monitoring activities since the last update to the Board of Forestry in September 2019. We discuss the implementation study, two monitoring projects assessing effectiveness of riparian protections, and other monitoring-related work.

CONTEXT

The Board's 2011 Forestry Program for Oregon supports an effective, science-based, and adaptive Oregon Forest Practices Act (FPA) as a cornerstone of forest resource protection on private lands in Oregon (Objective A.2). The discussion of Goal A recognizes that the FPA includes a set of best management practices to ensure that forest operations meet state water quality standards. The Board's objectives also promote management practices that protect forest soil productivity from losses due to human-induced landslides, soil erosion, and soil compaction (Objective D.8). The Board's guiding principles and philosophies includes a commitment to continuous learning, evaluating and appropriately adjusting forest management policies and programs based upon ongoing monitoring, assessment, and research (Value Statement 11). The Board has also adopted administrative rules that emphasize effectiveness monitoring for riparian management areas, landslides and public safety, and pesticides.

BACKGROUND

At their September 2019 meeting, the Board received a general update on Private Forests monitoring activities. Topics included a progress update on the implementation study, a literature review for the Siskiyou Project, and progress reports on reviews for sufficiency of streamside protections in Western Oregon.

ANALYSIS

High-priority Forests Practices monitoring projects over the last year include (see Attachment 1 for details):

- Completion of a summary literature review and contextual information on climate-induced impacts on stream temperature and shade in the Siskiyou geographic region (Attachment 2). This project was designed to assess sufficiency of riparian rules to meet water quality standards for stream temperature;
- Continuation of an effectiveness monitoring project in western Oregon. This project assesses sufficiency of riparian rules to meet DFC for stand structure and large wood in streams.
- Work with DEQ on enhancing collaboration for protecting and improving water quality;
- Assistance with Oregon State University's Trees to Tap project;
- Progress on development of the next phase of the implementation study¹, focusing on reforestation rules (Attachment 3); and,
- Progress on re-examination of previous implementation study efforts (Attachments 3 and 4).

Note that many of these projects have extensive outreach and discussion with interested stakeholders and tribes.

Monitoring Unit personnel have also been involved in various other duties as assigned.

RECOMMENDATION

This agenda item is informational only.

ATTACHMENTS

- (1) Forest Practices Implementation and Effectiveness Monitoring: 2020 Update
- (2) Siskiyou Streamside Protections Review: Summary of Literature Review
- (3) Forest Practices Monitoring Update: Implementation Study
- (4) Compliance Audit: Reports from Consultant

¹ The study formerly known as the Compliance Audit.

Forest Practices Implementation and Effectiveness Monitoring: 2020 Update

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1. Introduction

This report summarizes monitoring-related work completed by ODF Private Forests staff since the last Board of Forestry (Board) update in September 2019.

In 2016 the Board of Forestry approved the department's current Monitoring Strategy which set priorities for the study of implementation and effectiveness of current FPA standards. The Monitoring Unit continuously links our work with the Strategy, as shown in Table 1.

Table 1. Relationship between monitoring studies and questions from the 2016 Monitoring Strategy.

Monitoring study	Question from 2016 Monitoring Strategy (priority¹)
Implementation study on reforestation rules	What is the level of compliance with reforestation rules? (M)
Western Oregon and Siskiyou Streamside Protections Reviews	What fraction of riparian areas in forest operation areas are currently on track to meet FPA riparian "desired future condition" targets? (H) Are forest practices, including roads, under current rules effective in meeting all applicable water quality criteria established by the Oregon Department of Environmental Quality (DEQ), including those established by TMDLs, for water quality parameters affected by forest practices on fish and non-fish bearing water bodies? (H) Do the riparian rules promote streamside forest stand structure and large wood recruitment levels that mimic mature riparian stand conditions? (L)

¹ L=low; M=medium; H=high.

2. Implementation Monitoring

2.1 Forest Practices Act (FPA) Implementation Study

This topic is discussed extensively in Attachment 3, with a consultant's analyses presented in Attachment 4.

3. Effectiveness Monitoring

The Monitoring Unit worked on two effectiveness monitoring projects this past year. One project focused in the Siskiyou geographic region, the other project on the rest of western Oregon (Figure 1). Both projects looked at the effectiveness of riparian protections for small and medium Fish streams, and include input from stakeholders and tribes. The Siskiyou Project assessed sufficiency of rules to meet desired future conditions (DFC)¹, and stream temperature and shade. The western Oregon project assesses sufficiency of these rules to meet DFC and large wood recruitment goals. These projects are further detailed below.

¹ OAR 629-642-0000

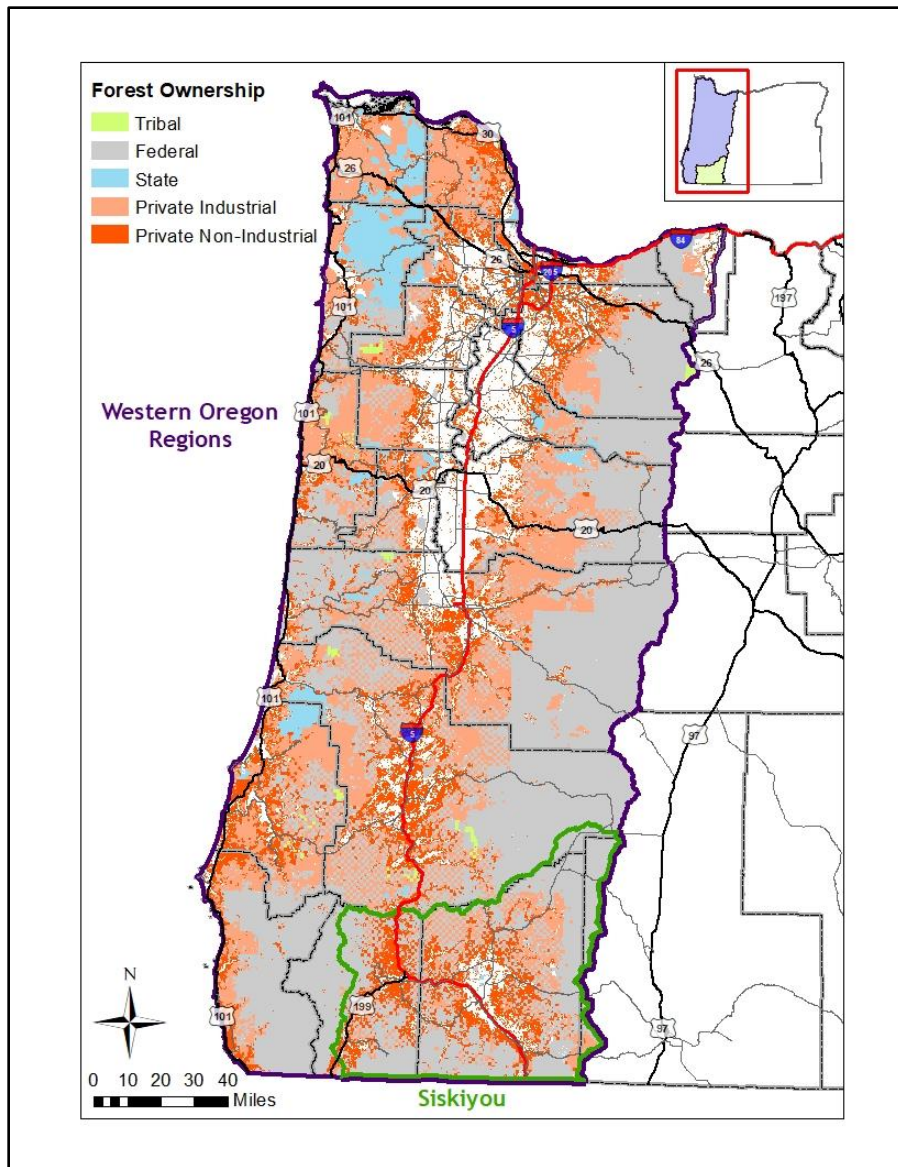


Figure 1. Map of ownership in the two effectiveness monitoring project areas. The purple and green lines denote the western Oregon² and Siskiyou effectiveness monitoring projects, respectively.

3.1 Western Oregon Streamside Protections Review

Introduction

The FPA water protection rules for vegetation retention along fish streams were designed to produce DFC for riparian stands along streams in Oregon. The DFC of riparian stands along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to mature streamside stands. In the FPA, mature stands are characterized as often being dominated by conifer trees, 80-200 years of age that provide ample

² Note: the western Oregon Project formerly excluded the Siskiyou, but based on recent Board and departmental decisions, it now includes the Siskiyou.

shade over the stream channel, an abundance of large wood in the channel, root masses along edge of channel, snags, and regular inputs of nutrients through litter fall³.

The Oregon Department of Forestry (ODF) initiated the Riparian Function and Stream Temperature (RipStream) study throughout the Oregon Coast Range. One objective of the RipStream project was to evaluate the effectiveness of FPA rules at promoting DFC and providing an abundance of large wood in streams. The Western Oregon Streamside Protections Review (i.e., Western Oregon Project) expands on the RipStream work, and will use multiple lines of analysis of DFC and large wood recruitment, including: 1) RipStream field data, 2) a systematic review of scientific literature, and 3) modeling analysis to project long-term (80-200 years) changes in stand conditions, and/or collect field data at RipStream sites to measure change in stand conditions over a shorter period of time.

Due to limited staff capacity and higher priority of the Siskiyou project (described below), the Western Oregon project was put on hold for a few months. In June 2020, the Western Oregon project resumed when the Board approved the request by the MOU signatories to: 1) pass a temporary rule extending the SSBT rules to the Siskiyou, and 2) pause the Siskiyou Project.

The components of the Western Oregon project described above will be integrated to create a comprehensive report to inform the Board's policy-making. Also, this work might help inform the MOU process (see section 3.2), because it includes a comprehensive assessment of riparian conditions and large wood in streams on private forestland.

Phase 1. RipStream Report on DFC and Large Wood

In September 2019, monitoring staff presented a detailed analysis and timeline of the RipStream vegetation and large wood report to the Board. Briefly, the RipStream report includes a data analysis of harvesting effects on riparian stand conditions, understory vegetation, downed wood in RMAs, and large wood in streams. RipStream sites were on state and private land along small and medium fish-bearing streams in the Coast Range and Interior geographic regions. When the Board stopped the Siskiyou Project, monitoring staff completed the draft RipStream report in June 2020. This draft report was sent to tribes, conservation and timber stakeholders, and state and federal agencies for their review and input. We plan to summarize their feedback, and make revisions to the report based on their comments. The final draft of the report will be issued and communicated as ODF Technical Report #21. ODF monitoring staff will also summarize the main findings in a 2-page 'short communication' that will be sent to ODF staff, stakeholders, and tribes. Monitoring staff are also exploring avenues for publishing the findings of the RipStream data in a peer-reviewed scientific journal.

Phase 2. Literature review on DFC and large wood

This literature review will: 1) assess the effectiveness of FPA riparian protection standards to meet DFC and large wood goals, and 2) define the ranges of key descriptors of DFC and large wood. ODF monitoring staff has created a literature review protocol, conducted all searches for literature, and performed an initial filter of the DFC literature to include relevant studies. The

³ OAR 629-642-0000(2)

methodology of the literature review is similar to past systematic reviews conducted by ODF staff; however, a few elements of the systematic review process have been modified due to limited staff capacity to balance completing a review in a timely manner while also having a high quality review. For example, the literature review methods will not include extensive efforts to quantify relevance and quality of studies, and data extraction tables will not be generated. As part of our effort to define ranges of large wood found across the landscape, we plan to continue our discussions and collaboration with the Oregon Department of Fish and Wildlife (ODFW), and federal partners as well, to find alignment on large wood targets toward achieving DFC.

Phase 3. Forest stand modeling and field data collection

Both DFC and large wood are influenced by long-term forest processes. The RipStream data analysis and literature review will provide insight into these processes. However, a limitation of the RipStream analysis in evaluating whether stands are on track to meet the goals for DFC is the relatively short period of time in which data were collected, as well as the relatively young age (~40 years) of stands on private land. Regarding our literature review, relevant studies in riparian forests typically include data collection at one point in time, also limiting inferences about riparian stand development. Collectively, this presents a challenge for the Monitoring Unit to conduct a thorough assessment of long-term changes in riparian stand conditions over time. To address the question of whether these stands are on track to achieve DFC, Monitoring staff have been developing a parallel study that would contract work for modeling riparian stand growth and large wood recruitment over time, using RipStream field data as model inputs. This study would be beneficial in understanding changes in stand development over many decades for riparian forests next to harvested units relative to reference, unharvested reaches.

However, departmental funding challenges make hiring a contractor for the modeling work currently difficult, and there is uncertainty regarding department budgets over the next few years. Alternatively, additional field measurements at RipStream sites could provide valuable information regarding long-term response of riparian stands to harvesting. The initial efforts by ODF staff in establishing the RipStream plots in 2002 now present an opportunity to revisit sites to measure and evaluate long-term trends in riparian stand conditions. Ultimately, the agency budget and staff capacity will determine whether modeling or field data collection are possible options in the near future.

3.2 Siskiyou streamside protections review (“Siskiyou Project”)

In November 2015, the Board of Forestry increased streamside protection standards in western Oregon on streams (the Salmon, Steelhead, and Bull Trout [SSBT] rules). The Siskiyou geographic region was not included in this decision.

In March 2018, the Board directed the department to conduct a scientific literature review on stream temperature, and the shade and stand structure components of DFC of riparian forests at meeting FPA. The review’s scope was limited to assessing the FPA’s sufficiency at meeting DFC and stream temperature water quality standards for small and medium fish streams in the Siskiyou geographic region. Updates on the review were presented to the Board in September 2018 and January 2019. This latter meeting also included presentations from DEQ and ODFW on contextual information (water quality, fish status and trends in the Siskiyou).

In June 2019, the department presented the results from the literature review. With 13 studies, the review identified information found on mature streamside stands (DFC goal), some information on whether harvested stands met that goal, and some information on stream temperature related to water quality standards. The Board decided that there was not enough information to make a decision on rule sufficiency for each of DFC and stream temperature in the Siskiyou region.

The Board directed the department to initiate collaboration with DEQ in using Total Maximum Daily Load (TMDL) temperature analyses for forested reaches of small and medium fish streams in the Siskiyou. They also directed the department to expand the geographic scope of the literature review to include areas with forests similar to the rest of western Oregon, and form an Advisory Committee to inform the department's work and resultant Board discussions. The Board approved a work charter encompassing all of this work in January 2020.

The department hired a contractor to facilitate meetings of the Siskiyou Advisory Committee. The Committee kicked off its work in early March and met again in late April to discuss feedback on the draft Summary on Stream Temperature and Shade report. There was a meeting planned in early June. However, that meeting was canceled in light of the Board's decision to end the Siskiyou Project and pass a temporary rule (see below), both in support of the MOU. The department is currently working with the Siskiyou Advisory Committee which will be the rule advisory committee for elements needed to adopt the permanent rule. We are very grateful for the work and commitment of this Committee.

The Board requested that external experts present coarse information on the impacts of climate change on both DFC and stream temperature in the Siskiyou. In April, three experts (Gordie Reeves, Kara Anlauf-Dunn, and Jessica Halofsky) presented on these impacts, and also had a panel discussion with the Board. Written summaries of their presentations are available on the April Board meeting website.

In February 2020, Governor Brown announced a Memorandum of Understanding (MOU) between environmental groups and forest landowners. It requested the legislature pass a bill that would change Oregon forestry laws, including ending the Siskiyou Project and extending SSBT rules to the Siskiyou. It also asked for mediated discussions for these groups with federal agencies, with the goal to obtain a Habitat Conservation Plan (HCP), covering Oregon aquatic species. The legislature adjourned without voting on the associated bill.

In May, the signatories to the MOU asked the Board to pass a temporary rule on SSBT, and forgo the Board's associated sufficiency decision that had been scheduled for July. They also requested that the Board direct the department to cease work on the Siskiyou Project, except for completing the aforementioned literature review as an information-only item for the Board. On June 3rd, the Board agreed to these requests. In late June, the legislature held a special session and passed Senate Bill 1602 that implemented the requested measures from the MOU. The department thereafter initiated work on the elements of SB 1602 under our purview.

Per the Board's June 2020 direction, staff completed the Summary on Stream Temperature and Shade report, Attachment 2.

4. Other Monitoring Work

4.1 Water Quality Pesticide Management Team (WQPMT)

The Water Quality Pesticide Management Team (WQPMT) is comprised of state agencies responsible for water quality, pesticides, and/or natural resource management in Oregon. The Team includes:

- Oregon Department of Agriculture (ODA),
- Oregon Department of Environmental Quality (DEQ),
- Oregon Health Authority (OHA),
- Oregon Watershed Enhancement Board (OWEB),
- Oregon State University (OSU), and
- Oregon Department of Forestry (ODF).

The Team's work revolves around the Pesticide Management Plan (PMP; Riley *et al.*, 2011; currently being updated), which was approved by the Environmental Protection Agency (EPA). The Plan's main goal is reducing ground and surface water contamination from pesticides currently registered and used in Oregon. This approach aligns closely with FPA rules that direct the department to work with partners to conduct monitoring and evaluation of the chemical and other petroleum product rules, including placing a high priority on securing adequate resources to conduct monitoring. The Private Forests Division's Water Quality Specialist is the current ODF representative on the WQPMT.

The goals of the WQPMT are to (1) identify and prioritize higher risk pesticides, use patterns, and watersheds; and (2) achieve these goals in a cooperative, voluntary manner. The WQPMT facilitates and coordinates water quality activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions, generally through the DEQ Pesticide Stewardship Program (PSP). There are currently nine PSP watersheds located throughout the state. Most watersheds encompass multiple land uses of varying proportions of areas.

During 2019, data from the South Umpqua pilot PSP was reviewed and meetings held with local stakeholders, which resulted in the decision to suspend monitoring. The monitoring data indicated no exceedances above 15% of any aquatic life benchmarks for pesticide concentration levels based on the 2014-2019 samples. With the exception of the herbicide atrazine, the pesticide detection frequencies were also low based on the WQPMT's EPA-approved decision matrix. To summarize the monitoring results and actions taken during the pilot project, the WQPMT has produced a findings and recommendation report (OWQPMT, 2020).

In November 2019, a stakeholder advisory group (SAG) was established by WQPMT member agencies. The purpose of the SAG is to provide advice to the WQPMT regarding issues related to the implementation of the Pesticide Stewardship Partnership. The SAG consists of members from a wide range of stakeholder organizations representing a balance between pesticide user groups, and environmental and environmental justice organizations. The SAG will be used to assist the WQPMT in the development of a statewide PSP Strategic Plan, develop a series of standard operation procedures, and review various reports that will be generated by the WQPMT. The intent is to have the SAG meet every two months initially for the first year to develop foundational documents.

4.2 Trees to Tap report

Drinking water in Oregon is provided by more than 300 public water providers that rely on surface water from rivers, lakes or reservoirs as their main source to supply about 75 percent of Oregonians with their safe drinking water. With over 50% of Oregon forested in a variety of public and private ownership, forested watersheds are an important source of drinking water. As forest management and drinking water quality are of public concern, the Oregon Forest Resources Institute (OFRI) provided a grant to the Oregon State University (OSU) Institute of Natural Resources to lead a science-based review of the effects of forest management on drinking water which has resulted in detailed report written by OSU faculty, titled - *Trees To Tap*. The full report has been summarized by OFRI in several documents including a special report and a summary of recommendations and findings.

4.3 Collaboration with Oregon Department of Environmental Quality (DEQ)

The Board directed the department to work with DEQ on further evaluation of TMDL information for informing the Siskiyou Project. The department initiated this work (“the Collaboration”) with DEQ, and we mutually agreed it would be beneficial to expand the scope of the work beyond the Siskiyou Project to address our collaboration on water quality issues on Oregon’s non-federal, non-tribal forestlands.

ODF and DEQ have different legal and policy frameworks within which we operate to assess sufficiency of rules in meeting water quality standards, and implementing total maximum daily loads (TMDLs). Early on in this process, the agencies directors developed the following vision:

Leaders Intent (Vision): Achieve and maintain high water quality on all non-federal, non-tribal forestlands.

Mission: Restore and maintain water quality at a pace and scale that reduces the risk that water quality goals will not be achieved.

Goals:

- 1) Come to a common understanding of ODF and DEQ policy and legal frameworks and how they advance the mission and vision.
- 2) Agree to develop mutually-acceptable processes to assess the adequacy of Forest Practices Act (FPA) rules and other measures in achieving water quality standards and (if completed) TMDL load allocations.
- 3) Agree to mutually-acceptable processes for TMDL development, load allocations relating to forestlands, and conditions necessary to achieve water quality standards.
- 4) Capture the work completed in goals 1-3 in a signed interagency Memorandum of Understanding.

The departments hired a contractor to facilitate the Collaboration discussions. The department updated the Board on the Collaboration’s progress in March and July 2020. In addition to the Collaboration’s monthly meetings, there are quarterly meetings of the respective leadership of each department (department and division directors, and the chairs and liaisons of the Board the Environmental Quality Commission).

We have invested significant effort to understand each other's statutory authorities, rules, and policies, along with respective work cultures. These aspects have consistently been part of monthly meetings. Towards this end, each agency's Oregon Department of Justice (DOJ) counsel has also participated in meetings:

DEQ provided input on ODF's Summary on Stream Temperature and Shade report (Attachment 2). Also, ODF worked to understand TMDLs policy framework, and the technical details of Heat Source and associated shade modeling, with each agency's respective technical staff meeting regularly to discuss this.

The Collaboration expects to complete its work in mid- to late-2021.

4.4 Monitoring resources and budget

The state's budget situation, strain the Monitoring Unit in several different ways. At the time of writing these Board materials, our budget was not yet adjusted due to the Coronavirus-related state financial challenges, but we are certain there will be significant declines in funding. As agency policy, our first priority is maintaining sufficient staffing levels to ensure we can continue working on core business functions. Thus, as a division, we've decided to not spend funding originally budgeted for external contractors, most of the work had been planned for the implementation study (see Attachment 3).

As an additional cost-savings measure, the Agency has implemented a hiring freeze and has left most vacant positions unfilled. Since early winter, the Monitoring Unit has had staff and the manager move on to other positions (out of a total of 5.5 full time equivalents (FTE) plus a manager). Cam Amabile, a limited duration position in the Unit, took a permanent position with the Oregon State Library. Ariel Cowan was a Monitoring Specialist with the Unit, took a temporary position as a Stewardship Forester, and then was hired into the position permanently. Finally, Marganne Allen was the Manager of Monitoring and Forest Health, and took a similar position with the Oregon Department of Agriculture. All three of these women contributed greatly to the Unit's work, and we miss them dearly!

The Unit now has 3.5 FTE and no manager – a nearly 50% decline in staffing. About half of the staff are focused on each of effectiveness and implementation monitoring projects.

4.5 Other Engagement and Support

Unit and Division personnel also:

- Represented the department on the interagency water-monitoring group, Stream Team.
- Provided support to Committee for Family Forestlands and the three Regional Forest Practices Committees.
- Participated in two DEQ efforts on total daily maximum loads (TMDLs) for the mid-coast and Willamette River.
- Engaged in the Water Quality Pesticide Management Team.
- Participated on planning team for the November 7, 2019 Board science and policy workshop

- Participated in training for, and support of, the agency mission for fire protection.

5. References

Riley, Steve, Janet Fults, Kevin Masterson, Koto Kishida, Deanna Conners, Dave Wilkinson, Sheila Marcoe, Marganne Allen, Bradley Knotts, Rose Kachadoorian, David Farrer. 2011. Pesticide Management Plan for Water Quality Protection.

Oregon Water Quality Pesticide Management Team. 2020. South Umpqua Pilot Study 2014-2019: Findings and Recommendations. *Soon to be released.*

Appendix 1. Monitoring-related presentations to the Board

In the past year, the department has presented a variety of information to the Board, outlined in the table below.

<u>Date; agenda item</u>	<u>Topic</u>
September 4, 2019; 5f	Western Oregon Streamside Protections Review Update
September 4, 2019; 6	Siskiyou Streamside Protections Review
September 4, 2019; Consent Agenda G	Annual Forest Practices Division Monitoring Report
January 8, 2020; 3	Siskiyou Streamside Protections Review
March 4, 2020; Consent Agenda D	Revised Work Plan – Siskiyou Streamside Protections Project
March 4, 2020; 7	DEQ and ODF Collaboration Quarterly Update
April 22, 2020; 2	Climate Change Contextual Information for Siskiyou Streamside Protections Review
June 3, 2020; 5	Request for Temporary Rule in the Siskiyou Georegion
July 22, 2020; Consent Agenda F	DEQ and ODF Collaboration Quarterly Update
July 22, 2020; Consent Agenda G	Permanent Rulemaking for Salmon, Steelhead, and Bull Trout Streams in Siskiyou Region

Siskiyou Streamside Protections Review: Summary of Literature Review

Adam Coble, W. Terry Frueh, John Hawksworth, Ariel Cowan

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This report would not have come together so quickly without the exceptional help and support of many individuals. Cam Amabile, part of the Monitoring Unit in a developmental role, helped determine which literature to include in the report. DEQ staff Ryan Michie, Josh Seeds, and Gene Foster provided helpful review and insight, particularly for using their TMDL information. Our Siskiyou Advisory Committee, comprised of a broad spectrum of interests, provided feedback that helped us tremendously improve the first draft of this report. Finally, we had good support from other ODF staff: Janet Stevens and Susan Dominique provided administrative support; Kyle Abraham, Marganne Allen, and Josh Barnard all provided helpful managerial support.

Main Findings

Stream temperature

- Relevant literature (12 studies) suggests implementation of current FPA rules will not ensure maintenance of Protecting Cold Water standard or the Human Use Allowance.
- Results from existing literature indicate that harvested sites infrequently exceeded the Biologically-based Numeric Criterion.
- A paucity of data, combined with complex spatial and temporal dynamics of heat transport, present many challenges in quantifying cumulative effects from multiple upstream timber harvests. The only component of these dynamics for which there were data showed no consistent trends in warming downstream of harvest units.

Shade

- Results from TMDL modeling and from existing literature (4 studies) suggest that shade increases with buffer width, and trees within ~50 and ~70 feet, respectively, of streams provide the most shade to streams.
- In the 50-70 feet range of buffer widths, additional trees appear to increase shade by a few percent, and not at all beyond approximately 80-100 feet range of buffer widths.

1. Background

1.1 Policy

In January 2012, the Oregon Board of Forestry (Board) found degradation of water quality for small and medium streams based on an Oregon Department of Forestry (ODF) study (Groom *et al.*, 2011a), which initiated the Riparian Rule Analysis. In 2017, the Board adopted additional riparian rules for small and medium streams with salmon, steelhead, and bull trout (“SSBT rules”). The Board voted to apply these rules in all of western Oregon except in the Siskiyou geographic region.

In March 2018, the Board directed ODF to assess the sufficiency of Forest Practices Act (FPA) rules to meet riparian goals along small and medium fish streams in the Siskiyou, and thereby commencing the Siskiyou Streamside Protections Review (“Siskiyou Project”). These goals were Desired Future Conditions (DFC) and Oregon Department of Environmental Quality (DEQ) water quality standards for stream temperature. In 2019, ODF staff completed a systematic review of literature to inform these Board sufficiency decisions (Cowan *et al.*, 2019). The geographic scope of this review was included studies from the Siskiyou and adjacent areas of northern California with similar forests.

Based on the results of this initial review, the Board found in June 2019 there was insufficient evidence to make a decision on the sufficiency of the Forest Practices Act (FPA) rules to protect stream temperature and DFC. The Board directed the department to formulate a range of approaches to study sufficiency of rules, including additional work with DEQ and further evaluation of Total Maximum Daily Load (TMDL) information. In September 2019, the Board directed ODF staff to draft an executive summary of relevant scientific literature with an expanded geographic scope to include forests similar to those of the rest of western Oregon (Appendix I, Figure I.1).

In February 2020, a group of environmental and forest industry stakeholders signed a Memorandum of Understanding (MOU) requesting the legislature revise the FPA and pass permanent rules for small and medium SSBT streams in the Siskiyou georegion. Although a bill in support of this MOU and legislation was drafted, the legislature did not vote on this bill. In order to support the work of this MOU, signatories of the MOU requested the Board: 1) pass a temporary rule extending the SSBT rules to the Siskiyou, and 2) pause the Siskiyou Project. The Board approved these recommendations on June 3, 2020, when the report was nearly completed. At their special session in late June 2020, the legislature passed Senate Bill 1602 which directed the Board to begin permanent rulemaking for SSBT streams in the Siskiyou Georegion.

1.2 Science: Stream Temperature and Shade

Since the 2013 systematic review on stream temperature and shade in forestry (Czarnomski *et al.*, 2013), a number of publications have reported results on harvesting effects on stream temperature and shade throughout western Oregon including paired watershed studies (Bladon *et al.*, 2016; Bladon *et al.*, 2018; Reiter *et al.*, 2020), ODF’s Riparian Function and Stream Temperature study (“RipStream”; Davis *et al.*, 2016; Groom *et al.*, 2017; Groom *et al.*, 2018; Arismendi and Groom, 2019), the Density Management and Buffer Study (Anderson and Poage, 2014; Leach *et al.*, 2017), and the work of Cowan *et al.* (2019). There were also similar experiments in other areas of the Pacific Northwest relevant to this summary, including northern

California (Jones *et al.* 2013), western Washington (McIntyre *et al.* 2018), and British Columbia (Guenther *et al.* 2014)¹.

A common theme among many of these studies is that riparian buffers provide shade to streams, which is important for preventing substantial increases in stream temperature associated with forest harvest. For example, the paired catchment studies observed greater increases in stream temperature following harvesting for headwater streams with no buffers as compared to buffered streams (Bladon *et al.*, 2018; Reiter *et al.*, 2020). RipStream papers addressed DEQ water quality standards, including the frequency of exceedances of the Biologically Based Numeric Criteria (“NC”; Groom *et al.*, 2017), and buffer width requirements to maintain stream temperature from exceeding the protecting cold water (PCW) criterion (Groom *et al.*, 2018). RipStream papers also evaluated harvesting effects on downstream temperature (Davis *et al.*, 2016; Arismendi and Groom, 2019). A few studies (Gomi *et al.*, 2006; McIntyre *et al.*, 2018) outside of Oregon provide results that are used in this summary, even though these studies did not explicitly test DEQ standards.

This summary informs the Board’s policy considerations regarding attainment of DEQ water quality standards for temperature for small and medium fish-bearing streams in the Siskiyou geographic region. The following sections address relevant findings to two DEQ water quality standards²: 1) Protecting Cold Water Criterion (PCW); and, 2) NC. We also include a third section that summarizes findings that address the cumulative effects of multiple timber harvest units throughout a watershed. Not all studies directly assessed whether FPA rules are effective in meeting DEQ water quality standards, which presents a challenge in addressing questions that were not specifically in the original analysis. We have included results from these studies as they provide insight into potential harvesting effects on stream temperature and shade, as well as effects of harvesting on downstream temperature.

Most studies included in this analysis measured stream temperature and shade adjacent to or downstream of clearcuts with a hard-edged, unthinned buffer, unless otherwise noted. This summary combines the information on stream temperature and shade described in Czarnomski *et al.* (2013), Cowan *et al.* (2019), and any publications completed since 2013 relevant to this summary. The similarity of forests, and their resultant shade and stream temperature dynamics, between the Siskiyou and the rest of western Oregon are not evaluated in this paper. This report is a summary, and therefore is not exhaustive.

2. Analysis

2.1 Protecting Cold Water and Human Use Allowance

The PCW prohibits human activities, including harvesting, from increasing stream temperatures by more than 0.3 °C. From the RipStream study, Groom *et al.* (2011a) found that clearcut harvesting and retaining buffers on privately owned lands showed a 40% probability of exceeding the PCW. For the aforementioned Riparian Rule Analysis, ODF had a systematic science review drafted (Czarnomski *et al.*, 2013), along with additional technical evaluations.

Czarnomski *et al.* (2013) found that exceedances of the PCW occurred in other studies in the Interior geographic region in Oregon with riparian buffer widths that were consistent with FPA

¹ For a complete list of publications used in this report, see Appendix III.

² Oregon Administrative Rule (OAR) 340-041-0028

rules³ for fish streams. Building on the results of Czarnomski *et al.* (2013), we show that, on average, studies within a number of regions in the Pacific Northwest (Fig. 1) observed harvest-associated changes in stream temperature (ΔT) that exceeded the PCW criterion. Data in Figure 1 include study sites with buffer widths ranging from 20' to 70', which reflects the minimum width (20') that would contain sufficient basal area to meet targets in the FPA, and the widest required possible buffer width (70') required by the FPA for medium streams with insufficient conifer basal area.

We make the distinction between two types of study designs (i.e., upstream/downstream and paired catchment designs) due to differences in how data were collected and locations of reference stream locations (Fig. 1). The upstream/downstream design typically involved stream temperature sensor placement above and below a treatment reach with additional sensors in a control reach further upstream. Paired catchment designs had stream temperature sensors located within and below treatment reaches, which had corresponding reference locations in a different stream catchment prior to and following harvest.

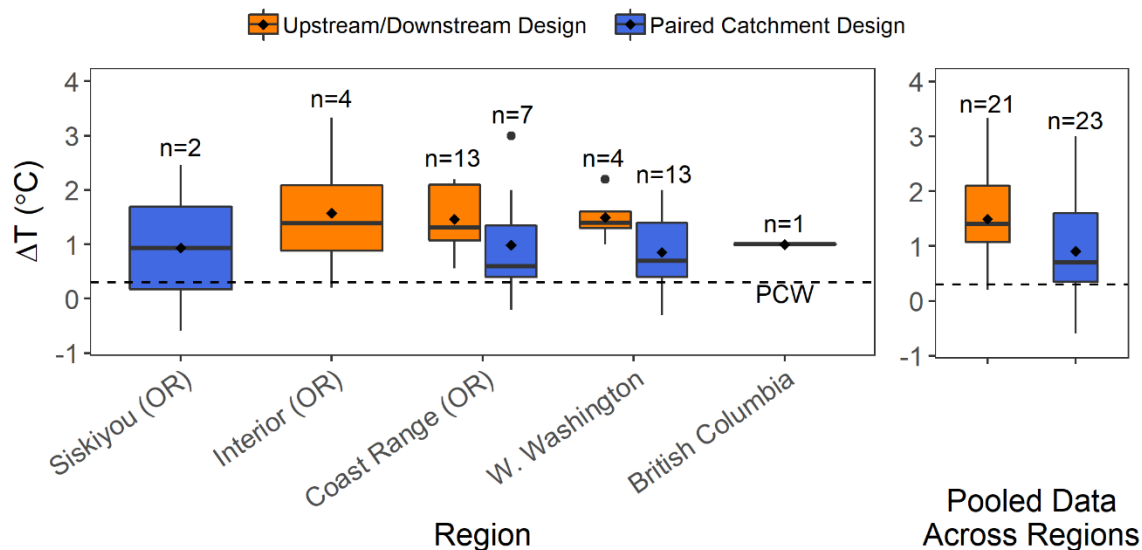


Figure 1. Boxplots of harvest-associated changes in stream temperature (ΔT , °C) by FPA geographic regions (e.g., Siskiyou, Interior, and Coast Range) and other regions of the Pacific Northwest (e.g., western Washington, British Columbia). The one site in British Columbia used a paired catchment design. Mean values by study design across regions are shown in the right panel. The dashed line corresponds with the Protecting Cold Water criterion of 0.3 °C. Each box shows the interquartile range from the 25th to 75th percentile represented by the bottom and top, respectively, of the box. The median is the horizontal line near the center of the boxes and the mean is the point within the box. The maximum and minimum are the ends of each vertical line, and outliers are points above or below the maximum and minimum. The number of sites (n) per region are provided above each boxplot.

³ Note: Most studies available for this review looked at buffer widths as the controlling variable on stream temperature or shade. Those widths which do not correspond precisely with FPA fish stream rules, which have a 20 foot no cut buffer, plus requirements for basal area retention out to 50 feet and 70 feet for small and medium streams, respectively.

Given the Board's decision to expand the geographic scope of literature included in this summary for their consideration, a central question in consideration is the extent to which ΔT may differ between geographic regions. When viewing our findings within each study design, mean ΔT were fairly consistent across the regions. For example, ΔT ranged from 1.46 to 1.58 °C for upstream/downstream designs, whereas ΔT ranged from 0.85 to 1.00 °C for paired catchment designs.

Our analysis suggests study design influences ΔT measured in a study (Fig. 1). On average, paired catchment study designs found smaller ΔT . After pooling data across regions, we found mean ΔT was 1.5 and 0.9 °C for upstream/downstream and paired catchment designs (Fig. 1), respectively, despite the upstream/downstream designs having a greater mean buffer width (48 feet) than the paired catchment designs (40 feet).

Figure 2a shows site-specific relationships between ΔT and buffer width⁴, from data across a broad geographic range in the Pacific Northwest (Fig. I.2.A, Appendix I), but with only a few points representing the Siskiyou region (Volpe, 2009). As buffer width increases, ΔT decreases, highlighting the importance of riparian buffers in moderating stream temperature. This trend is apparent despite the relatively large spread in the data, some of which may be an artifact of differing study designs and reported metrics. Similar to our analysis in Figure 1, study design appeared to influence the relationship between ΔT and buffer width. When fitting a curve (e.g., quadratic function) to the data in Figure 2, we found that the curve crossed the PCW threshold at a narrower buffer width for the paired catchment studies, as compared to studies that used an upstream/downstream design (data not shown).

Based on a Bayesian model using RipStream data, Groom *et al.* (2018) predicted riparian buffer widths of 90 feet to maintain ΔT below the PCW threshold of +0.3 °C (Fig. 2b). Because basal area was often maintained above the FPA requirements at RipStream sites, ODF staff estimated buffer widths under the scenario of landowners harvesting down to minimum FPA basal area requirements (Oregon Department of Forestry, 2015a, b). These widths averaged 23 and 41 feet for small and medium streams, respectively. These widths correspond with increases in ΔT of 1.9 and 1.4 °C, respectively (Fig. 2b). In contrast, significant increases in ΔT were not found along streams with riparian buffers (~50 feet) in Alsea Watershed Studies (Revisited) in western Oregon (Bladon *et al.*, 2016).

Basal area of riparian stands is another important factor in influencing shade, and therefore, stream temperature. Groom *et al.* (2011b) show that basal area and mean tree height were strong predictors of stream shade, and explain more variation in shade as compared with buffer width. Similar to the Bayesian modeling approach in Groom *et al.* (2018), ODF staff predicted a stand total basal area⁵ (conifers and hardwoods) of 280 ft² per 1000 ft. to maintain ΔT below the PCW threshold of +0.3 °C (Fig. 2c). Note that this prediction only used data from no-cut buffers adjacent to clearcuts, and thus we cannot determine how appropriate the predictions are for thinned buffers or uplands.

⁴ Appendix III provides details on how these data were obtained and/or calculated.

⁵ Note that the basal area standard targets for fish streams in the FPA (OAR 629-642-0100(6)) are based primarily on conifers, and only allow up to 10% of hardwood basal area to count towards these targets.

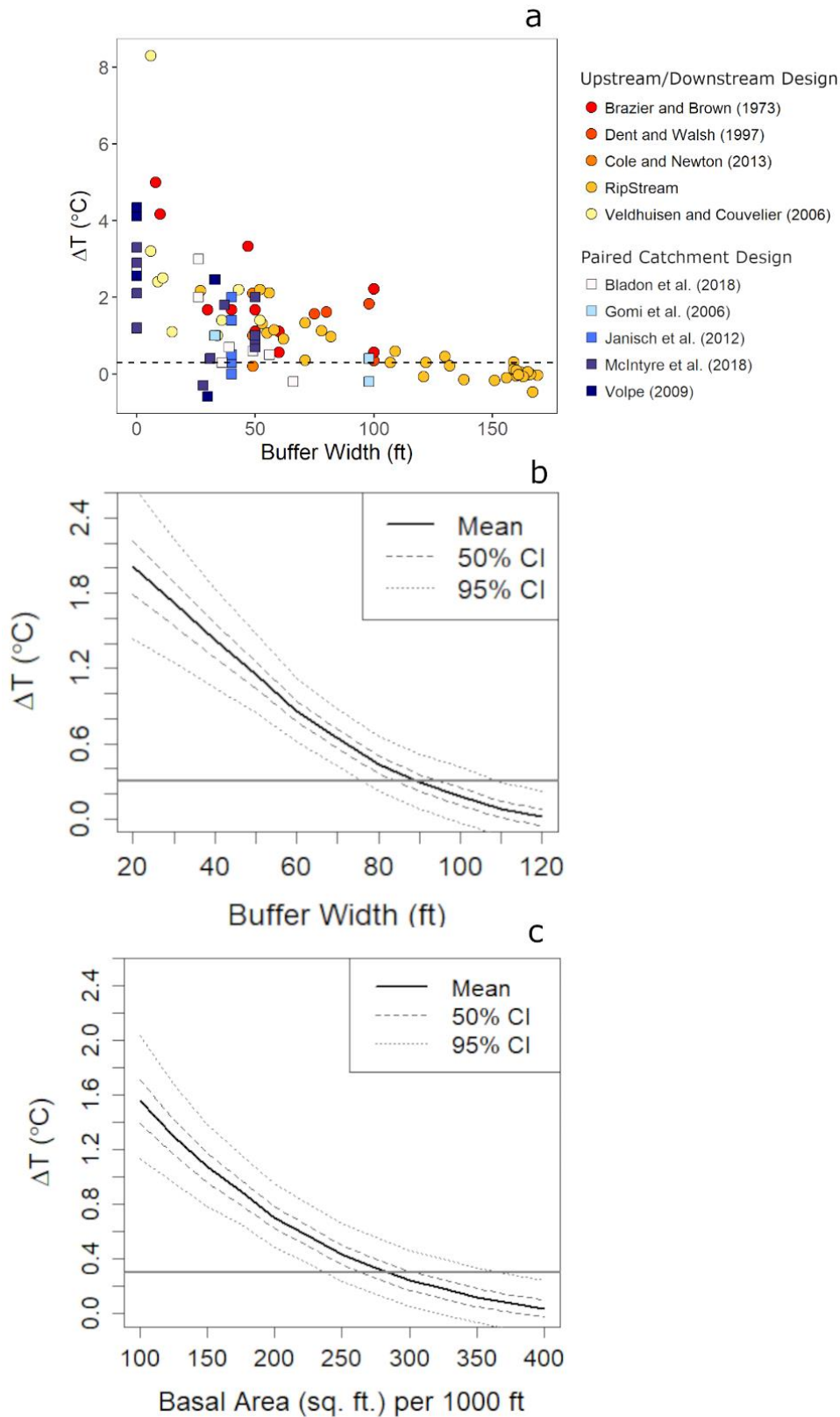


Figure 2. Post-harvest changes in stream temperature (ΔT , $^{\circ}\text{C}$) as a function of: buffer width using literature (Panel a), buffer width as predicted by Groom *et al.* (2018) (Panel b), and basal area as predicted by Groom *et al.* (2018) (Panel c). Data points (Panel a) are color-coded by study that used an upstream/ downstream design (circles) and a paired catchment design (squares). The dashed line crosses the y-intercept at the PCW threshold ($+0.3^{\circ}\text{C}$). The dashed and dotted lines (Panel b and c) represent the 50% and 95% credible intervals (CI), respectively. A 95% credible interval indicates there is a 95% probability that the mean will fall within that interval.

Stream temperature TMDLs are implementation plans for how to achieve DEQ water quality standards (PCW and NC). These TMDLs prescribe the amount of heat that a water body can receive in order to attain the water quality standards. Private forest landowners must meet the requirements set by a human use allowance (HUA) if a temperature TMDL has been established in their watershed. Under current EPA approved plans, private forests landowners are expected to meet this requirement by following stream protection rules in the Forest Practices Act rules. In the Siskiyou geographic region, six temperature TMDLs have been established: the Rogue River Basin TMDL, Upper Sucker Creek Watershed TMDL, Lower Sucker Creek Watershed TMDL, Applegate Subbasin TMDL, Bear Creek Watershed TMDL, and the Upper Klamath and Lost River Subbasins TMDL. The HUA for all of these waterbodies is 0 °C, except for the Rogue Basin, which is 0.04 °C. Thus, for these watersheds, there are greater restrictions for stream temperature than that of the PCW. Where the PCW is not met, HUA is also not being met given its lower temperature threshold. For western Oregon, the modeling conducted by Groom *et al.* (2018) suggests that a buffer width of 120 feet or more would be required to prevent $\Delta T > 0$ °C (Fig. 2b).

Because shade is the major human-influenced control on stream temperature, and is the surrogate measure used in TMDLs to assess proper implementation, we examined shade data from the literature⁶. Based on studies that reported shade as a function of buffer width in the Coast Range geographic region (Allen and Dent, 2001; Reiter *et al.*, 2020), there is an increasing trend in shade with increasing buffer width (Fig. 3a). This trend is most apparent for the RipStream data, which covered a range of buffer widths from 27 to 168 feet. There is evidence that Reiter *et al.* (2020) and McIntyre *et al.* (2018) (77-80%) measured greater shade for a given buffer width (20-70 feet) than the other studies (69-71%). Reiter *et al.* (2020) and McIntyre *et al.* (2018) were conducted on non-fish-bearing streams that were likely narrower, and therefore have more canopy cover due to its overhanging streams more than the fish-bearing streams studied in Allen and Dent (2001) and in the RipStream study.

Comparing pre- and post-harvest shade also provides insight on harvest-associated changes in stream temperature. Three studies reported both pre-and post-harvest shade (RipStream; Reiter *et al.*, 2020; McIntyre *et al.*, 2018) with which to evaluate harvest-associated changes in shade (Fig. 3b). The change in percent shade ranged from -31% to +4 percent. The 18 sites with buffer widths greater than 120 feet, on average, experienced no net loss of shade, whereas the remaining thirteen sites (< 120 feet) experienced an average change in shade of -19%. Buffers in the Trask Watershed Study (Reiter *et al.*, 2020) showed a smaller decrease in shade for a given buffer width. This smaller decrease in shade may be a result of aforementioned narrower channel widths at the Trask Watershed study sites.

⁶ Note that most studies assessed sites with forests less than 80 years old, and thus these sites were not at either the FPA's desired future condition, or DEQ's site potential vegetation.

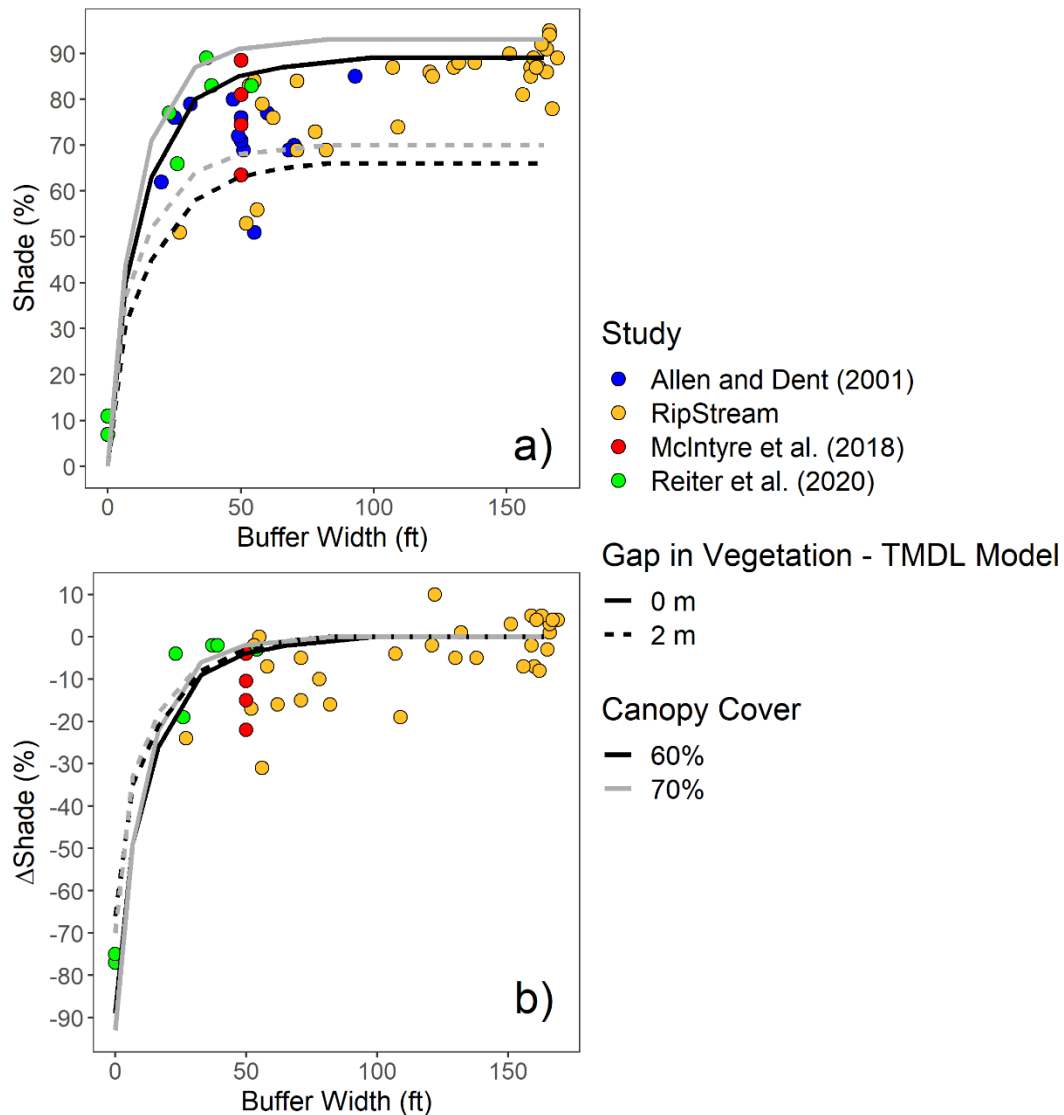


Figure 3. Shade (Panel a) and changes in shade (Δ Shade; Panel b) as a function of buffer width from the literature and TMDL model shade data for riparian stands. The TMDL model used in this analysis was calibrated for mid-Coast, which is in proximity to most of the field data.

To gain a sense of what shade might be expected to be at these sites, we show predicted shade and change in shade (Δ shade) values as a function of buffer width from the DEQ TMDL heat source model (“TMDL values”) in Figures 3a and b, assuming a 0 and 2 m gap⁷ in vegetation

⁷ For comparison, Groom et al (2011b) reported an average wetted channel width of 2.1 meters (Range 1.0-3.7 m).

(i.e., directly above the stream)⁸. In Figure 3a, most field data fall within the range of the 0 and 2 m gap TMDL shade values, which appear to provide a reasonable approximation of shade values observed in western Oregon.

TMDL Δ shade values show steep declines in the 0-40 foot buffer range, with small changes in the 50-80 foot buffer range (Fig. 3b). Field data approximately follow the TMDL values for change in shade (Fig. 3b), except they are more negative than the TMDL curves in the 50-80 foot range of buffer widths. Discrepancies between field data and TMDL values may be explained by a number of factors. First, the model assumes a uniform vertical and horizontal distribution of leaves (i.e., cover) within the canopy, which may not be the case for riparian stands in western Oregon. Second, RipStream stands might not be consistent with DEQ's recommended model input parameter of 60-70% canopy cover. Finally, canopy cover input values used in the TMDL shade modeling are based on measurements occurring in the riparian area (outside of stream), whereas our RipStream measured 90% canopy cover a directly above the streams.

DEQ policy on HUA in the Siskiyou watersheds states that there can be no increase in stream temperature from forestry activities, and thus any reduction in shade can cause a stream to not meet the HUA (R. Michie, personal communication). In Fig. 3b, a 0% change in shade (Δ shade) for 3 of 4 modeled curves correspond with a buffer width of 80 feet, and the remaining curves reaches 0% Δ shade at a buffer width of 100 feet. These TMDL values are presented without uncertainty that is inherent in the natural world, and thus we have also considered TMDL Δ shade values that are from 0 to -5% to account for some degree of uncertainty around a 0% change in shade (i.e., the value required by the HUA). These Δ shade values reach this -5% threshold at a buffer width of 50 feet for all curves.

2.2 Biologically Based Numeric Criterion (NC)

In the Rogue Basin, the NC prohibits human activities, including harvesting, from increasing the seven-day-average maximum stream temperature above 16 °C for streams that have core cold water habitat, and above 18 °C for streams that have salmon and trout rearing and migration use.

Cowan *et al.* (2019) reported results from one study (Volpe, 2009) that evaluated NC. The study's treatments were thinning of wildfire fuels in riparian areas, and thus their shade dynamics are significantly different than unthinned buffers adjacent to clearcuts (i.e., the treatments from the other studies assessed in this summary). Volpe (2009) reported the number of days that exceeded NC for: 1) untreated ("control") catchments; 2) catchments that experienced thinning and prescribed fire to the stream edge; and, 3) catchments that retained a no cut buffer with upland thinning and prescribed fire. Regarding the control watersheds, one site had zero days exceeding the NC both pre- and post-harvest, and the other site decreased by a few days from pre- to post-harvest years. Of the three thinned buffer sites, one increased from 36 to 56 days/summer, one had a small increase, and one went from zero to 49 days/summer. For the

⁸ The TMDL shade values in Figure 3 are based on approximations of pre-harvest stand conditions in order to compare with similar field data. These data do represent stand conditions and not site potential vegetation as used by DEQ to estimate shade targets to achieve heat load allocations set by TMDLs. Figure 3 uses shade predictions from the Mid-Coast TMDL model, and not from TMDLs in the Siskiyou region, since most of the field data are from the Coast Range. DEQ said for these TMDL models, to use 25 m tall trees, and 65% canopy cover for the mid-Coast.

no cut buffer sites, one site remained at zero days/summer pre- and post-harvest, and the other increased from three to 70 days/summer.

In extending the geographic scope, we found two additional studies that specifically address harvesting effects on NC in western Oregon (Bladon *et al.*, 2016; Groom *et al.*, 2017). Groom *et al.* (2017) showed that on private land, exceedances of the NC associated with harvesting occurred at 3 sites out of a total of 18. For these three sites, daily exceedances occurred during 6 to 16% of the time over the course of one post-harvest summer (e.g., year 1 post-harvest in July and August). Buffer widths for the 3 sites with NC exceedances ranged from 56 to 82 feet with an average buffer width of 67 feet. The remaining 15 sites had buffer widths that ranged from 27 to 159 ft. with an average buffer width of 78 feet. In contrast to sites on private land, 0 sites exceeded the NC following state forest prescriptions. Furthermore, exceedances were generally only observed within the first two years following harvesting. Groom *et al.* (2017) also found exceedances of NC pre-harvest, and thereby highlighted the challenge in identifying specific causes of NC exceedances.

In the Alsea watershed, the numeric criterion for core cold-water fish (16 °C), non-core juvenile rearing and migration (18 °C), and migrating salmon and trout (20 °C) were never exceeded along stream reaches within the harvested area with a riparian buffer and downstream (~1600-2000 feet) of the harvest unit (Bladon *et al.* 2016). Reiter *et al.* (2020) also evaluated duration of stream temperature above three thresholds (15, 16, and 18 °C), which represent the thermal niche for coastal giant salamanders (15 °C) and coastal tailed frogs (16 °C), as well as the threshold for mortality of coastal tailed frog eggs (18 °C). Streams with FPA buffers did not experience changes in the duration of temperature above either threshold as a result of harvesting, which indicates harvest did not cause exceedances of NC since these thresholds are at or below those of the NC.

2.3 Cumulative Effects

The PCW indicates that water flowing into salmon, steelhead or bull trout (SSBT) stream reaches require protection so that the receiving stream does not increase ΔT more than 0.3 °C at the point of maximum impact (POMI)⁹. Additionally, HUAs¹⁰ in temperature TMDLs have the same restriction. This measure indicates that multiple harvest units, as well as management activities on other land uses such as agricultural or urban land, may exceed the PCW and HUA downstream if their combined heat loads resulted in a $\Delta T > 0.3$ °C at the POMI due to cumulative effects. This exceedance might occur even if ΔT at each location (e.g., harvest unit or farm) was below the 0.3 °C threshold.

Rigorously quantifying cumulative ΔT at a POMI presents many challenges, such as:

- 1) identifying the specific location of the POMI for a given set of harvest units throughout a small watershed;
- 2) quantifying the heat load for each harvest unit; and,

⁹ In OAR 340-041-0028 (11), the PCW "...applies to all sources taken together at the point of maximum impact where salmon, steelhead or bull trout [SSBT] are present".

¹⁰ OAR 340-041-0028 (12); note that stream temperature TMDLs focus on heat load as the pollutant, but temperature is the metric for attainment.

- 3) quantifying heat dissipation downstream of harvest units intermixed with additional heat load from other sources, which requires knowing transit times of diurnal heat pulses.

Quantifying cumulative effects, and subsequent regulation of those effects, would also require predicting when and where timber harvests are occurring within a watershed, which is not within ODF's statutory authority. Overall, development of a model to rigorously analyze cumulative effects would require many assumptions, potentially leading to spurious model results. However, we can gain some insight into the downstream heat dissipation using existing literature that involved stream temperature measurements downstream of harvests.

In western Oregon, a few studies evaluated the effects of harvesting on stream temperature further downstream from individual harvest units (Cole and Newton, 2013; Davis *et al.*, 2016; Arismendi and Groom, 2019) and paired watershed studies (Bladon *et al.* 2018). An additional study assessed cumulative effects by implementing treatments with no buffers, partial buffers, and FPA buffers intermixed with non-treatment reaches (Newton and Cole, 2013). They observed temperature decreases approximately 260 feet downstream of all treatments. However, three of four streams experienced elevated downstream temperatures relative to that of pre-harvest.

Using RipStream data, Davis *et al.* (2016) modeled ΔT 1000 feet downstream of harvest, and found the range of downstream ΔT was 82 to 1% (56% on average) of that at the downstream end of the harvest reach. The primary factors that influenced the downstream temperature changes included stream width, depth, and gradient.

Arismendi and Groom (2019) further evaluated these same RipStream data. They observed mixed findings with regard to downstream ΔT . For example, 50% of the sites showed increases and the other 50% showed decreases in the difference between the downstream and harvest reaches first summer post-harvest. Across all post-harvest years, the downstream ΔT increased 0.2 °C on average. The greatest differences between the treatment and downstream reaches were observed during the first and second year post-harvest (Arismendi and Groom, 2019). By year 5 post-harvest, temperature patterns downstream were most similar to pre-harvest conditions, which may partially be explained by increasing understory vegetation near the channel in response to greater light availability following harvesting. Overall, their results suggests streams may warm or cool downstream prior to and after harvesting. As described above, there is evidence other factors (e.g., stream morphology) likely play an important role in determining temperature response of reaches downstream of harvesting.

From the paired catchment studies, Bladon *et al.* (2018) evaluated downstream ΔT for sites that ranged from 50 to 4659 feet from the downstream boundary of harvest units. There was strong evidence that downstream cooling did occur once streams exited the harvested unit and entered into unharvested areas, and no evidence for warming at downstream sites. Downstream transport of ΔT was primarily controlled by bedrock characteristics and percentage of harvested area within the catchment. In catchments with a less permeable bedrock, the thermal regime appeared to be more tightly coupled with the effective shade provided by vegetation (i.e., greater temperature increases in response to harvesting). Bladon *et al.* (2018) suggested geology played an important role in influencing downstream transport of heat due to the role of the underlying lithology in determining the relative proportions of surface flow, groundwater, and subsurface flow. In more permeable geology, streamflow is primarily dominated by groundwater, which tends to be cooler and thermally stable compared to surface water during the summer.

Data gaps

There were no analyses of:

- Heat transport downstream of harvests (only temperature down stream of harvests was analyzed)
- The effect of thinned buffers adjacent to clearcuts, on stream shade or temperature
- The impact on stream shade or temperature due to differences in:
 - stand density
 - stream flow for small vs. medium streams or
 - stream width

Limitations

Out of scope for this report were:

- Additional impacts of climate change on stream temperature and shade
- Assessment of the extent, if any, of different harvest-related impacts on stream temperature and shade from different forest types in the Siskiyou vs. those of the rest of western Oregon, or the resulting confidence in extrapolating results from western Oregon to the Siskiyou
- A rigorous analysis of variables that explain outcomes of studies

3. Conclusions

In extending the geographic scope of the Siskiyou Streamside Protections Review we reviewed recent literature in addition to literature that was reviewed in Czarnomski *et al.* (2013) and Cowan *et al.* (2019). Our review of relevant literature suggests implementation of current FPA rules likely do not meet the PCW ($\Delta T \leq 0.3$ °C) criterion of water quality standards. For example, studies with buffers similar to those of the FPA had ΔT in the 0.9-1.5 °C range. This conclusion is further supported by Groom *et al.* (2018), who show that buffer widths less than 90 feet are likely to result in exceedances of the PCW. Previous work by ODF staff also show implementation of minimum FPA requirements for vegetation retention would result in buffer widths of 23 and 41 feet along small and medium streams, respectively, in the Coast Range. These widths correspond to ΔT of 1.9 and 1.4 °C, respectively.

Furthermore, we show 88% of sites with buffers widths 20 to 70 feet and 73% sites of sites with buffers >70 feet appear to exceed the PCW (Table 1) for most relevant studies that involved implementation of FPA rules for vegetation retention along streams during logging operations. It is worth noting Groom *et al.* (2011a) applied a more rigorous approach to evaluating PCW for RipStream sites and found sites on private land had a 40% probability of exceeding the PCW. The discrepancy between Groom *et al.* (2011a) and our analysis may be due to a few reasons including the larger geographic used in this analysis and the use of multiple post-harvest years by Groom *et al.* (2011a).

There is evidence that clear-cut harvesting under FPA rules for fish streams resulted in a net loss of shade as a result of harvesting, which likely explains exceedances of the PCW ($\Delta T \leq 0.3$ °C), and therefore also the HUA ($\Delta T = 0$ °C). The DEQ TMDL modeling predicts 0% Δ shade as a

result of harvesting when buffer widths are ~80 feet or greater, and less than a 5% Δ shade when buffer widths are ~50 feet or greater. Results from recent studies partially confirms the model projections from the TMDL model, although there are a few inconsistencies. For example, the RipStream study showed greater actual post-harvest decreases in Δ shade than that of the TMDL model for buffer widths of 50 to 80 feet.

In contrast to the PCW, sites appeared to infrequently exceed the NC. We found that 17% of sites with buffer widths of 20-70 feet, and 9% of sites with buffer widths >70 feet, exceeded the NC. All exceedances were observed in the RipStream study, whereas the five sites in the Alsea and Trask Watershed studies did not appear to exceed the NC (Table 1). Considering shade, most of these field data are in the range of TMDL shade values, which likely explains why NC is met at most sites harvested following the FPA.

Table 1. Summary of data from relevant studies that identify whether the FPA is meeting water quality standards. This table includes studies that implemented current FPA prescriptive rules on vegetation retention along streams¹¹. The number of sites that appeared to meet or not meet the PCW and NC, as well as total number of and percentage of sites, are provided.

Study	# of Sites	= FPA or > FPA	Buffer width (ft.) Mean (Range)	Appear to Meet PCW? (# of Sites)		Appear to Meet NC? (# of Sites)		
				Yes	No	Yes	No	
Dent and Walsh (1997)	4	> FPA	88 (75 – 100)	0	4	-	-	
Newton and Cole (2013)	3	= FPA	49	1	2	-	-	
RipStream:	7	= FPA	52 (27 – 62)	0	7	5	2 ^a	
Groom <i>et al.</i> (2011); Groom <i>et al.</i> (2017)	11	> FPA	107 (71 – 159)	4	7	10	1 ^a	
Bladon <i>et al.</i> (2016)	2	= FPA	49	-	-	2	0 ^b	
Bladon <i>et al.</i> (2018)	7	= FPA	43 (26 – 66)	1	6	-	-	
Reiter <i>et al.</i> (2020)	3	= FPA	43 (37 – 54)	-	-	3	0 ^c	
= FPA				Total:	2	15	10	2
				Percentage:	12%	88%	83%	17%
> FPA				Total:	4	11	10	1
				Percentage:	27%	73%	91%	9%

^aNumeric criterion included a 16 °C criterion for sites with salmon and anadromous trout core cold-water habitat and an 18 °C criterion for sites used for non-core juvenile rearing and migration by salmon and trout.

^bStream temperature never exceeded the 16 °C criterion for salmon and anadromous trout core cold-water habitat, the 18 °C criterion for sites for rearing and migration by salmon and trout, or the 20 °C for migrating salmon and trout.

^cAlthough the numeric criterion was not explicitly tested, Reiter *et al.* (2020) show that stream temperature of buffered streams never exceed 15, 16 or 18 °C, which corresponds with the upper thermal niche for coastal giant salamanders (15 °C) and coastal tailed frogs (16 °C), as well as the threshold for mortality of coastal tailed frog eggs (18 °C).

¹¹Not including sites that implemented additional forest management plans (e.g., ODF State Forest Northwest Forest Management Plan)

In consideration of TMDL shade values, our results suggest that assuming a 0-meter gap in vegetation with DEQ’s recommended 60-70% canopy cover for a 50 year-old Douglas fir stand sets a high shade target of 91% that are achieved by about thirty percent of pre-harvest sites (Table 2). In contrast, all pre-harvest stands were capable of achieving a shade value of 68%, which was the TMDL shade value for a 2-meter gap. Most of these stands continued to provide post-harvest shade equaling or exceeding 68% (Table 3). While maximizing shade and canopy cover for streams is an important goal, it is important to identify inherent limitations of riparian stands in providing shade to streams. In some cases, stream temperature decreased further downstream for some sites, but it also increased downstream for other sites. In the paired watershed Studies in western Oregon, there was strong evidence that downstream cooling of harvest units occurred¹².

Table 2. Pre-harvest comparison of treatment sites with DEQ effective shade lookup tables for 82 foot tall vegetation, at 65% riparian canopy density.

Study	# of Sites	Buffer width (ft.) Mean (Range)	Meet 0-m gap TMDL curve max (91%)? (# of Sites)		Meet 2-m gap TMDL curve max (68%)? (# of Sites)	
			Yes	No	Yes	No
McIntyre (2018)	4	NA	2	2	4	0
Reiter (2020)	5	NA	1	4	5	0
RipStream ^a	31	NA	9	22	31	0
	7 ^b	NA				
Total:			12	28	40	0
Percentage^c:			30%	70%	100%	0%

^aGroom *et al.* (2011; 2017)

^bSites listed in Table 3 (subset of 31 listed in previous line).

^cFor sites listed in Table 3, 16/16 (100%) meet 68% shade criterion.

¹²Not including sites that implemented additional forest management plans (e.g., ODF State Forest Northwest Forest Management Plan)

Table 3. Post-harvest comparison of treatment sites with DEQ effective shade lookup tables for 82 foot tall vegetation, at 65% riparian canopy density.

Study	# of Sites	Buffer width (ft.) Mean (Range)	Meet 0-m gap TMDL curve max (91%)? (# of Sites)		Meet 2-m gap TMDL curve max (68%)? (# of Sites)	
			Yes	No	Yes	No
Allen and Dent (2001)	12	48 (20 – 70)	8	4	11	1
McIntyre (2018)	4	50	0	4	3	1
Reiter (2020)	5	36 (23 – 54)	0	5	4	1
RipStream: Groom <i>et al.</i> (2011) Groom <i>et al.</i> (2017)	7	52 (27-62)	0	7	4	3
Total:			8	20	22	6
Percentage:			29%	71%	79%	21%

*Of studies with pre-harvest data, 69% (11/16) of post-harvest treatments meet the TMDL value of shade for 2-m gap.

4. References (includes citations in appendices)

- Allen M, Dent L., 2001. Shade conditions over forested streams in the Blue Mountain and Coast Range georegions of Oregon. Oregon Department of Forestry. Technical Report #13.
- Anderson, P.D., Larson, D.J., Chan, S.S., 2007. Riparian buffer and density management influences on microclimate of young headwater forests of western Oregon. *Forest Science* 53, 254–269.
- Anderson, P.D., Poage, N.J., 2014. The Density Management and Riparian Buffer Study: A large-scale silviculture experiment informing riparian management in the Pacific Northwest, USA. *Forest ecology and management* 316, 90–99.
- Arismendi, I., Groom, J.D., 2019. A novel approach for examining downstream thermal responses of streams to contemporary forestry. *Science of The Total Environment* 651, 736–748.
- Bateman, D.S., R.E. Gresswell, D. Warren, D.P.Hockman-Wert, D.W. Leera, J.T. Light, J.D. Stednick, 2018. Fish response to contemporary timber harvest practices in a second-growth forest from the central Coast Range of Oregon. *Forest Ecology and Management* 411 (2018) 142–157. <https://doi.org/10.1016/j.foreco.2018.01.030>
- Bladon, K.D., Cook, N.A., Light, J.T., Segura, C., 2016. A catchment-scale assessment of stream temperature response to contemporary forest harvesting in the Oregon Coast Range. *Forest ecology and management* 379, 153–164.

- Bladon, K.D., Segura, C., Cook, N.A., Bywater-Reyes, S., Reiter, M., 2018. A multicatchment analysis of headwater and downstream temperature effects from contemporary forest harvesting. *Hydrological Processes* 32, 293–304.
- Brazier JR, Brown G.W., 1973. Buffer strips for stream temperature control. OSU School of Forestry: Corvallis, OR
- Cole, E., Newton, M., 2013. Influence of streamside buffers on stream temperature response following clear-cut harvesting in western Oregon. *Canadian Journal of Forest Research* 43:993-1005.
- Cole E, Newton M., 2015. Relationships between radiation and canopy closure estimates in streamside buffers in western Oregon. *For. Sci.* 61(3):559–569.
- Cowan, A.D., Frueh, W.T., Allen, M., 2019. Siskiyou Streamside Protections Review: A Systematic Review on Stream Temperature, Shade, and Desired Future Condition: Report. Oregon Department of Forestry.
- Czarnomski, N.; Hale, C.V.; Frueh, W.T.; Allen, M.; Groom, J.D. 2013. Effectiveness of Riparian Buffers at Protecting Stream Temperature and Shade in Pacific Northwest Forests: A Systematic Review. Final Report September 2013.
- Davis, L.J., Reiter, M., Groom, J.D., 2016. Modelling temperature change downstream of forest harvest using Newton’s law of cooling. *Hydrological Processes* 30, 959–971.
- Dent, L.F., Walsh, J.B.S., 1997. Effectiveness of riparian management areas and hardwood conversions in maintaining stream temperature. Oregon Department of Forestry, Forest Practices Technical Report 3.
- Gomi, T., Moore, R.D., Dhakal A.S., 2006. Headwater stream temperature response to clear-cut harvesting with different riparian treatments, coastal British Columbia, Canada. *Water Resources Research* 42, W08437.
- Groom, J.D., Dent, L., Madsen, L.J., 2011a. Stream temperature change detection for state and private forests in the Oregon Coast Range. *Water Resources Research* 47, W0151.
- Groom, J.D., Dent, L., Madsen, L.J., Fleuret, J., 2011b. Response of western Oregon (USA) stream temperature to contemporary forest management. *Forest Ecology and Management* 262:1618-1629.
- Groom, J.D., Johnson, S.L., Seeds, J.D., Ice, G.G., 2017. Evaluating links between forest harvest and stream temperature threshold exceedances: The value of spatial and temporal data. *JAWRA Journal of the American Water Resources Association* 53, 761–773.
- Groom, J.D., Madsen, L.J., Jones, J.E., Giovanini, J.N., 2018. Informing changes to riparian forestry rules with a Bayesian hierarchical model. *Forest ecology and management* 419, 17–30.

- Guenther, S.M., Gomi, T., Moore, R.D., 2014. Stream and bed temperature variability in a coastal headwater catchment: influences of surface-subsurface interactions and partial-retention forest harvesting. *Hydrological Processes* 28, 1238–1249.
- Hairston, A.B., 1996. Response to water protection rule changes in the Oregon Forest Practices Act: Landowner/operator opinions and streamside conditions. PhD Dissertation. Oregon State University. September 27, 1996.
- Heimann, D.C., 1988. Recruitment trends and physical characteristics of coarse woody debris in Oregon Coast Range streams. MS thesis. Forest Engineering, Oregon State University. August 9, 1988.
- Janisch, J.E., Wondzell S.M., Ehinger W.J., 2012. Headwater stream temperature: Interpreting response after logging, with and without riparian buffers, Washington, USA. *Forest Ecology and Management* 270: 302-313.
- Jones, B.E., Krupa, M., Tate, K.W., 2013. Aquatic ecosystem response to timber harvesting for the purpose of restoring Aspen. *PloS one* 8.
- Kaylor, M.J., Warren, D.R., 2017. Linking riparian shade and the legacies of forest management to fish and vertebrate biomass in forested streams. *Ecosphere* 8(6):e01845. 10.1002/ecs2.1845.
- Kibler, K.M., Skaugset, A., Ganio, L.M., Huso M.M., 2013. Effect of contemporary forest harvesting practices on headwater stream temperatures: Initial response of the Hinkle Creek catchment, Pacific Northwest, USA. *Forest Ecology and Management* 310 (2013) 680–691.
- Leach, J.A., Olson, D.H., Anderson, P.D., Eskelson, B.N.I., 2017. Spatial and seasonal variability of forested headwater stream temperatures in western Oregon, USA. *Aquatic sciences* 79, 291–307.
- McIntyre, A.P., Hayes, M.P., Ehinger, W.J., Estrella, S.M., Schuett-Hames, D., Quinn, T., 2018. Effectiveness of Experimental Riparian Buffers on Perennial Non-fish-bearing Streams on Competent Lithologies in Western Washington (Technical Report No. CMER 18-100), Cooperative Monitoring, Evaluation and Research Report. Washington Department of Natural Resources, Olympia, Washington.
- Morman, D., 1993. Riparian rule effectiveness study report. Forest Practices Program, Oregon Department of Forestry [online] Available from: <http://www.getcited.org/pub/100206391> (Accessed 19 February 2013)
- Newton M., Cole E.C., 2013. Stream temperature and streamside cover 14-17 years after clearcutting along small forested streams, western Oregon. *Western Journal of Applied Forestry* 28: 107–115.
- Oregon Department of Environmental Quality, 2008. Rogue River Basin TMDL.

- Oregon Department of Forestry, 2015a. Riparian Rule Analysis: Methods for evaluating prescriptions and their geographic extent. Board of Forestry Meeting, April 22. Attachment 3.
- Oregon Department of Forestry, 2015b. Decision Matrix. Board of Forestry Meeting, July, 23. Attachment 1.
- Piccolo, J.J., Wipfli, M.S., 2002. Does red alder (*Alnus rubra*) in upland riparian forests elevate macroinvertebrate and detritus export from headwater streams to downstream habitats in southeastern Alaska? *Can. J. Fish. Aquat. Sci.* 59: 503–513 (2002) DOI: 10.1139/F02-019.
- Reiter, M., Johnson, S.L., Homyack, J., Jones, J.E., James, P.L., 2020. Summer stream temperature changes following forest harvest in the headwaters of the Trask River watershed, Oregon Coast Range. *Ecohydrology*, e2178. DOI: 10.1002/eco.2178
- Ridgeway, J., 2019. An analysis of changes in stream temperature due to forest harvest practices using DHSVM-RBM. M.S. Thesis, California Polytechnic State University. June 2019.
- Steinblums, I.J., 1977. Streamside buffer strips: Survival, effectiveness, and design. M.S. Thesis, Oregon State University. June 22, 1977.
- Steinblums, I.J., Froehlich, H.A., Lyons, J.K., 1984. Designing stable buffer strips for stream protection. *Journal of Forestry* 82: 49–52.
- Veldhuisen, C., Couvelier, D., 2006. Summer Temperatures of Skagit Basin Headwater Streams: Results of 2001 – 2003 Monitoring.
- Volpe, C.J., 2009. Effects of prescribed riparian fire in small headwater streams in the Rogue River basin, southwest Oregon. USDI-BLM agency report. Bureau of Land Management, Medford, OR.
- Warren, D.R., Keeton, W.S., Bechtold, H.A., Rosi-Marshall, E.J., 2013. Comparing streambed light availability and canopy cover in streams with old-growth versus early-mature riparian forests in western Oregon. *Aquat Sci* (2013) 75:547–558 DOI 10.1007/s00027-013-0299-2.

Appendix I. Geographic Area Covered by Report

This appendix shows the geographic scope, per Board direction, for studies to be considered relevant for this report (Figure I.1), and sites from studies included in the report (Figure I.2).

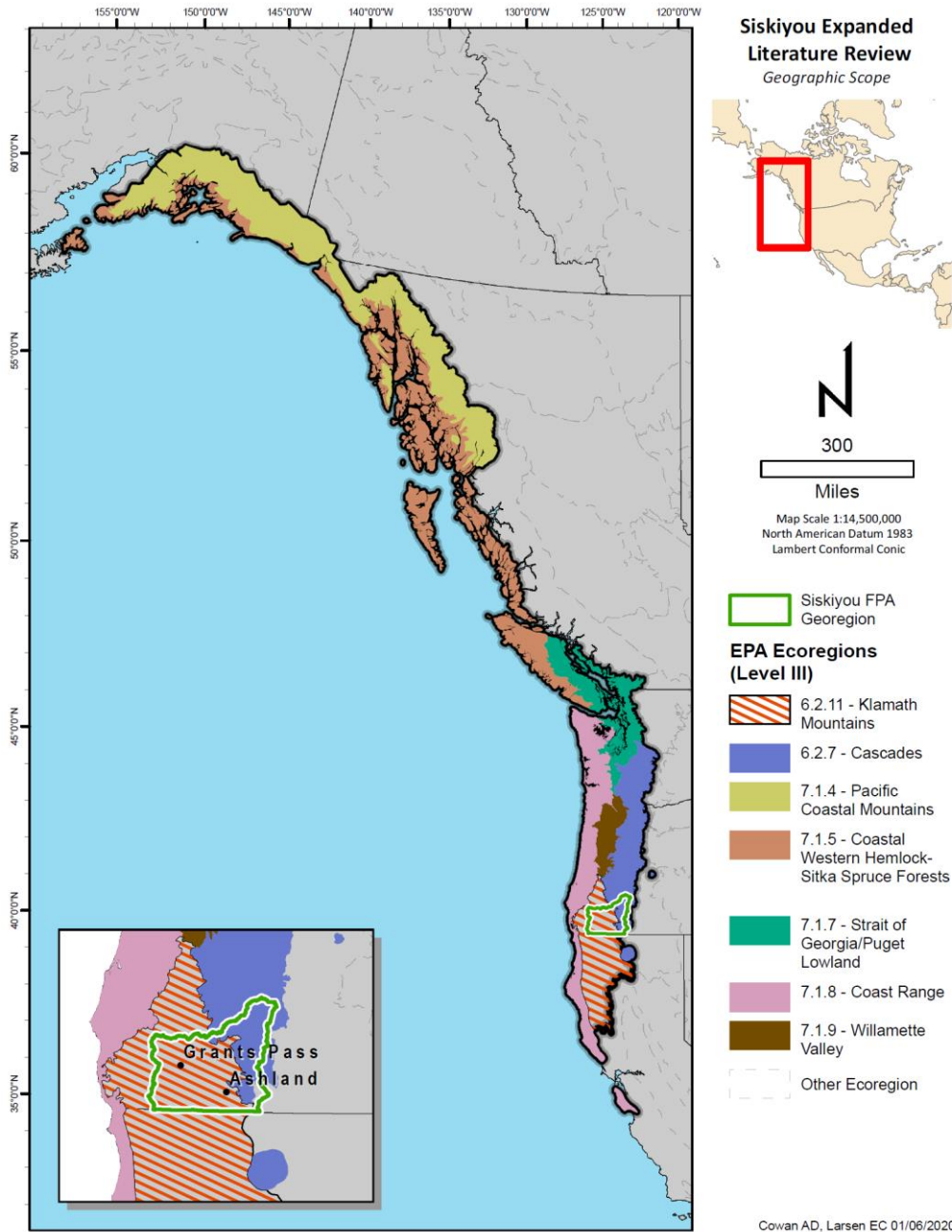


Figure I.1. Map of expanded geography, per Board direction, for studies to be considered in this summary. Map credits: Ariel D. Cowan and Erik C. Larsen.

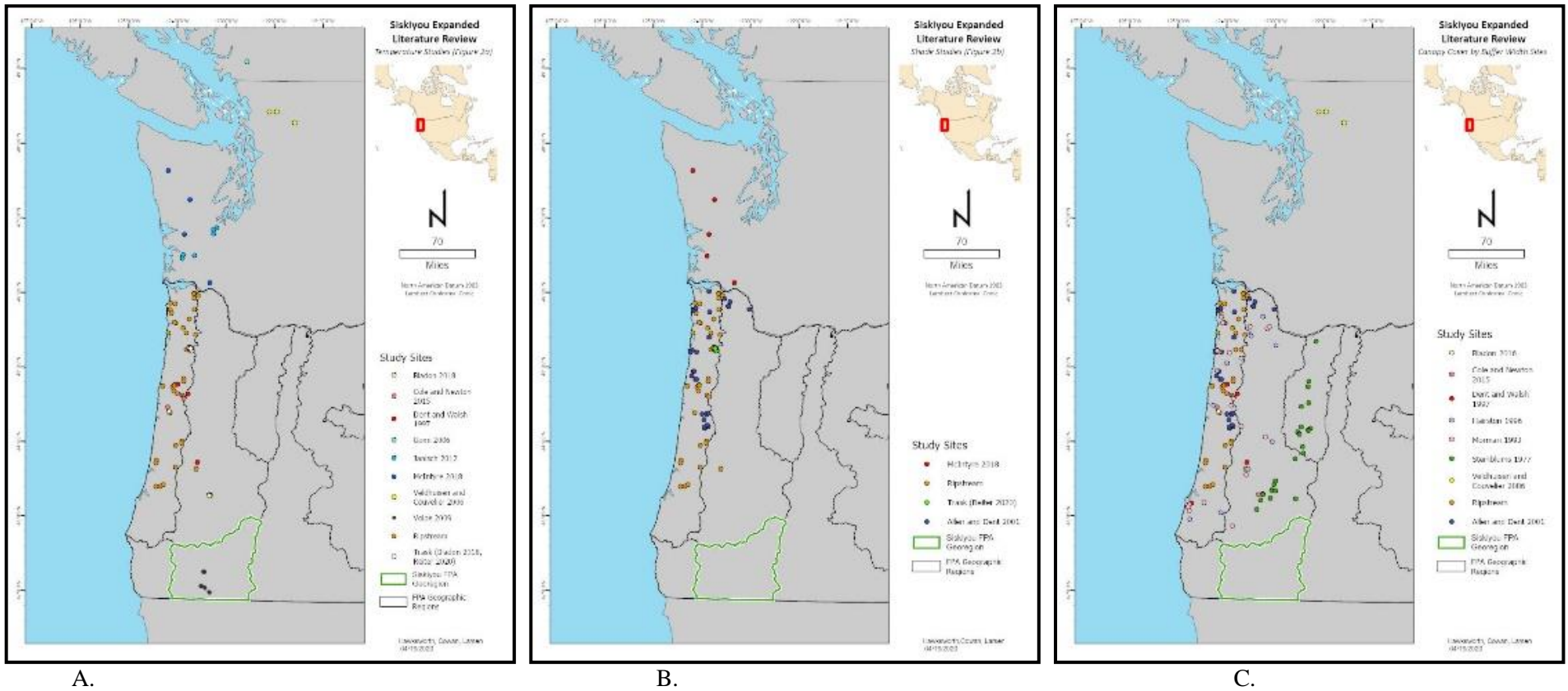


Figure 1.2. Distribution of survey sites for studies in the literature review, relative to the Siskiyou FPA Geographic Region. A). Temperature studies listed in Report Figure 2a. B). Shade studies listed in Report Figure 3. C). Studies that reported both canopy cover and buffer width. Brazier and Brown (1973) was not included in panel A because of uncertainty in site locations.

Appendix II. Instream Canopy Cover

To understand the range of instream canopy covers experienced in the field, we analyzed data from the literature. This resulted in a median estimate of 79% (Range 37%-96%; Bateman *et al.* 2018, Bladon *et al.* 2016, Anderson *et al.* 2007), with most of the data from Oregon (mostly, Coast Range, some west Cascades). The largest single dataset came from RipStream (Figure II.1). Most of these stands exceeded 90% instream canopy cover, with few stands less than 80%. These estimates can assist with understanding the range of variability in natural riparian stands, and can be used for comparison with the Siskiyou Forest Practices Geographic Region.

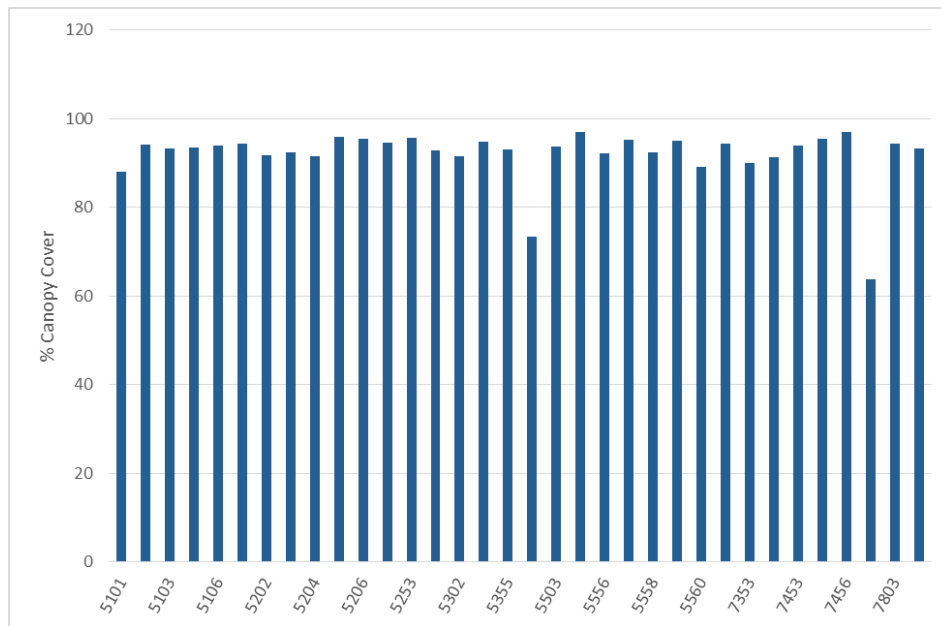


Figure II.1. Pretreatment mean instream canopy cover at RipStream sites. Mean 92%, Median 94%, Range 64-97%.

We further estimated instream canopy cover with age from a subset of eight studies representing 134 sites (Figure II.2). This estimation was considered important to determine how quickly baseline characteristics might be achieved, and whether there was a peak age for riparian canopy cover. Figure II.2 indicates that cover similar to baseline may be achieved by 20 years of age, although 30 may be a more conservative estimate. Once this age is achieved, there is little systematic variation in canopy cover.

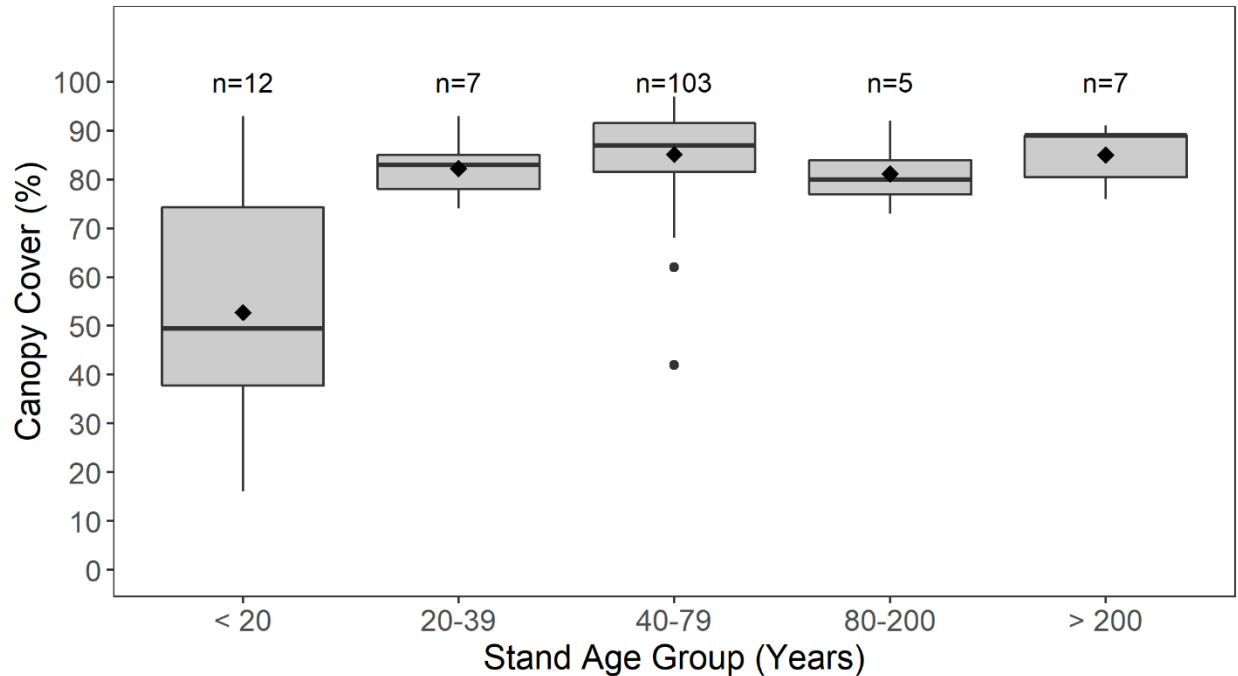


Figure II.2. Box plots of in-stream canopy cover as a function of stand age. “n” represents the number of sites within each age group; boxes represent the 25th to the 75th percentile of the data. The central line represents the median, while the central dot represents the mean; vertical lines represent the minimum and maximum ranges, except for dots beyond these lines that represent outliers. Stands in this figure exceeding 20 years of age had a median canopy cover¹³ of 87%. Source: Allen and Dent, 2001; Bladon *et al.*, 2016; Brazier and Brown, 1973; Cole and Newton, 2015; Dent and Walsh, 1997; Hairston, 1996; Heimann, 1988; Kaylor and Warren, 2017; Kibler *et al.*, 2013; Morman, 1993; Newton and Cole, 2013; Piccolo and Wipfli, 2002; RipStream; Steinblums *et al.*, 1984; Veldhuisen and Couvelier, 2006; Warren *et al.*, 2013. In general, a number of studies have indicated a weak increasing trend of canopy cover with increasing buffer width. In our analysis, canopy cover was highly variable for buffer widths less than 75’ across all data sets (data not shown). For example, in-stream canopy cover at a 50’ buffer width ranged from 15%-95%, while buffers approximating 100’ ranged from 60%-93%. Similar to shade, we found that decreases in canopy cover from pre- to post-harvest were greatest for smaller buffer widths (data not shown).

¹³ Canopy cover is the percentage of visible sky blocked by vegetation (foliage, branches, stems) or topographic features, whereas effective shade is the percent reduction of potential daily solar radiation load delivered to the stream surface (DEQ 2008).

Appendix III. Methods

In the process of summarizing and extracting data from the literature, we also noted stream temperature and shade metrics used in the relevant papers, data sources within each paper, and how ODF staff or authors of the paper calculated changes in stream temperature (Tables III.1 and III.2). One challenge in analyzing and comparing results among different studies is in using multiple sources of data that have different metrics, as well as differences in study design.

The temperature metric most appropriate for evaluating PCW and NC is the 7-day moving average of daily maximum. In this analysis, we included results from studies that did not use this metric (Table III.1) because we felt that this information still provided valuable insight into the effects of harvesting on stream temperature. In summarizing exceedances of DEQ water quality standards in Table 1, most studies used the 7-day moving average of daily maximum, with two exceptions. Cole and Newton (2013) reported average daily maximum values, and Reiter *et al.* (2020) reported 30-minute stream temperature data. The Cole and Newton (2013) paper was used to assess PCW exceedances, whereas Reiter *et al.* (2020) was used to evaluate NC exceedances.

Regarding the use of daily maximum versus 7-day moving average of daily maximum, it is likely that both metrics will yield similar results, especially when these values are averaged over a period of a month or so, a common approach for studies used in the analysis. To test whether metrics would yield different results, we randomly generated stream temperature daily maximum values over a period of a month. We then compared a monthly average daily maximum values and a monthly average of 7-day moving average of daily maximum. Both approaches resulted in nearly identical values, which suggests that results from Cole and Newton (2013) are appropriate for testing exceedances of the PCW.

Regarding the use of 30-minute data vs. 7-day moving average of daily maximum stream temperature data to test the NC, Reiter *et al.* (2020) did not detect exceedances. A series of 30-minute stream temperature data over a period of a day or more includes daily maximums. Therefore, if no 30-minute stream temperature measurements exceed the NC, neither the daily maximum or 7-day moving average of daily maximum would have exceeded the NC.

Another caveat to the analysis in this report is that a few studies did not report pre-harvest stream temperature results (Brazier and Brown, 1973; Veldhuisen and Couvelier, 2006) or did not report pre-harvest data for sites that could be used in this analysis (Dent and Walsh, 1997). Pre-harvest measurements are used to account for inter-annual variability in stream temperature, which can potentially influence the change in stream temperature through a harvest unit. Note that Dent and Walsh (1997) was used in Table 1 due to geographic relevance and implementation of FPA buffers. Results from Brazier and Brown (1973) and Veldhuisen and Couvelier (2006) were only used in Figures 1 and 2.

In the shade analysis (Fig. 3a, b), we included predicted shade values from the Mid-Coast TMDL model, assuming 82-foot tall trees (mean tree height from RipStream; Groom *et al.*, 2011b) and riparian canopy cover of 60-70%. The 0-meter gap was chosen because that was the only assumption that matched DEQ system potential shade as quantified in shade curves in their

TMDLs (under system potential tree height and canopy density conditions, e.g., Rogue River TMDL (DEQ, 2008)) The 2-meter gap was also selected since Groom *et al.* (2011b) found that wetted width of streams studied in the RipStream study were 2 m on average, and DEQ uses wetted width as an approximation of vegetation gaps in the canopy above a stream.

Table III.1 Summary information for studies used in the stream temperature analysis of this report including stream temperature metrics, specific location of the data sources, and a brief description of how ΔT was calculated¹⁴e

Study	Geographic Region	Study Design	Water Quality Standard	Stream Temperature Metrics	Data Source	Calculation of ΔT
Bladon <i>et al.</i> (2016)	Coast Range, Oregon	Paired Catchment	NC	7-day moving average of daily maximum	Text of discussion, pg. 161	--
Bladon <i>et al.</i> (2018)	Coast Range, Oregon	Paired Catchment	PCW	7-day moving average of daily maximum	Figure 3* (data extracted)	1
Brazier and Brown (1973)	Coast Range and Interior, Oregon	Upstream/downstream	PCW	Average	Table 1 (Observed Temperature)	2
Cole and Newton (2013)	Coast Range and Interior, Oregon	Upstream/downstream	PCW	Daily maximum	Authors provided requested data to ODF	3
Dent and Walsh (1997)	Coast Range and Interior, Oregon	Upstream/downstream	PCW	7-day moving average of daily maximum	Table 3	2
Gomi <i>et al.</i> (2006)	Coastal British Columbia	Paired Catchment	PCW	Daily maximum	Table 3 (C, D, & H; Summer)	4
Janisch <i>et al.</i> (2012)	Western Washington	Paired Catchment	PCW	Daily maximum	Figure 3b (Continuous buffers)	4
McIntyre <i>et al.</i> (2018)	Western Washington	Paired Catchment	PCW	Daily maximum	Table 7-6 (OLYM, CASC, WIL1, WIL2); July and August	4, 5
Reiter <i>et al.</i> (2020)	Coast Range, Oregon	Paired Catchment	NC	30-min. stream temperature	Text of results and discussion	-
RipStream Groom <i>et al.</i> (2011, 2017, & 2018)	Coast Range and Interior, Oregon	Upstream/downstream	PCW, NC	7-day moving average of daily maximum	2014 Board of Forestry Workshop	3
Veldhuisen and Couvelier (2006)	Western Washington	Upstream/downstream	PCW	7-day moving average of daily maximum	Appendix 2, 3, 4b	2
Volpe (2009)	Siskiyou, Oregon	Paired Catchment	PCW, NC	7-day moving average of daily maximum	Table 2 (US2, F2, B1, LS2, F1)	1

$$^1\Delta T = (T_{\text{Post.treatment}} - T_{\text{Pre.treatment}}) - (T_{\text{Post.reference}} - T_{\text{Pre.reference}})$$

$$^2\Delta T = T_{\text{upstream}} - T_{\text{downstream}}$$

$$^3\Delta T = (T_{\text{Post.downstream}} - T_{\text{Post.upstream}}) - (T_{\text{Pre.downstream}} - T_{\text{Pre.upstream}})$$

⁴ $\Delta T = T_{\text{Observed}} - T_{\text{Predicted}}$; Regression analysis used to develop equations that described relationship between pre-harvest treatment vs. control. Equations were then used to predict post-harvest temperature ($T_{\text{Predicted}}$) at treatment reaches using control post-harvest. Observed values (T_{Observed}) included measured post-harvest stream temperature.

⁵Daily ΔT was averaged for each month to obtain a mean monthly temperature response.

¹⁴ Note: a publication came to our attention from the Siskiyou Advisory Committee’s review for the first draft of this report, “An analysis of changes in stream temperature due to forest harvest practices using DHSVM-RBM” by Ridgeway (2019). Whereas it passed all the inclusion criteria, we decided not to include it since the analysis only included modeled stream temperature values that were not validated at the location of the harvest in California, and would have therefore required its own distinct section and discussion, and cannot be rigorously compared with field data.

Table III.2. Summary information for studies used in the shade and canopy cover analysis of this report including timing of measurement relative to harvesting, specific location of the data sources, and a brief description of methodology and measurements.

Study	Geographic Region	Study Design	Parameter	Measurement Timing	Data Source	Measurement Method
Allen and Dent (2001)	Coast Range, Oregon	Multiple Watershed	Shade, Canopy cover	Postharvest, with unharvested controls	Tables A-1 and B-1	Hemispherical Photos; Densiometer
McIntyre <i>et al.</i> (2018)	Western Washington	Paired Catchment	Shade, Canopy cover	Preharvest, Postharvest	Appx Table 7-B-1, 7-B-2, 7-B-5	Hemispherical Photos; Densiometer
Reiter <i>et al.</i> (2020)	Coast Range, Oregon	Paired Catchment	Shade	Preharvest, Postharvest	Table 1	Hemispherical Photos
RipStream	Coast Range and Interior, Oregon	Upstream/downstream	Shade, Canopy Cover	Preharvest, Postharvest	ODF Data	Hemispherical Photos; Densiometer
Bladon <i>et al.</i> (2016)	Coast Range, Oregon	Paired Catchment	Canopy Cover	Preharvest, postharvest	Text of discussion, pg. 154	Densiometer
Brazier and Brown (1973)	Coast Range and Interior, Oregon	Upstream/downstream	Canopy Cover	Postharvest	Table 1 (Angular Canopy Density)	Angular Can. Densiometer
Cole and Newton (2015)	Coast Range and Interior, Oregon	Upstream/downstream	Canopy Cover	Preharvest, Postharvest	Table A-1	Multiple, Densiometer numbers used.
Dent and Walsh (1997)	Coast Range and Interior, Oregon	Upstream/downstream	Canopy Cover	Postharvest with control reach, 1 site preharvest	Appendix A.	Densiometer, Fisheye lens camera
Hairston 1996	Western Oregon	Paired Catchment	Canopy Cover	Postharvest	Appendix A	Densiometer
Heimann (1988)	Coast Range, Oregon	Multiple Watershed	Canopy Cover	Postharvest	Table 7 (page 44)	Densiometer
Kaylor and Warren(2017)	HJ Andrews, WC, Oregon	Upstream/Downstream	Canopy Cover	Preharvest, Postharvest	Table 1 (page 5)	Densiometer
Kibler et al (2013)	Hinkle Cr, Interior, Oregon	Paired Catchment	Canopy Cover	Preharvest, Postharvest	Table 5 (p 688), and text on pages 686-687	Densiometer

Table III.2. cont.

Study	Geographic Region	Study Design	Parameter	Measurement Timing	Data Source	Measurement Method
Morman. (1993)	Western Oregon	Multiple Watershed	Canopy Cover	Preharvest, Postharvest	Section 3: pages 47-149	Densiometer
Newton and Cole (2013)	Coast Range, Interior, Oregon	Upstream/Downstream	Canopy Cover	Postharvest	Table 4	Densiometer
Piccolo and Wipfli (2002)	Prince of Wales Is., SE Alaska	Multiple Watershed, replicated	Canopy Cover	Postharvest	Table 1 (p 506)	Viewing Tube
Steinblums (1977)	Western Cascade and Interior, Oregon	Multiple Watershed	Canopy Cover	Postharvest	Table 2 (US2, F2, B1, LS2, F1)	Angular Can. Densiometer
Veldhuisen and Couvelier (2006)	Western Washington	Upstream/downstream	Canopy Cover	Postharvest	Appendix 4a	Densiometer
Warren et al (2013)	HJ Andrews, WC, Oregon	Upstream/Downstream	Canopy Cover	Postharvest, SG with OG reference	Table 2 (p 552)	Densiometer

Appendix IV. Stakeholder Feedback on Draft Report

Comments from all stakeholders are compiled into themes, along with their respective ODF responses.

Theme: How are Desired Future Conditions (DFC) being addressed in this report?

Response: In addition to temperature, this review covered information on the shade component of DFC. The other components of DFC will be addressed in a separate forthcoming report.

Theme: Please provide detailed comparisons between the design and location of the studies included in this report.

Response: Based on previous stakeholder feedback and limited time, the Monitoring unit elected to use a less intensive version of a systematic review. As a result, detailed information comparing each study was out of scope. However, the report discusses the relevance of each study to the Forest Practices Act (FPA) rules.

Theme: Be clearer about what conclusions are statistically-based and reword references to magnitude of evidence without statistical results.

Response: The discussion and conclusion sections were reworded to address this concern. The methods outlined before starting the literature review stated that no new analysis would be conducted with this review (only use statistical results provided in the included literature).

Theme: The point of maximum impact (POMI) and analysis of the Numeric Criterion (NC) exceedances needs further addressing.

Response: The ODF Monitoring unit is currently working with DEQ to discuss related topics, and we appropriately modified wording in the report related to NC and POMI.

Theme: Why is flow not included in this report?

Response: The current scope of this rule review does not consider flow. However, the Board of Forestry can request a review on impacts of rules regarding flow.

Theme: Why is climate change not mentioned in this report?

Response: Climate change is not addressed in the FPA and this review specifically assesses the rule's goals as they were written in the FPA. Per the Board's direction, the Monitoring Unit provided contextual information to the Board on climate change in the Siskiyou by inviting experts to present on the subject at the June 2020 Board of Forestry meeting.

Theme: Why are geology, stream size, width, basal area and other variables not part of the analysis?

Response: Stream characteristics like size and geology are considered important effects modifiers. However, extensive analysis of these characteristics was not one of the objectives of the rule review, although we acknowledge it in the report as data gaps. The format of this review

did not include any new analysis. A figure with additional discussion on basal area was added to the report.

Theme: “ODF states that 17% of sites with buffer widths of 20-70 feet and 9% of sites with buffer widths less than 70 feet exceeded the NC. We are concerned that evidence of exceedances of the NC (17% of sites with buffers 20-70 feet) has been characterized as “little evidence.” Under the Clean Water Act, any exceedance of the water quality standard would be a violation.”

Response: The report has been updated to address these concerns.

Theme: ODF should provide more context on limitations and assumptions for this report.

Response: The report has been updated to address these concerns.

Theme: ODF should more specifically address how RipStream field data shows the PCW is likely not met with buffer widths less than 90 feet (Groom *et al.* 2018) and buffer widths >50 feet are important for achieving the PCW.

Response: The report has been updated to address these concerns.

Theme: Do not conflate second-growth forest conditions with mature forest conditions in the results.

Response: Language was added to the report to address this concern.

Theme: Consider riparian stocking density within the reviewed datasets.

Response: We do not have studies published with this information. Riparian stocking densities, if found in the literature and relevant to the view, may be compared in the forthcoming report on DFC. Language was added to the temperature/shade report to clarify this.

Theme: Are the assumptions of the Human Use Allowance (HUA) appropriate/adequate?

Response: It is outside the scope of this review to question the assumptions of the HUA.

Theme: A 5-10% reduction in shade can cause a riparian area not to meet the HUA based on RipStream results and TMDL analysis.

Response: The report was modified to include this information.

Theme: Using a 90% canopy cover is too high in the model context. Use a canopy cover in the 60-70% range for the Siskiyou region.

Response: 90% canopy cover was measured at RipStream sites. However, per direction from DEQ on using their TMDL model information, we included shade curves from the look-up table using 60-70% canopy cover.

Theme: If the shade allocations are not attainable because the site does not support the type of vegetation that would provide that shade, then there should be no loss of shade from pre- to post- harvest for meeting the intent of the TMDL shade targets.

Response: The report was modified to address this information.

Theme: Most sites included in the Groom et al (2011a) study retained post-harvest basal area above ODF prescribed minimum targets, and therefore did not represent potential shade loss associated with FPA prescriptions. If FPA riparian basal area retention requirements allow for a buffer that is narrower than the buffer widths in the studies considered, then the change in temperature found in these studies is likely to be less than it would be under minimum retention requirements. Therefore, fixed buffer widths should not be used as an explanatory variable.

Response: The report specifies what the average buffer widths would be for small and medium streams if landowners removed all the basal area allowed per the FPA, and the associated temperature increases.

Theme: Include the temperature response and expected temperature increase associated with the application of FPA rule on private forest lands with small and medium fish streams.

Response: The report was modified to address this information.

Theme: The presented “Shade Curve” results are different than the Bayesian model, DEQ model, and field data, therefore the “Shade Curve” results are not correctly assessing the effect of buffer width reduction on stream shade conditions.

Response: The “Shade Curve” results are from the DEQ model, and are compared with field data in nearby forests to place the data in context.

Theme: Current management to meet FPA rules in the Siskiyou may not match the default FPA buffer widths. Monitoring (field data collection) is needed to identify whether water quality standards are being met in this region.

Response: New collection of field data is out of scope for the review at this time.

Theme: Include the study on Caspar Creek in Northern California.

Response: Addressed with a footnote in Table III.1.

Theme: Why are there different responses and what is the significance for interpretation of buffers meeting stream temperature criteria?

Response: This report was a summary of literature, and thus detailed analysis as to why the different responses was outside the scope of the work.

Theme: Are the studies included applicable to the rule review for the Siskiyou region?

Response: The geographic extent of the review was widened at the request of Board members. We acknowledge the risk of extrapolation in exchange for more information.

Theme: Canopy cover and shade is difficult to measure with significant possible variations between observers and equipment/methods.

Response: We assume that methods for collecting field data, within a given study, were consistently applied per their stated methods narratives. We acknowledge in the report that between-study variations in methods presents a challenge when comparing them.

Forest Practices Monitoring Update: Implementation Study

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1. Background

Annual assessments of implementation of the Forest Practices Act (FPA) is an ongoing core business practice. Over the years, the Private Forests Division has monitored implementation of the FPA. For example, we examined compliance with fish passage and peak flow rules (Oregon Department of Forestry, 2002), a statewide compliance audit (Oregon Department of Forestry, 2002), and with leave tree and downed wood requirements (Oregon Department of Forestry, 2006). However, due to budgetary issues starting around 2007, this monitoring was stopped.

In a note to the Agency's 2011 budget, the Oregon Legislature mandated the department to hire private contractors to assist in compliance monitoring. In the ensuing 2013-2017 effort, contractors were hired to collect field data, which the department used to determine rates of compliance. These results were presented in annual reports to the Board, and reported annually to the legislature as a Key Performance Measure.

Current Efforts – Identifying Study Topics and Priorities

The current study is focused on FPA Division 610 – Reforestation. This Division applies to forest operations that reduce stocking of free to grow forest stands below site-productivity based standards. The purpose of this Division is to assure continuous growing and harvesting of forest tree species. Reforestation was selected as the next focus of implementation monitoring to align with Division workload. Additionally, stakeholders requested we examine it, and the 2016 Monitoring Strategy identifies reforestation as a medium priority.

The study focuses on timber harvest operations that listed “Clear-cut / Overstory Removal” as the type of harvest in the Notification of Operations. Sampling is stratified by ODF Administrative Area and Landowner Type.

Stakeholder Participation

The Monitoring Unit met with a standing team of stakeholders twice so far in the planning process for the current study. Oregon Department of Revenue personnel have recently joined the committee, bringing a unique outlook to a group that also includes the Department of Environmental Quality, forest industries, loggers, landowner groups. We are pleased a representative of the Oregon Stream Protection Coalition has recently agreed to participate.

2. Implementation Study Goals

As the department and the Board consider upcoming work on the implementation study, it is crucial to ensure these considerations are focused on meeting the study's various purposes, while also being appropriate stewards of taxpayers' funds and producing meaningful results with existing resources.

These goals include:

- Provide data for annual reporting to the Oregon Legislature;
- Verify implementation of forest practices on private property, which is especially valuable to landowners who participate in certification systems, such as the

Sustainable Forestry Initiative, American Tree Farm System, and the Forest Stewardship Council;

- Provide an informed and systematic basis for targeted training efforts by both the department and forest industry in order to increase compliance with rules;
- Improve the public's trust in both the department, and those we regulate; and,
- Provide data for the Board to consider regarding the department's efforts to administer the FPA.

Implementation monitoring may also be a part of future agreements (e.g., an MOA with the Oregon Department of Fish and Wildlife).

3. Implementation Study: Continuous Improvement

In order to collect compliance data on private property, landowner permission is required by law. The rate of return on requests for permission to access subject lands continues to be a vexing aspect of the study: To get permission for access to 100 sites, 300+ requests have been required. Owners of private, non-industrial ownerships have by far the lowest percentage of granting permission to visit their property.

It has been pointed out that there may be a response bias in the study results. They ask: are landowners with high rates of compliance more likely to grant access to collect compliance data on their property than landowners with low rates of compliance? Because of this potential for bias, the validity of results have been questioned.

The statistical analyses of the field data has also been questioned, with a focus on methods for stratifying samples, and necessity to estimate error rates.

4. Potential Solutions

4.1 Reassessment of 2013-2017 work

The concerns of the previous implementation study warrant careful, thoughtful consideration. As part of this consideration, the department hired Groom Analytics to provide a preliminary analysis of these issues and multiple options for how to address them. Groom Analytics was selected because its principle, Dr. Jeremy Groom, both had previous, extensive experience with the compliance audit work (including designing methods for data collection and analysis), and has extensive expertise in statistics.

Groom Analytics completed two summary papers for the department (Attachment 4). The first paper coalesces the concerns into 11 issues, and outlines their respective potential solutions. These solutions are of various types, including policy changes, changes in statistical analysis, clarified report narratives, and changes to methods.

The second paper recommended a two stage strategy for reassessment of the 2013-2017 implementation study. Stage one entails a consultant (not Groom Analytics) reviewing both the work and reports between 2012 and 2018, vis a vis the 11 issues, and assessing the utility of the

data relative to the program's purpose. It would also describe possible approaches for improving the rigor and utility of those data sets.

Stage two of the proposed re-assessment would be the department response to the stage one findings. The department could re-analyze the initial data and produce a revision to the reports. The stage one work might inform a different course of action entirely for the department.

Integral to pursuing the aforementioned stages as outlined by Groom Analytics is a departmental assessment, aided by consultants as needed, of the appropriate approach for the study by balancing various challenges. On the one hand, the department is committed to providing quality analysis derived from the appropriate amount of methodological rigor to meet the needs for the study. At the same time constraints such as funding and staffing levels, and requests for additional work, all affect the Monitoring Unit's ability to complete work.

4.2 Pilot Implementation Study: Reforestation

The current study of rates of compliance has been designed to provide statistical rigor, and methods that would provide an opportunity to employ private sector contractors to gather field data as directed by the Legislature (Section 1, above).

The reforestation rules include a schedule for completion of certain steps toward assuring harvested stands are reforested within six years following harvest. This study addresses the first step, which is the two-year after harvest planting requirement.

We hired Oregon State University's Statistics for Natural Resources (StatNat) group to assess our approach for this phase. StatNat's assessment focused on the sampling methods that ODF had proposed and provided a preliminary analysis of methods and the implications of uncertainty for access to all study sites (McLaughlin and Madsen, 2019). This group provided recommendations on two major themes:

- Landowners not granting access to their property for data collection, and thereby potentially biasing results ("self-selection bias"); and,
- Sample selection to appropriately quantify confidence intervals in various strata.

A second engagement of external statistical review has been delayed by current budget constraints. That effort would focus on the methods revised per StatNat's initial recommendations, with an additional focus on collection of field data. The department was intending to have a follow-up analysis of our protocol that we refined per StatNat's input. Because of unknown variability within and between sampled field units, the StatNat's review also did not specify an appropriate sample size. At present there is no schedule for this follow-up review.

5. Staff resources and budget

The state's budget situation, along with declines in the harvest tax, strains the Monitoring Unit in several different ways. At the time of writing these Board materials, our budget was not yet set, but we are certain there will be significant declines in our funding. As agency policy, our first

priority is maintaining sufficient staffing levels to ensure we can continue working on core business functions. Thus, as a division, we've decided to not spend funding originally budgeted for external contractors.

6. Current Work

The Monitoring Unit is moving forward with a pilot study on reforestation, and began collecting data in July. The principle questions of this pilot study are:

1. Did the landowner replant trees within the required period of time?
2. Did the landowner plant enough trees?
3. Did the landowner plant the right kind of trees?

We are doing this pilot to test and improve the study protocol given the aforementioned input from StatNat, and to collect meaningful data. It utilizes a simplified sampling design of a single landowner type within a defined geographic area (Private Industrial landowners within the Interior Forest Practices Geographic Region) to test the efficiency and effectiveness of the proposed sampling design, assess how to incorporate auxiliary information, and estimate variation within and between harvest units. As future budgets permit, we would use this information in a stage 2 external statistical review to streamline our field methods while maintaining statistical validity, to provide reference variability figures when determining appropriate sample size, and to determine the statistical analysis method that most efficiently provides the information we need. This pilot study will help us prepare future contracts with anticipated cost savings relative to a contract prepared without benefit of the pilot study. Additionally, we have heard from numerous stakeholders how important it is for us to collect and analyze FPA implementation data.

Due to budget constraints and travel restrictions, data will be collected by Unit staff, and within a day's round trip drive of Salem.

This pilot study approach addresses StatNat's identification of areas for improvement. Regarding the impact of landowners not granting access, the pilot focuses only on private industrial landowners that historically have a high rate of granting access. Regarding quantification of confidence intervals, since there is only one stratum (PI in the Interior georegion), the calculations are more straightforward.

We are working with the Implementation Study External Review Team to gather input on this endeavor. We have worked with this team over the years, and they provide helpful perspective on the methods to collect data, the utility of the results, and how best to report and disseminate results.

7. Future work

Due to the aforementioned shortages of both Monitoring Unit staff, and department funding with which to hire consultants, we are delaying much work until we have sufficient resources to tackle it.

Upon having sufficient resources, the first priority will be to obtain external statistical review of our reforestation study methods. This review is the highest future priority to ensure that we collect additional, high value data going forward and can meet our requirements for reporting to the legislature. We are also prioritizing this review because it is a relatively small and inexpensive project, as compared with either hiring a contractor to collect reforestation data, or commencing the retrospective analysis of 2013-2017 data, using the approach outlined by Groom Analytics.

8. References

McLaughlin, Katherine and Lisa Madsen, 2019. Report on Sampling Protocol for “Reforestation Implementation Study” (Oregon Department of Forestry). June 28, 2019.

Oregon Department of Forestry, 2002. Technical Report #14. Compliance With Fish Passage and Peak Flow Requirements at Stream Crossings: Final Study Results, April 2002.

Oregon Department of Forestry, 2002. Technical Report #15. Best Management Practices Compliance Monitoring Project: Final Report, April 2002.

Oregon Department of Forestry, 2006. Technical Report #18. Compliance With Leave Tree and Downed Wood Forest Practices Act Regulations: Results From A Pilot Study, February 2006.

Compliance Audit: Reports from Consultant

Report 1
Description of ODF Compliance Audit Review
28 February 2020

Background and Purpose

The Oregon Department of Forestry (ODF) Private Forest Monitoring Unit (Monitoring Unit) was directed by budget note in 2011 to conduct a compliance audit. In response the Monitoring Unit developed a compliance audit to quantifiably assess landowner compliance with forest harvest, road construction, and water protection rules in the Forest Practices Act, Divisions 625, 630, 640, 655, and 660 (ODF 2010) and to use contractors for fieldwork. The Monitoring Unit developed and conducted its Forest Practices Compliance Audit (Compliance Audit) in 2013, 2014, 2016, and 2017 and produced reports in each of the subsequent years. No field work was conducted in 2015. The Monitoring Unit used the results to guide landowner and operator education and outreach efforts. In late 2018 and throughout 2019, the Oregon Department of Forestry's Private Forests Division (Division) received public comments and comments from Board of Forestry (Board) members regarding the 2017 Compliance Audit report. The comments identified potential problems with the project methodology and expressed concern with the interpretation of the results.

The Oregon Department of Forestry is interested in developing a strategy for moving forward with Compliance Audit efforts given the recent negative reception of the 2017 report. It therefore wishes to obtain an unbiased and thorough review of its Compliance Audit work as conducted between 2012 and 2018, specifically in regard to the study design, statistical analysis, results, and communication of the results relative to the intended purpose of the Audit. This document provides the material for a possible statement of work for an independent reviewer (Reviewer).

The contract will be constructed with two anticipated phases. The first phase of the project will involve a review of the Compliance Audit work and reports between 2012 and 2018 and an assessment of the utility of the data relative to the program's purpose. The first phase will also involve a description of possible approaches for improving the rigor and utility of the program, and the feasibility and utility of applying those approaches to the current data sets.

The second phase is optional at the discretion of the Department and is contingent on the outcomes of the first phase. The contract will be amended to include the second phase if the Division decides to proceed with some or all of the Reviewer's suggestions from the first phase.

The second phase, if enacted, could involve the re-analysis of previously collected data and the production of revised findings along with a complete explanation of methods used and study inference. The re-analysis would also specifically address issues discovered by the Reviewer in Phase 1 and the relevant 2018 and 2019 comments made by members of the Board and public. Phase 2 may also pursue a different course of action depending on Division decisions and the findings of Phase 1.

The ideal Reviewer candidate is familiar with forestry and forestry fieldwork. They demonstrate a strong familiarity and experience with the development and analysis of sampling designs and have a degree in statistics or are able to provide evidence of expertise via research and publications. The candidate has credentials that are difficult to dispute. The Division may consider, when selecting among Potential Reviewers, the utility of involving or receiving feedback from environmental and industry representatives.

Available Materials

The following materials are available for the Reviewer (or Prospective Reviewer). The material was gathered and created to expedite bringing the Reviewer up to date on the status of the project and to facilitate an informed bidding process. ODF Monitoring Unit staff will be available to answer questions, provide additional project background, and supply specific data files to the Reviewer as needed.

Protocol: The four reports do not provide detailed explanations of sampling process and analysis techniques used. An updated protocol description (see the document ODF Forest Practices Compliance Audit Protocol Addendum) provides a more complete explanation of the methods used to analyze the data and create the reports.

Reports: The four Compliance Audit reports are provided. Note that the reports include appendices that describe data collection methodologies.

Comments from Board members and members of the public: These unedited comments are provided to aid the Reviewer's own assessment of the issues raised.

Synthesis of comments: The Synthesis document provides a summary of issues raised by Board members and members of the public. The document also offers comments on the interpretation or perceived relevance of the issues raised and the availability of information to address the issues. Possible solutions for addressing the issue are provided. These solutions should be strictly interpreted as an incomplete suite of possible options that neither need to be addressed nor used in the review.

Potential Reviewer Instructions and Areas of Focus

This section provides material that may be used to create a Statement of Work for creating a Request for Proposals if the Division decides to hire a Reviewer. If this material was used, the Reviewer would be responsible for the following deliverables:

Report: The State of the Compliance Audit

This report will include the following sections:

- 1) Review of work to date. Review includes meeting with Monitoring Unit staff to understand:
 - General history of the Compliance Audit project since 2012
 - Field data collection processes
 - Field data processing and interpretation
 - Data compilation and analysis
 - Report writing
 - Process for using findings to create landowner and operator outreach and education efforts.

The review process also includes reading through and understanding the Available Materials listed above.

The review effort may involve one or more site visits to understand how contractors conducted data collection. The Monitoring Unit staff will explain computer files and provide the files to the Reviewer as requested. The review is expected to focus less on data collection and rule compliance evaluation and more on the sampling and data analysis aspects of the project. The Review will describe their understanding of each of the bulleted points above.

- 2) Description of the Compliance Audit purpose. This section is expected to be relatively short but serve as the metric against which proposed “next steps” are compared. The Reviewer should derive the purpose from available documents, communications with Division Staff, and documents that influenced the development of the Compliance Audit.
- 3) Assessment of issues raised by Board of Forestry members and members of the public. The Reviewer will examine points raised in the Synthesis and read through the original issues documents to verify that the Synthesis captures the issues adequately. Given the Reviewer’s knowledge gained from constructing section (1) of the report, the Reviewer will assess the applicability of the issues and provide possible solutions. The solutions may include retrospective changes to the analyses and report material and prospective changes to future Compliance Audit efforts. The Reviewer should also provide a description of expected effort to enact each solution and the expected outcomes of each solution.

The Reviewer should focus especially on two issues that were raised:

- The rate of landowner non-response to access inquiries and refusal of access may be related to levels of non-compliance, potentially biasing results. The Reviewer should describe the issue and explore different solutions. The solutions may include sensitivity analyses, changes in monitoring approaches, altering the population to which the program attempts to make statistical inference, and others.
- The calculation of unit-level compliance. The Reviewer should describe different approaches for estimating unit-level compliance rates and the strengths, weaknesses, and appropriateness of these different approaches for achieving the Compliance Audit program’s purpose.

4) Proposals for Next Steps.

The Reviewer will answer the following questions:

- Can the Division reanalyze Compliance Audit data such that the issues discussed in (3) are adequately addressed?
 - If not, provide an explanation. Include a description of which issues the reanalysis could address and which ones it would be unable to address.
 - If so, describe different possible approaches and how they affect the program’s inference.
 - Also, if a reanalysis were conducted, how should the resulting report be constructed?
- How can the format of Compliance Audit reports change to better communicate methodology while still providing concise findings?
- What suggestions does the Reviewer have for structuring the Compliance Audit to address different rule sets over time and for tracking progress of education and outreach at improving outcomes?
- What overall process changes does the Reviewer recommend that the Division adopt that would help ensure the rigor, utility, and defensibility of future Compliance Audit efforts?

The Reviewer will then propose at least three alternative actions that the Division could next pursue. These could include reanalysis, changing data collection approaches, abandoning attempting to obtain geographic and owner-class inference, increasing sampling effort per year but decreasing the frequency of sampling events, etc. For each alternative, the Reviewer will describe the alternative’s strengths and shortcomings relative to the purpose of the Audit as well as the required effort.

- 5) Summary and recommendation. The Reviewer summarizes their findings regarding the Compliance Audit and explains which alternative action they suggest that the Division pursues.

The Reviewer will provide a draft and final version of the report to Division staff.

Presentation of findings to ODF Private Forests Division staff

The Reviewer provides Division staff with an in-person presentation that describes work performed to date and salient findings.

Response to Comments

The Reviewer will obtain written comments for the draft report from Division staff and create a response document that describes how comments will be addressed in the final version or explains why changes will not be made to address comments.

Following the response to comments, the Reviewer will provide Division staff with a final version of the report.

Presentation of findings to the Oregon Board of Forestry

The Reviewer will provide Division staff with a digital presentation of the final assessment of the Compliance Audit 2012-2018. The presentation will include an explanation of the purpose of the Audit, the sampling and analysis approaches to date, relevant issues with the current approach, summarize possible solutions, and explain the costs and benefits of different alternative actions. The Reviewer may be expected to present this material in person to the Oregon Board of Forestry.

Report 2
2017 ODF Compliance Audit Report Summary of Identified Issues
28 February 2020

Background:

In late 2018 and throughout 2019, the Oregon Department of Forestry's Private Forests Division received public comments and comments from Board of Forestry (Board) members regarding the 2017 Forest Practices Act Compliance Audit report. Specifically, there were five documents that included commentary and concern regarding the report. Those documents include:

- Memorandum to Mary Scurlock, Oregon Stream Protection Coalition, from Chris Mendoza of Mendoza Environmental LLC, Olympia, WA. Subject: General comments on Oregon Compliance Monitoring Survey Results. 20 December 2018
- Memorandum to Bob Van Dyk, Wild Salmon Center. From Don L. Stevens, Jr. RE: Comments ON "Forest practices compliance audit: 2017 Annual Report". 26 February 2019
- Email from Lena Tucker to Brenda McComb. Subject: RE: 95% CI and pseudoreplication. 3 January 2019.
- Email from Brenda McComb to Peter Daugherty. Re: B. McComb Schedule for January 2nd. 31 December 2018
- Marganne Allen. September 2018 Board of Forestry Meeting Follow up to Cindy Deacon Williams questions on Compliance Audit

The concerns raised in the document predominantly focused on the statistical and sampling approaches used by the Division to conduct and report on rule compliance rates.

Purpose:

Commentary received on the 2017 Compliance Audit report included issues that were raised by more than one person and that differed in their potential severity of affecting the results interpretation. This document serves as a summarization of issues raised by the five documents, ranked in order of perceived severity. Its purpose is to inform efforts for evaluating the current Compliance Audit and improving future reporting. The goal is to succinctly communicate issues raised, provide potentially relevant background information that may be useful for evaluating the issues, and raise possible solutions for consideration.

Listing and ranking of issues:

Issues raised by public comment and Board member are summarized and presented below in perceived order of severity with the most severe presented first. Severe issues are those that are difficult to correct and/or could create biased findings. Issue summaries are presented in bold font. After each summarized issue are notes regarding relevant information and interpretation of the issue along with possible solutions. The possible solutions offered should not be considered to represent a complete set of options as other solutions may exist. Possible solutions may be combined.

- 1) **Non-response by landowners or landowner access refusal presents the possibility that results are biased, particularly for Private Non-industrial Landowners (PNI) which exhibited the greatest rate of non-responses/refusal.**

Note: The PNI non-response/refusal rate is a severe statistical problem; compliance rates may be lower for landowners who did not participate in the survey. Sampling changes may not be able to overcome this issue, as the ODF has no authority to enter private land without landowner permission, excepting in emergencies (see the document "Follow up to Cindy Deacon Williams [CDW] questions on Compliance Audit" for a more thorough treatment of this point).

Possible Solutions:

- Conduct sensitivity analysis on existing findings to determine how different rates of non-compliance would affect results
- Cease attempting to make inference to PNI landowners, continue making inference to Private Industrial (PI) and Other landowners. Conduct sensitivity analysis for PI and Other landowners.
- Recommend legal changes to ODF's authority so that audit does not require landowner permission. Perhaps change notifications to a permit-based system, like Washington State.
- Exert exceptional effort to gain access from some refusal/non-response notifications to inform sensitivity analyses.
- Concede that the Department cannot conduct an unbiased survey because it relies on landowner permission (see comments by Mendoza). Accept that results cannot be extrapolated, explicitly describe study's inferential limitations, cease attempting to provide confidence intervals.

2) Estimates based on a stratified random sample must take into account the stratification used. It is inappropriate to divide the number of compliant rule applications by the number of total rule application to obtain a point estimate for total compliance rate given the sampling approach.

3) Applications of the same rules were sampled, in some cases, multiple times in a given harvest unit. Rule applications (and their compliance rates) were likely not independent, making the calculation of a confidence interval from a binomial result difficult or impossible.

Note for 2) and 3): The 2017 report and all earlier reports calculate compliance rates for different strata (landowner type: PNI, PI, Other; operational area: Northwest, Southwest, and Eastern Oregon Areas) in which all estimates are conducted as described in (2). However, the overall state-wide compliance rates for 2013, 2014, and 2016 were found using an estimation technique that took stratification into account and used the unit compliance rate as the sample unit (see the document ODF Forest Practices Compliance Audit Protocol Addendum [Protocol Addendum]). The reports failed to provide the specifics of the analysis. If this approach is found acceptable, the information exists to additionally provide stratum-level estimates with associated confidence intervals as well as a state-wide estimate for 2017.

Note about compliance estimation: Not enough information was conveyed in the 2017 report to allow for a full evaluation of the study by the Board or stakeholders. As stated by Dr. Stevens, "A possible approach would be to derive an aggregate measure of compliance at the site level, and then combine over sites to obtain a population-level metric." As stated above, this approach was used (but not described) for the state-wide estimate. An important related issue is how the Monitoring Unit calculates and reports site-level compliance. There is probably no single "correct" method; instead, the method used should reflect the purpose of the Audit and the utility of the values.

Possible Solutions:

- Redo 2013, 2014, 2016, 2017 estimates for overall compliance rate and for each stratum, utilizing stratification information
- Develop alternate approach to obtaining valid estimates
- Provide a complete protocol detailing the analysis approach
- Provide a rationale and method for assessing unit-level compliance
- Cease attempting to obtain a statistically valid inference statewide or by each stratum of interest

- 4) **In order to obtain a stratified estimate, we must know the total size of the population to which we wish to make inference. However, a high proportion of the notifications selected via sampling turned out to fall outside of the desired sample frame – forest operations never occurred, operations did not represent commercial harvest, etc. Therefore, the population size of the sample frame is unknown.**

Possible Solution:

- Estimate the total population size and population size for each stratum using, e.g., Table 2 of the 2017 audit, to determine an estimate of unsuitable sites. Use these rates to adjust the notification population sizes of strata. Conduct a sensitivity analysis to observe how reasonable changes to the population sizes would affect outcomes.

- 5) **Strata are drawn proportional to acreage without justification and acreage is not used as a reporting element.**

Possible solutions:

- Provide justification in reports for the purpose of stratifying by acreage
- Draw samples according to another criterion (see 2013 report)

- 6) **All estimates should have associated error rates.**

Note: The purpose of the Compliance Audit is to (a) provide an estimate of compliance and (b) inform training and education of landowners and operators. Currently the intent is for the statewide and stratum-level estimates to provide statistically defensible estimates of compliance. At the rule level the intent is to identify those with lower rates of compliance and direct training to those. Should sampling be adjusted to assure the reporting of statistically valid estimates at the level of individual rules?

The answer may lie in how results are interpreted and used by the Division for developing landowner and operator education and outreach. If the findings are tightly associated with resulting training efforts, then it would behoove the Division to ensure that the estimates accurately represent compliance issues. If the Division relies on other information, insight, and/or assumptions regarding Audit findings to guide education efforts, then unbiased, accurate values at a rule level may be of less utility.

Possible solutions:

- Improve report clarity and rationale for how compliance summaries were obtained and used. This would include an explanation for how results are reviewed to guide training and education and a rationale for the sufficiency of the statistics.
- Develop alternative sampling methods to obtain statistically valid samples at useful levels of compliance. In Washington State compliance is assessed at the level of the “application”, or groups of rules associated with a particular forestry feature. The outcomes of these alternative methods must inform training and education.

- 7) **The Audit must include oversampling initially to draw replacement samples, and there must be a valid protocol for selecting from replacement sites to replace unusable samples.**

Note: This was done in the 2014, 2016, and 2017 sampling procedure but was not described in the reports.

Possible solutions:

- Ensure that a sufficient sample overdraw is made and replacement samples are selected in a defensible manner.
- Provide detail in the report about how replacement units are selected.

8) Criteria used to assess contractor data quality list acceptable levels of error for different measurements. This degree of error should be incorporated into estimates.

Note: This issue may be translatable into a question of how to incorporate measurement error into the analysis. It is probably untrue that the contractors commit error according to what is permitted in the contract under all circumstances and for all measurements. However, the audit and contractor checks may not currently provide actual error rates to work with.

Possible solutions:

- Determine whether/how contractor measurement error should be incorporated into analysis.
- Determine if error rates can be estimated from available quality assurance checks of contractor
- Develop means for collecting such information from quality assurance checks in the future

9) This combination of issues represents misinterpretations of the study protocol. These issues include: Study sites were collected from volunteering landowners, compliance rate = dividing observed non-compliance rules by unobserved number of applicable rules, confusion between observing sediment delivery and reporting compliance rates of rules.

Note: Detailed information on how rule applications and their compliance were determined are provided in the appendices. Similarly, there is information on resource damage documentation and rule assessment as separate items.

Possible solution: Confusions of this sort should probably be addressed by clarifying the methods for determining compliance.

10) Sample size (100 sites) is too small to obtain a reasonable confidence interval.

Note: The estimation of state-wide compliance rate, accounting for stratification, resulted in narrow confidence intervals. Assuming that (1) the statistics used to combine site-level information were correct and (2) the method for calculating and interpreting site-level compliance rates are defensible, this result is not surprising, as compliance rates were generally high and the estimated rate of compliance is close to the boundary of 100% compliance. However, this information is not currently available in the 2017 (or 2013, 2014, or 2016) report.

Possible solutions:

- Provide complete protocol and revise estimates from earlier
- In the future provide complete protocol and include stratified estimates
- Abandon attempts at obtaining inference beyond the sample.

11) Need robust monitoring program to estimate direct impacts to aquatic resources, cannot use compliance monitoring to arrive at effectiveness monitoring results.

Note: The Compliance Audit is not performed by Stewardship Foresters who assess damages and issue citations. The Monitoring Unit can only use results to determine “apparent non-compliance”. The natural question that follows assessments of apparent non-compliance is “how severe was the

observed damage?” The Monitoring Unit perceives that providing information on the severity of apparent non-compliance claims is useful for addressing this question.

Possible solutions:

- Have reports clarify the purpose and utility of reporting sediment delivery information and its expected accuracy.
- Obtain outside review of the field protocol by an expert of road building, hydrology, and forestry to assess how well the collection methodology meets its intended purpose

Agenda Item No.:	D
Work Plan:	Private Forests
Topic:	Board Updates
Presentation Title:	2020 Forest Health Report
Date of Presentation:	September 9, 2020
	Contact Information: Mike Kroon, Manager, Forest Health Manager, Private Forests Division, ODF
	Christine Buhl, Entomologist, Private Forests Division, ODF
	Wyatt Williams, Invasive Species Specialist, Private Forests Division, ODF

SUMMARY

This agenda item provides an overview of the Oregon Department of Forestry (ODF) Forest Health Unit's work on major insect, disease, and other damaging agents affecting Oregon forests in 2019-2020, as required by Oregon Revised Statute (ORS) 527.335.

CONTEXT

The Board of Forestry's (Board) 2011 Forestry Program for Oregon defines a healthy, vital forest landscape as one that maintains its functions, diversity, and resiliency within the context of natural and human disturbances and is capable of providing people with the array of values, uses, and products desired now and in the future. The Board supports protecting and improving the health and resiliency of Oregon's dynamic forest ecosystems, watersheds, and airsheds (Goal F). The Board's objectives for Goal F include promoting resilient forest landscape conditions and management practices that will lead to reductions in adverse impacts from forest insects and diseases (Objective F.7). The Board's guiding principles and philosophies include a commitment to continuous learning, evaluating and appropriately adjusting forest management policies and programs based upon ongoing monitoring, assessment, and research (Value Statement 11).

BACKGROUND

Topics included in the 2019-2020 Forest Health Report: impact and response to Covid-19 interruptions of aerial survey program and other monitoring projects, status of known insect outbreaks, impacts of abiotic stress events (drought, storm damage), status of prevention and mitigation projects for invasive insects (gypsy moth, emerald ash borer, exotic woodboring beetles) and disease (Sudden Oak Death), and ecological improvement efforts (wildlife food plots, integrated pest management outreach).

ANALYSIS

Core business and high-priority Forest Health projects over the last 12 months include:

- **Annual aerial detection surveys for insects and disease:** The annual statewide aerial survey was cancelled due to Covid-19 concerns. Staff performed ground checks of known problem areas and analyzed aerial imagery to determine damage from forest health agents across the state. Analysis of imagery paired with site visits may also provide information on the feasibility using these tools in combination or in place of future aerial surveys. The

2019 Forest Health Highlights report shows the type of information that is typically reported from these surveys (Attachment 1).

- **Current insect outbreaks:** All current insect outbreaks are in the initial stages of decline or have collapsed as of 2020. These include spruce aphid along the NW coast, Pandora moth in central Oregon and Douglas-fir tussock moth in NE Oregon.
- **Abiotic stress impacts:** Areas most impacted by recent storm damage and ongoing drought were monitored and in some cases treated for secondary attack by insects, in an effort to prevent or mitigate outbreaks.
- **Unknown western redcedar decline:** ODF initiated a project with Washington Department Of Natural Resources (WADNR), United States Forest Service (USFS) and Oregon State University (OSU) to map and monitor pockets of western redcedar dieback across the Pacific Northwest. The objective is to determine spread and potential causes of the dieback. “Why is my tree dying: Western redcedar” fact sheet (Attachment 2).
- **Engagement with the field and landowners:** Increased outreach, training and technical assistance materials to better guide technical experts and landowners on preventative strategies and integrated pest management.
- **The ecological side of Forest Health:** In addition to pest mitigation, the Forest Health unit is increasing efforts for ecological stand improvement. Such efforts include enhancement of forest pollinator habitat and corridors via wildlife food plots and analysis of habitat health bioindicators. Woodland Fish and Wildlife “Forest Bee Pollinators” publication (Attachment 3).
- **Sudden oak death:** Since 2016, ODF has given highest priority for treatment to sites with the EU1 lineage, treating priority NA1 sites when resources were available. From 2018-2019, ODF treated 306 acres for SOD. In 2020, ODF started work with the Natural Resource Conservation Service to provide assistance with a cost share program to landowners within the core SOD infested area to reduce tree hazards. ODF and OSU initiated a citizen science monitoring effort to increase screening and to engage the public. ODF submitted a policy option package (POP) for Oregon's Sudden Oak Death Program (SOD). The POP would provide expanded capacity for the SOD program.
- **Gypsy moth monitoring and eradication:** Follow-up trapping in Corvallis indicated that the 2019 treatment for gypsy moth was successful. In 2020, ODF assisted Department of Agriculture (ODA) with the annual statewide gypsy moth surveillance trapping program.
- **Special projects:** Native Oregon ash seed was collected across western Oregon in an effort to create a seed repository and test for resistance to emerald ash borer. 2020 marked year 1 of a 2-year project.
- **Detections of new exotic forest insects:** The ODF/Oregon State University (OSU) Forest Pest Detector program revealed a new exotic species. In a separate insect trapping project, four new forest insect species were detected. ODF is working with the ODA on further surveillance and risk assessments for these species.

- **Technical assistance, support, and education:**
 - Customers: Forest landowners (family, industrial, other); ODF Stewardship Foresters, State Forests staff, Protection Division, and leadership; local, state and federal agencies; Tribes; university and industrial researchers.
 - Interagency/collaboratives: Cooperative Annual Statewide Aerial Survey, Oregon Invasive Species Council, Swiss Needle Cooperative, The Oregon Bee Project, Pest Detector Program, SOD Task Force, Gorse Action Group, Oregon State University (OSU) Swiss Needle Cast Cooperative.
 - Board Committees: Committee for Family Forestlands, Regional Forest Practices Committees.
- **Annual and other reports, publications**: 2019 Forest Health Highlights, Why is my Tree Dying: Western redcedar fact sheet, and Woodland Fish and Wildlife:Forest Bee Pollinators (see Attachments).
- **Attendance at local, state and national forest health meetings and conferences**

Unit personnel have also been involved in various other duties as assigned, including fire assignments.

RECOMMENDATION

This agenda item is informational only.

ATTACHMENTS

- (1) 2019 Forest Health Highlights
- (2) Why is my Tree Dying: Western redcedar
- (3) Woodland Fish and Wildlife “Forest Bee Pollinators”

Forest Health Highlights in Oregon - 2019



Forest Service January 2020



Pacific Northwest Region
Forest Health Protection

Oregon Department of Forestry
Forest Health Program

AGENDA ITEM D
Attachment 1
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In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotope, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

(1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442;

or (3) email: program.intake@usda.gov. USDA is an equal opportunity provider, employer, and lender.

AGENDA ITEM D

Attachment 1

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FOREST HEALTH HIGHLIGHTS IN OREGON - 2019

Joint publication contributors:

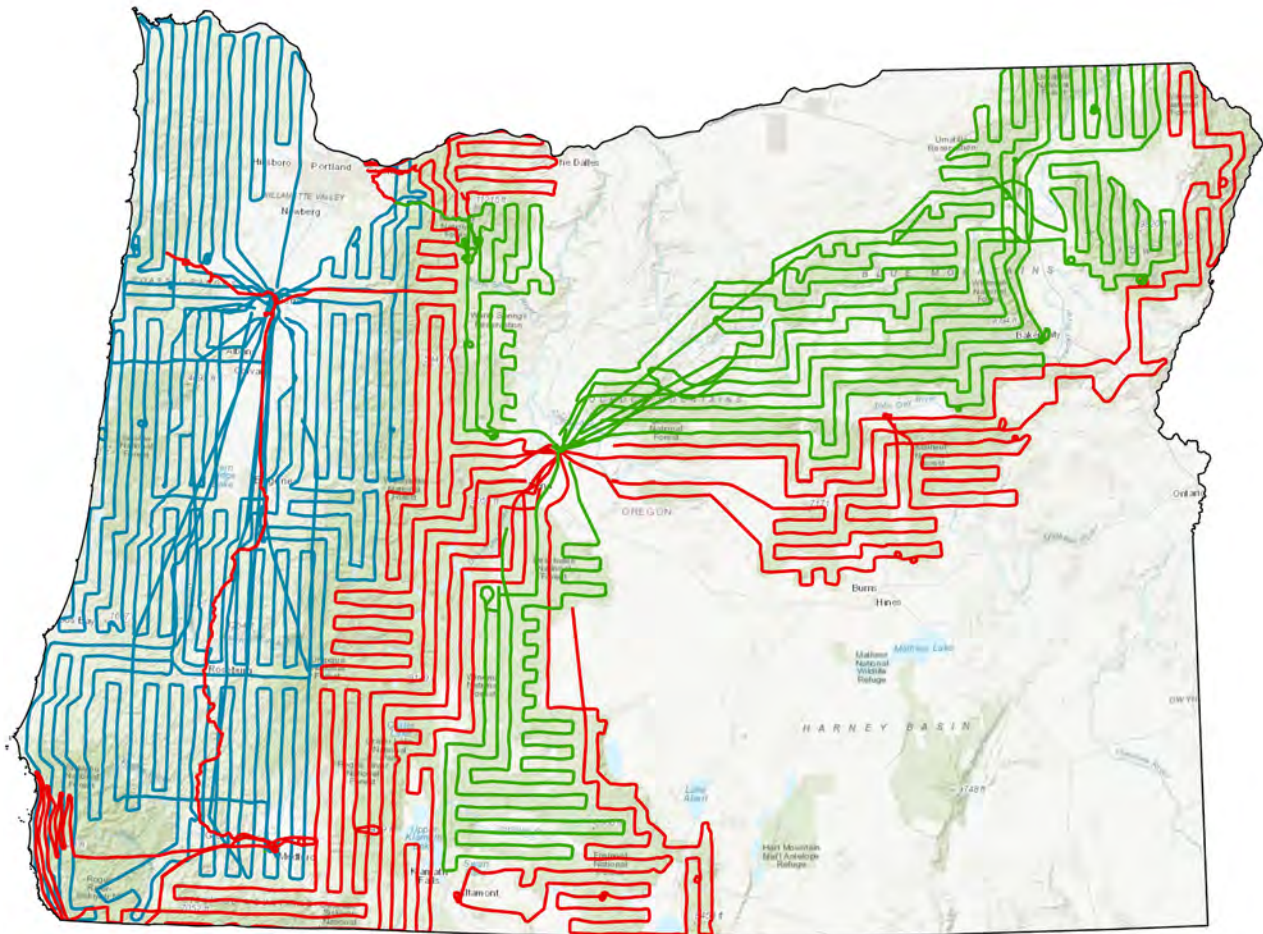


Christine Buhl
Sarah Navarro
Danny Norlander
Wyatt Williams



Zack Heath
Karen Ripley
Robert Schroeter
Ben Smith

Cooperative Aerial Survey: 2019 flight lines



Front cover: *Sudden oak death in Oregon: aerial photo over Brookings, OR of dead and dying tanoaks and close-up of a tanoak stem with girdling canker caused by *Phytophthora ramorum*, the causal agent of sudden oak death.*

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LANDOWNER RESOURCES

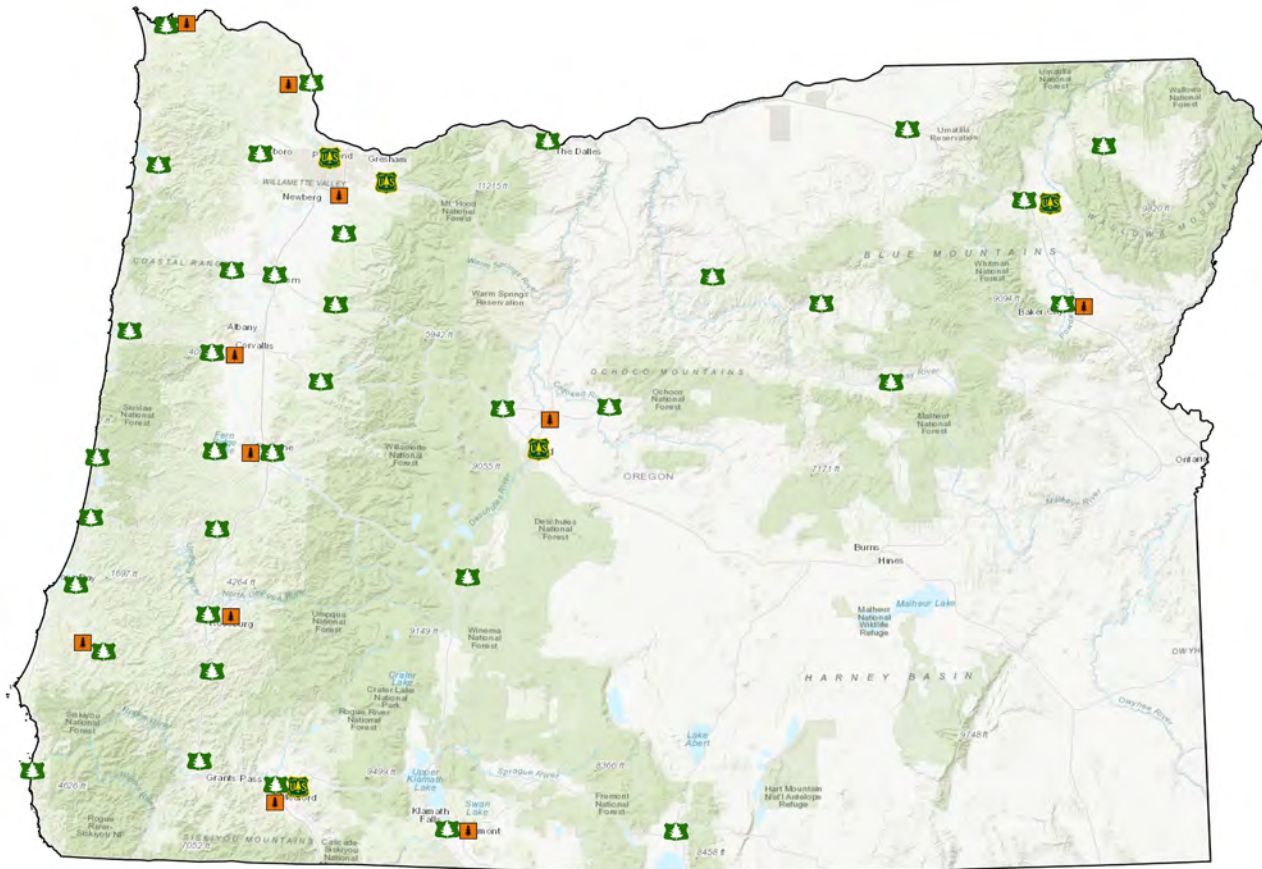


Figure 1. Map of ODF (green with white tree), USFS (green and yellow USFS badge) and OSU (orange tree) unit offices.



OREGON DEPARTMENT OF FORESTRY (ODF) RESOURCES:

Connect with your local ODF stewardship forester to get stand management guidance, diagnose and troubleshoot issues and learn about incentive programs: <https://tinyurl.com/ODF-forester>

Connect with the ODF Forest Health team to diagnose and manage abiotic stressors, insects, diseases, weeds and other invasive species. Visit the ODF Forest Health website for factsheets and training videos: <http://tinyurl.com/odf-foresthealth>



USDA FOREST SERVICE (USFS) RESOURCES:

(Federal agencies and Tribes only) Connect with USFS Forest Health Protection specialists to diagnose and manage abiotic stressors, insects, diseases, weeds and other invasive species: <https://www.fs.usda.gov/goto/r6/foresthealth>



OREGON STATE UNIVERSITY (OSU) FORESTRY EXTENSION SERVICE RESOURCES:

Connect with your local OSU Forestry Extension agent to get stand management guidance and to diagnose and troubleshoot forest health issues: <https://tinyurl.com/OSU-forester>

FORESTRY IN OREGON

Forestry has a long tradition in the Pacific Northwest, especially in Oregon which at 30 million acres is second only to Alaska in total acreage of forest lands. This number has remained unchanged since 1953.

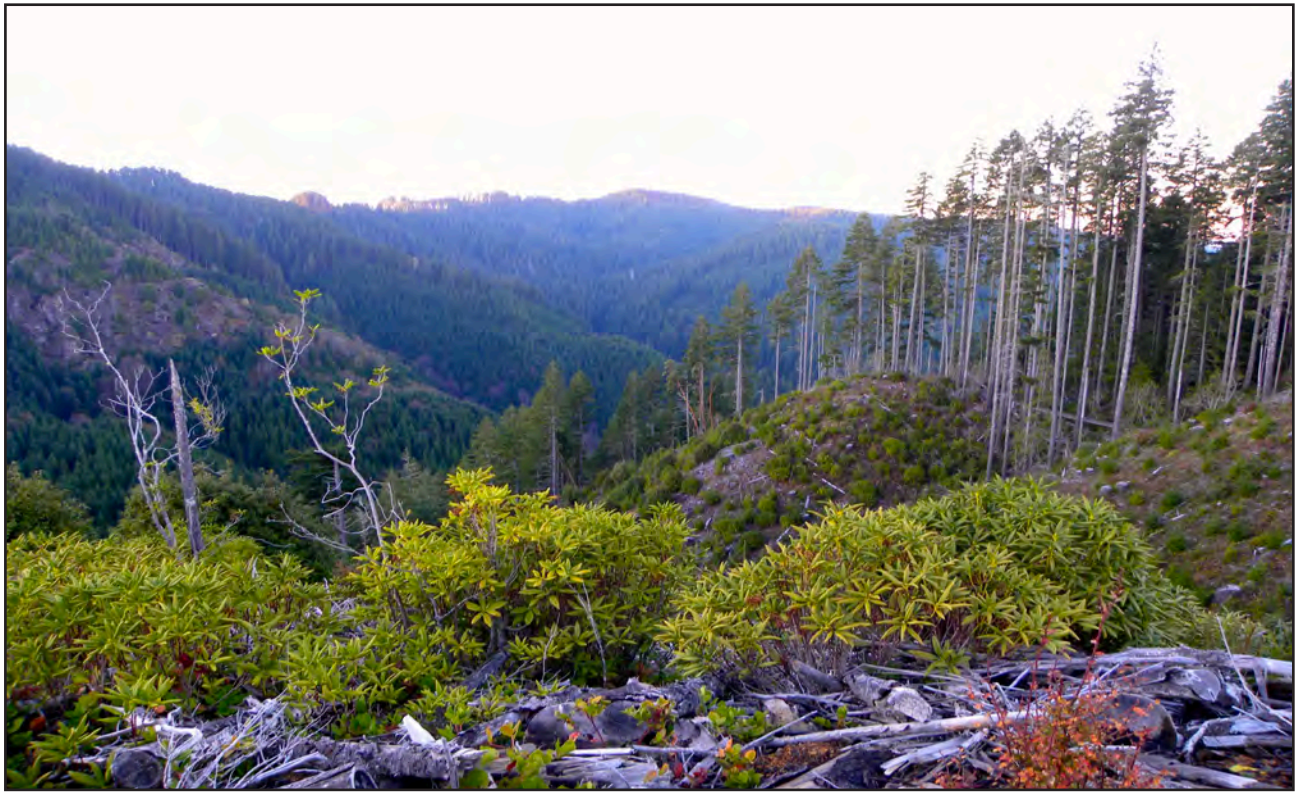


Figure 2. A recently harvested and replanted forest stand near Oakland, OR (Christine Buhl, ODF).

For over a decade, Oregon has been the #1 timber producer in the U.S., accounting for 18% of the nation’s total softwood production at about 5.2 billion board feet annually. Oregon supplies 30% of the nation’s plywood with 2.5 billion board feet annually and hosts 25% of the engineered wood (glulam, I-joist, laminated veneer, cross-laminated timber) facilities in the U.S. In 2019, forest timber products brought in over \$10 billion in revenue and supplied about 3% of total statewide employment. Additionally, 25% of U.S. Forest Service (USFS) and 50% of Bureau of Land Management* (BLM) timber revenues help fund education, road construction, libraries, fire police protection across the state.

Oregon’s forests cover approximately 30 million acres and consist of federal (60%), private (35%), state (3%), tribal (1%), and other public (1%) ownerships. Timber production is not the primary objective across the state. The Forest Practices Act (OAR 629) guides private landowners on how best to manage their forestlands to promote ecosystem functioning and sustainability while utilizing this renewable resource. There are certification processes (Sustainability Forestry Initiative, American Tree Farm System, Forest Stewardship Council) in place to help consumers identify products grown and harvested under specific standards.

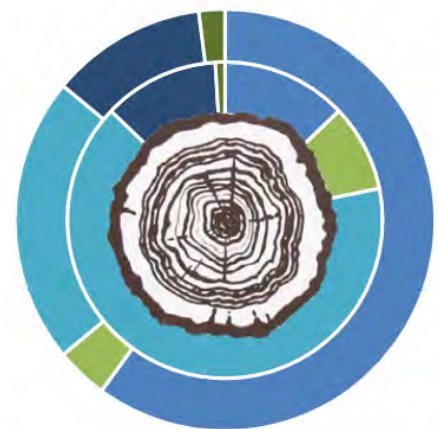


Figure 3. Proportion of acres owned (outer ring) and acres harvested in 2019 (inner ring) by landowner type.

Figure 3. Proportion of acres owned (outer ring) and acres harvested in 2019 (inner ring) by landowner type.

FOREST HEALTH SUMMARY

Insects, diseases and abiotic disturbance agents cause significant tree mortality, growth loss, and damage in Oregon forests each year. Large outbreaks and invasive exotic species can affect the function and resilience of forest ecosystems and may contribute to hazardous forest fire conditions. However, these agents also play a critical role in maintaining healthy, functioning forests by contributing to decomposition, nutrient cycling, and creating openings that enhance forest diversity and wildlife habitat.

A healthy forest is never totally free of insects, diseases, and other disturbances.

Western Oregon is characterized by high rainfall and dense coniferous forests along the Pacific coastline, the Coast Range, and western slopes of the Cascade Range. Eastern Oregon largely consists of lower density, semi-arid forests and higher elevation desert. Oregon forests are primarily dominated by conifers such as Douglas-fir, true firs, western redcedar, western hemlock, lodgepole and ponderosa pine, among others. The most abundant hardwoods are bigleaf maple, red alder, Oregon white oak, and black cottonwood.

This report highlights major agents of damage or mortality in Oregon forests over the past year and provides updates on chronic issues. Much of this information is obtained from aerial surveys, which provide a snapshot in time of damage visible from the air. Symptoms of some forest stressors may not be diagnosed from the air due to timing of surveys or a lack of externally visible signatures. Information for some of these agents is also obtained from ground surveys and monitoring programs. Complexes of multiple stressors are common and determining the initial or primary cause of tree mortality is sometimes difficult. Totals reflect acres with not of damage or mortality, meaning that not every tree in an identified pocket of poor health is damaged or dead. *Disclaimer: Volume of damage, causal agents and geolocations reported here and in the raw data are estimates and should not be used exclusively to guide management.*

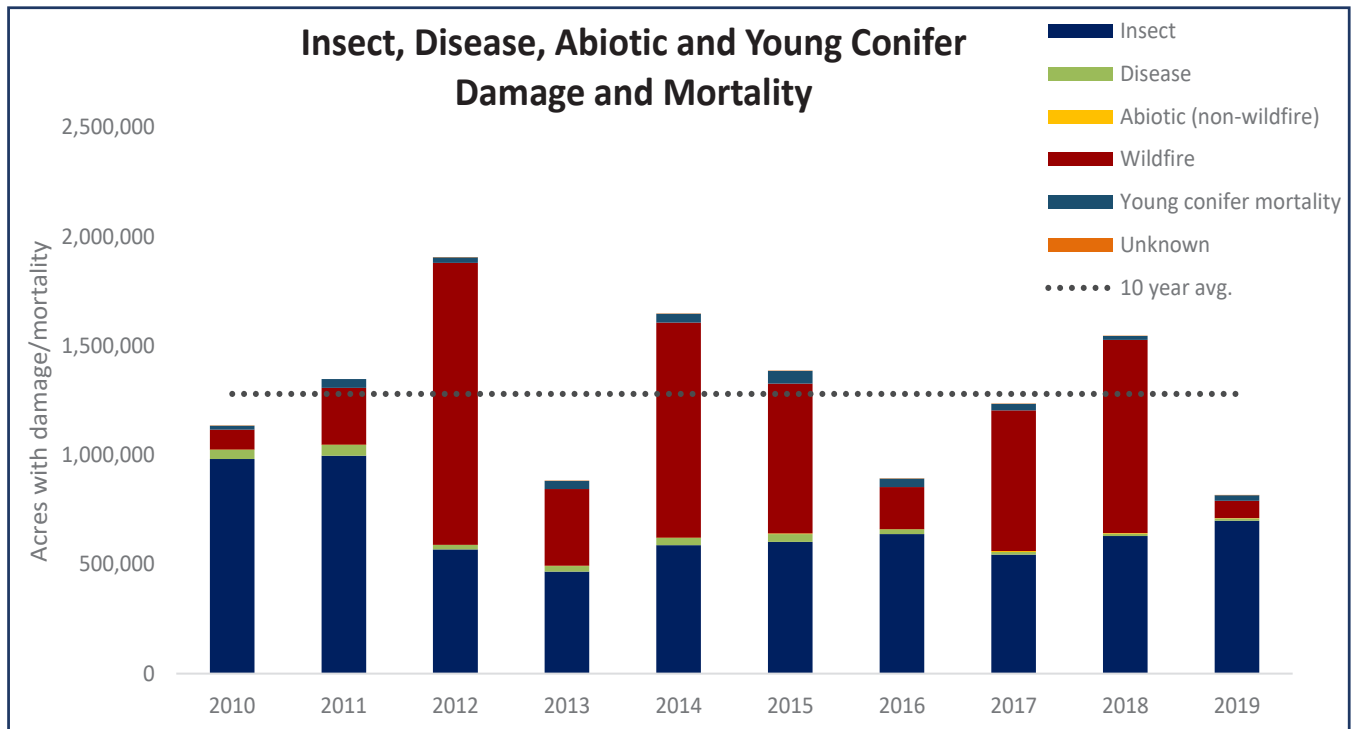


Figure 4. Of the approximately 30 million total forested acres in Oregon about 738,500 acres contained damage or mortality from insects, disease and abiotic stressors that could be observed in aerial surveys, and about another 79,000 acres were damaged by wildfire in 2019.

SURVEYS, MONITORING AND OTHER PROJECTS

Aerial survey

Each year ODF cooperatively surveys the forestland base with the USFS Forest Health Protection as part of a national effort to monitor trends in damage from forest insects, diseases and other stressors. In Oregon, annual surveys began in 1947. Each year observers from each agency climb into small aircraft like ODF's twin engine Partenavia Observer or a Quest Kodiak and conduct a process called sketch-mapping. With an observer on each side of the plane, damage to the forest is drawn on a map and the cause is attributed based on experience and educated assumption. Beginning in the early 2000's the mapping process was moved from paper maps to a digital system with a moving map screen, aerial photos, and a plethora of other information. More recent advances in technology have led to nationwide implementation of streamlined tablets, databases, and editing tools. Despite the advances over the years, sketch-mapping is more scientific art than pure quantification. Technical experts ground-check unidentified damage and undergo regular ground and classroom quality control training to better tune their assessments.

In Oregon, the annual "general overview" survey covers roughly 28 million acres to assess most insect, disease and biotic agents that can be identified from the air. Additional "special surveys" are flown for damage agents like Swiss needle cast, sudden oak death, pandora moth, and occasionally oak looper or gorse. In total, the agencies cover from 35 million to 41 million acres in a given year. Damage observed in these surveys can be cyclical with peaks and valleys as one agent or another ramps up and then declines. Historically we have seen this cycle time and again from agents such as mountain pine beetle causing landscape-level mortality in lodgepole landscapes to drought-induced mortality in Douglas-fir and true fir extending from the Willamette Valley to the Siskiyou.

The 2019 aerial survey year started off in June with a warm spring producing distinct damage signatures on much of the west side of the state, and survey of this region was completed by the end of the month. The remainder of the summer stayed cooler and cloudy which slowed completion of the central and eastern parts of the state. Fortunately, low fire activity in the region allowed skies to remain clear of smoky haze through most of the survey season.

Overall damage (not including wildfire) recorded during the 2019 aerial survey was slightly higher than the 10-year average by about 20,000 acres. Most of this damage was due to bark beetles in the eastern two thirds and southwest corner of the state, which increased from the previous year. Other areas of note include the damage from an impactful 2018-2019 winter storm that toppled trees and blocked roads from Veneta to Roseburg. As is typical with winter storm damage, not all of the impacted areas were visible from the air as the remaining canopy masked the true extent of damage. When looking at areas of mapped damage, it is important to note that the metric is acres *with* damage and that not all the trees in the indicated areas experience mortality or defoliation. Much like a fire, there are patches of uninjured trees within damage areas resulting in a mosaic of damage. As is normally observed, the majority of the area with damage is on federal lands, followed by industrial, small non-industrial, state, and tribal ownerships (Fig. 5).

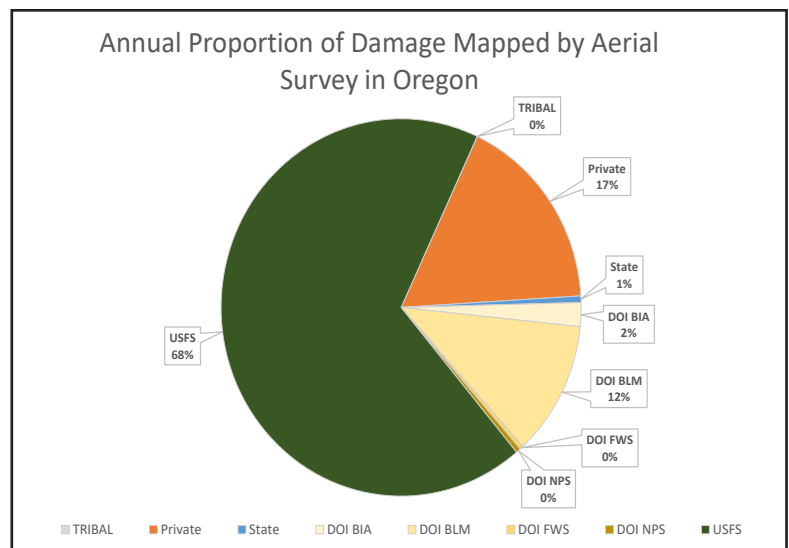


Figure 5. Proportion of acres mapped during aerial survey by ownership.

As part of the national aerial survey program, current year and future survey efforts will be conducted utilizing recently developed data collection software called Digital Mobile Sketch Mapping and a relatively new metric of observation, “percent forested area affected” for the Pacific Northwest. This new system provides the end user with reliable data that can more easily be compared across ecotypes and converted into *acres of damage*. While this is a change from the previous two decades of data, shifts in the metric of aerial surveys have happened in the past. It is important to remember that this form of survey work is highly subjective to the individual surveyor and is best applied at the landscape level, and thus, should not be utilized for fine scale management decisions such as silvicultural prescriptions or single stand management. If you would like to discuss this new system, its use, the metrics involved, or the process as a whole, contact ODF or USFS aerial survey staff.

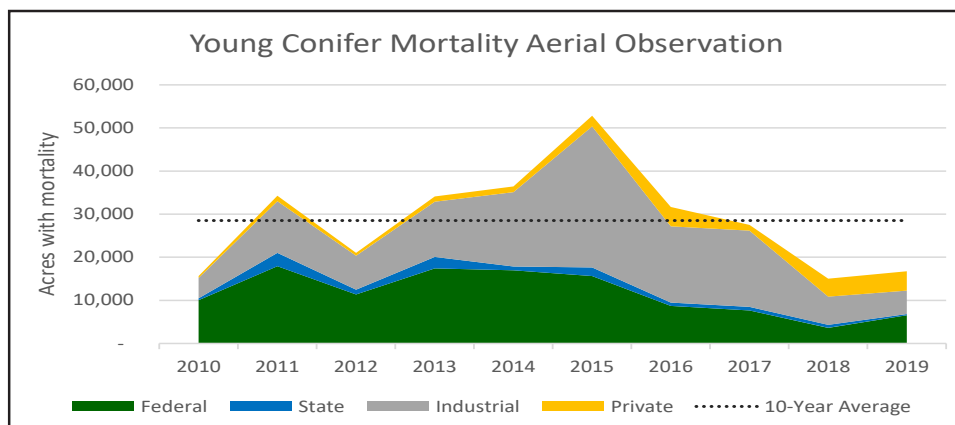


Figure 6. Acres with mortality mapped during aerial survey of young conifer.

Young conifer mortality aerial survey

Compounding impacts of early stand mortality can be significant. When the target rotation of a crop of trees is measured in decades, the loss of trees when they are young reduces growing stock, decreases the wood fiber accumulated, and reduces carbon stores (an area of increasing interest), and ultimately causes significant economic losses.

ODF and the USFS started conducting aerial surveys to target damage to young stands in 1988. Originally the survey on the west-side of the state focused on issues related to bark peeling by black bears. In more recent years the impact of drought stress and root disease, among others, is quantified at the same time. Recent research has shown that up to 70% of mortality in young stands is attributable to root diseases and abiotic injury; much higher than previous ODF surveys which indicated that roughly 30% of damage in young conifer stands was caused by these factors.

In the 2019 aerial survey, observers mapped about 16,700 acres of damage in young conifers. While damage observed was about 29,000 acres less than the 10-year average, it increased on federal and small private lands and decreased on state and industrial lands (Fig. 6). Damage to young conifers that is visible from the air tends to follow a cyclical trend with a peak roughly every 10 years. Although only speculative, young conifer damage is higher following drought years and then subsequently declines. Peaks were observed in 2003, 2007 and 2015; all years following drought periods.

Recent stand surveys suggest that the occurrence of black stain root disease may be increasing in several parts of the Oregon Coast Range, particularly in young stands. Additional field work and studies are ongoing through OSU and may shed light on this interaction and provide guidance on management strategies to reduce mortality in young stands.

SURVEYS, MONITORING AND OTHER PROJECTS

Drought online survey

The National Drought Mitigation Center has developed an online drought reporting survey in which landowners can report drought impacts on their forestlands to help us track spread and intensity:

https://go.unl.edu/cmor_drought

Western redcedar decline monitoring

From Oregon to Vancouver B.C. pockets of declining western redcedar (*Thuja plicata*) have been observed. The sites of decline are typically in pockets and often located in areas where redcedar typically thrives such as along streams and within closed canopies. *State and federal forestry agencies have been attempting to determine the cause, but so far no insect or disease agent has been identified* – beyond the agents that typically attack only dead or dying trees. It is possible that these trees are being impacted by a changing climate that includes drought stress, even along streams. Forest health experts in Oregon and Washington are working together to establish monitoring sites to identify the distribution of the problem, patterns and progression of mortality, and any potential causes. See ODF Why is my Tree Dying? Western redcedar fact sheet:

<http://tinyurl.com/odf-foresthealth>



Figure 7. Western redcedar showing a symptom (thin canopy) of decline (Christine Buhl, ODF).

Hazard Tree program

Pathologists with ODF and the USFS evaluate tree hazards and provide trainings on an annual basis to ensure that trees at risk of failure, due to root or stem rots, are removed to protect those working and recreating in the woods. ODF assists the Oregon Parks and Recreation Department with hazard tree training to ensure that state parks have trained staff available to identify hazard trees.

Bark beetle landowner incentives program

As part of the USFS Western Bark Beetle Strategy, treatments such as thinning, pine slash management, and anti-aggregation pheromone applications are used to improve tree resilience to bark beetles, which is especially important during times of drought. Each year money is allocated from the USFS to ODF to provide non-federal landowners partial funding (50/50) for doing this work to prevent or mitigate large-scale bark beetle outbreaks. In 2019, 170 private acres and 1,770 federal acres were treated for preventative management of bark beetles.



Figure 8. Expert tree climbers assessing structure of an old growth Sitka spruce in a coastal campground (Sarah Navarro, ODF).

Douglas-fir tussock moth surveillance trapping

This annual trapping effort to detect increases in moth populations and predict outbreak potentials in eastern Oregon entered its 40th year. The decrease in numbers in 2019 indicates that the current outbreak may be on the decline.

Monitor progress here: <https://tinyurl.com/dougfirtussockmoth>

Exotic woodborer monitoring

During 2016-2018, a special survey for exotic, invasive woodborers across 12 sites along the Columbia River corridor was conducted cooperatively by the Oregon Departments of Forestry and Agriculture (ODF and ODA). To date, over 100,000 bark beetles and ambrosia beetles (Curculionidae: Scolytinae), wood-boring beetles (Buprestidae; Cerambycidae) and wood wasps (Siricidae) have been collected and identified across all sites. There have been over 25 exotic species recorded in the survey, most of which are long-term residents of Oregon. However, four new exotic species have been detected in project traps: (1) an eastern U.S. flatheaded borer (*Chrysobothris rugosiceps*), (2) an Asian ambrosia beetle (*Cyclorhipidion pelliculosum*), (3) a European hardwood weevil (*Trypodendron domesticum*), and (4) a European ambrosia beetle (*Xyleborus monographus*).

In 2019, ODF Forest Health staff assisted ODA in delimiting trapping for *Xyleborus monographus* in the vicinity of Chinook Landing Marine Park near the city of Troutdale. This ambrosia beetle is known to cause damage to white oak trees in Europe and Asia. At the time of its discovery in Oregon in 2018, it had never been recorded in North America. However, since 2018 forest health professionals from California have reported *X. monographus* attacking and killing valley oaks (*Quercus lobata*) in Napa, Lake and Sonoma counties. The 2019 trapping effort at Chinook Landing Marine Park did not yield any *X. monographus*.



Figure 9. European ambrosia beetle (*X. monographus*) (ODA).

Oregon Forest Pest Detector program

For the sixth consecutive year, ODF Forest Health staff served on the interagency Oregon Forest Pest Detector (OFPD) program. The USDA-funded OFPD, coordinated and led by OSU Forestry Extension, aims to train arborists, landscapers, park workers and other professionals on the early signs and symptoms of priority invasive forest insects. Using a combination of online presentations, face-to-face seminars and field training courses, over 500 professionals have been trained as "First Detectors" of emerald ash borer, Asian long-horned beetles and other exotic forest insects. The OFPD works with the Oregon Invasive Species Council to utilize the Oregon Invasives Online Hotline reporting system so that First Detectors can take a picture and log a report of possible invasive species while in the field. The overall goal is to detect key forest invaders early in their invasion when eradication is still feasible. <http://pestdetector.forestry.oregonstate.edu>

In the summer of 2019, two graduates of the OFPD independently submitted reports to the state's invasive species hotline of suspicious exotic insect damage to native twinberry plants (*Lonicera involucrata*) in the Portland metro region. ODF Forest Health staff, alongside partners with the ODA, responded to the reports and identified an exotic woodborer, *Agrilus cyanescens*, previously unknown to the Pacific Northwest. This Eurasian insect has occurred in the northeastern U.S. since at least 1921, where it feeds on native honeysuckles (*Lonicera* spp.). ODF is assisting ODA and other partners in monitoring and outreach of this discovery. The discovery and reporting of previously undocumented exotic woodborer demonstrates the effectiveness of targeted education of Oregon's forest professionals through the OFPD program reporting through the Oregon Invasive Species Online Hotline: <https://oregoninvasiveshotline.org>

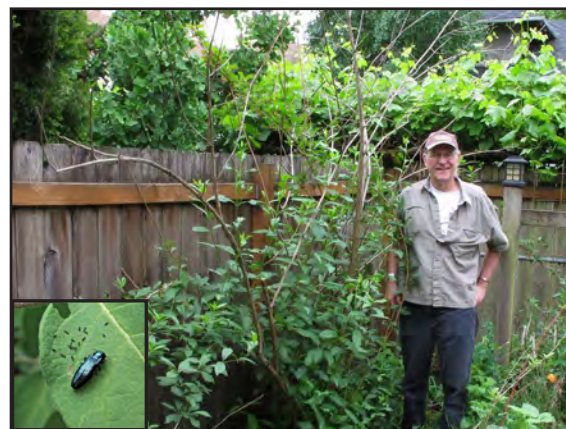


Figure 10. Twinberry (main) damaged by *A. cyanescens* (inset) (Ansel Oommen, Bugwood.org and Rick Westcott, ODA).

SURVEYS, MONITORING AND OTHER PROJECTS

ODF Tillamook Forest Center

The ODF Forest Health unit often collaborates with the Tillamook Forest Center (TFC) on education and training projects. In 2019, Forest Health staff installed a new field course at the TFC for Oregon Forest Pest Detector (see previous page). The TFC also hosts Fresh Brewed Forestry, an education event that enabled several Forest Health staff to speak to the public about various forest health-related topics:

<https://www.facebook.com/pg/tillamookforestcenteroregon/videos>

Forest Bee Projects

The Oregon Bee Project (OBP) and affiliated partners (shown observing pollinators, below right) have made great strides in 2019 in assessing forest bee populations. Most notable are efforts by OSU Forestry Extension, Hampton Lumber and many Oregon Bee Atlas citizen science volunteers:

- OSU established forbs and hedgerow shrubs in forest plots and began assessing bee populations and plant visitation as part of a multi-year study:
<http://blogs.oregonstate.edu/treetopics/2019/09/19/forests-and-native-bees-the-season-1-recap>

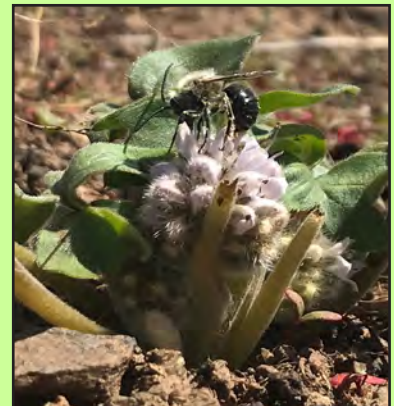


- Hampton continued their work establishing pollinator plots alongside harvest replants and continued research into post-harvest management techniques to increase pollinator habitat:
<https://www.hamptonlumber.com/sustainability/sustainable-forests/pollinator-project>

- Oregon Bee Atlas volunteers have been greatly increasing their participation from 2018 to 2019 by doubling collection locations (560 to 1,300) and individual specimens (12,000 to 27,500)!

Did you know?

Oregon has over 500 species of bees, most of which are ground and cavity nesting. Recent research from OSU has shown high abundance and diversity of bees in forests with high levels of disturbance by fire or harvest operations. This disturbance both exposes bare soil that bees use for nesting and increases light which warms nests and promotes the germination of flowering plants. Native bees in forests has become a hot topic and Oregon is leading the way, via the Oregon Bee Project (led by OSU, ODF and ODA), in enhancing bee health and habitat and engaging the public.



ABIOTIC AGENTS

Climate and weather are often primary contributors to tree health and forest conditions. Events that stress trees reduce growth and decrease their ability to defend themselves or rebound from insects, diseases and additional stressors. Healthy trees are able to defend themselves from insects and disease with pitch and compartmentalization, which are forms of mechanical and chemical defenses. Attacking insects get stuck in or drowned by pitch, or are repelled by the chemical compounds it produces. Similarly, pitch is a defense against some fungi by sealing wounds that can be entry points for spores, compartmentalizing diseases to prevent their spread among tissues, or reducing virulence by containing antimicrobial chemicals.

HEALTHY TREES = RESILIENT TREES

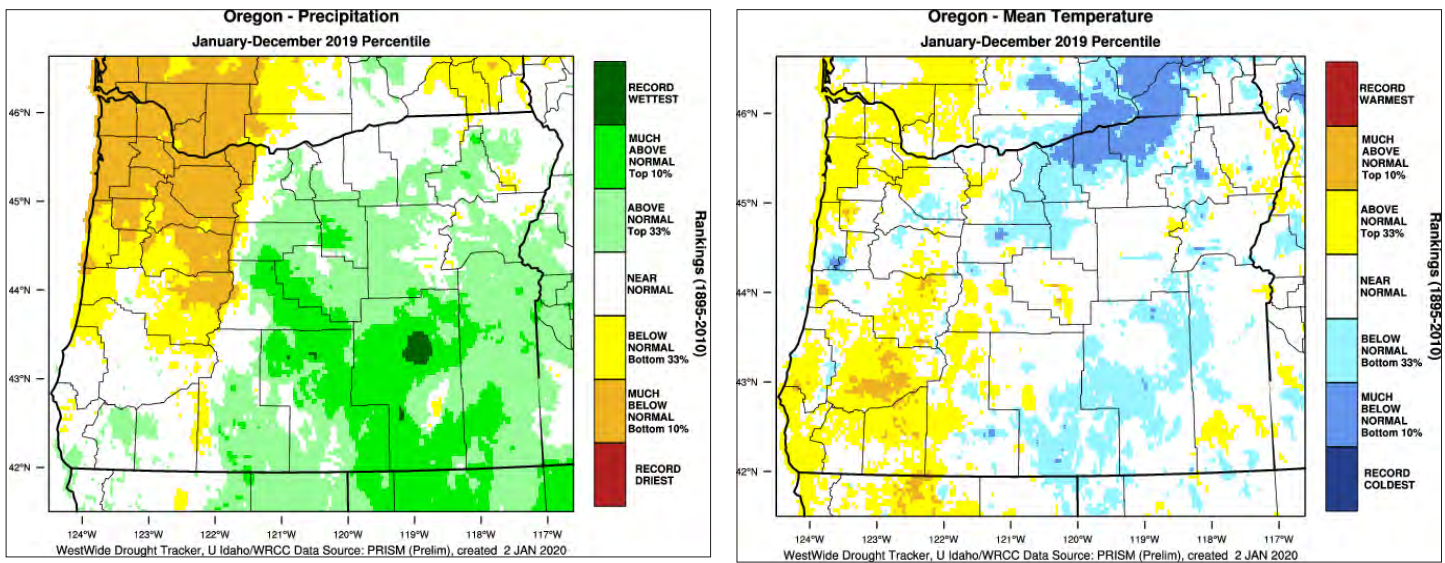


Figure 11. Average precipitation and temperature levels from January-November 2019, relative to the average normal based on 115 years spanning from 1895 to 2010 (Western Regional Climate Center).

Climate change

One of the major reoccurring stressors in Oregon forests has been ongoing drought as a result of climate change. Oregon has a diversity of forest ecosystems due to variations in latitude, elevation, topography, and proximity to the ocean and mountains (rain shadow effects). All these factors play a role in determining the impacts of altered temperatures and precipitation (rain and snow) levels. Additionally, soil and ground cover type, local water use and watershed dynamics can place different pressures on water storage capacities. Tree stocking levels influence the competition among trees for the availability of water resources. Some tree species have strategies to tolerate drought better than others.

There many climate change models for the Pacific Northwest but most echo the same prediction: warmer average temperatures resulting in warmer winters and longer summers; more erratic precipitation events; and winter precipitation in the form of rain rather than snow. The fact that we are experiencing a change is not unprecedented. Earth experiences naturally alternating periods of cooling and warming and we are currently in a warmer phase. However, the rate that change has been occurring is extreme. Temperatures have already risen 1.0 – 2.0°C along the west coast over the last 60 years and are predicted to increase by 1.0 - 3.5°C by the 2050's. In relation to forestry, many of these climate change projections predict change well within the span of a stand rotation or two. Therefore management decisions such as species mix and densities must be made in anticipation of these projections.

ABIOTIC AGENTS

Drought

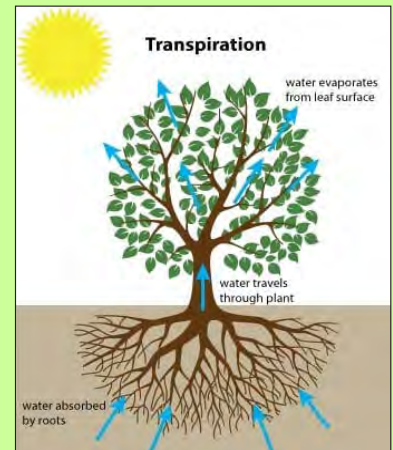
Droughts should not be simply defined by high temperature or low precipitation records. Timing and duration of these events must be taken into account to properly evaluate their impacts on trees. Warmer temperatures or drier conditions in the fall reduce moisture levels that hold trees over during dormancy, and similar conditions in the spring, when trees break dormancy, add further stress during a crucial time in growth. Trees also need long, slow “drinks” of water and can’t get their needs met by infrequent “dumps” of rain, or rain in place of snow (which slowly melts in the spring, watering higher elevation trees and recharging waterways). At times it may appear that we are getting a lot of rain or returning to the pre-drought conditions of 2012 either because of short storm/flood events or simply because we have become accustomed to current drought conditions. Keep up to date by subscribing to Oregon Water Resources Department’s monthly drought summary email:

<https://tinyurl.com/drought-report>

Although Oregon experienced a bit of a reprieve from enduring high temperatures and low moisture levels in 2019, many parts of the state returned to pre-drought conditions for most of the year (Fig. 11). However, it takes more than one year of improved moisture conditions for trees to rebound from years of drought damage. Although average temperatures did decrease and hot days did not persist, the type and timing of precipitation has still not been ideal for trees. At periods we have experienced some increased precipitation from previous years but often in the form of storm events resulting in flooding (rather than the slow watering that trees require) or winter precipitation as rain when snow should be expected.

How do trees respond to drought?

To understand how drought affects trees and how they respond, one must understand some basic biological processes. Trees are actively pulling in water through roots and transporting it through a bundled network of straws (vascular tissues) to leaves that release moisture into the air via small holes (stomata). A common misconception is that roots are pushing moisture up throughout the tree. In reality this process is driven by the pull of moisture from leaves into the atmosphere. Dry or windy conditions result in lower atmospheric moisture which results in a greater pull of moisture from leaves to maintain water balance between leaves and the air. When stomata open they let in CO₂ which, when combined with sunlight and water, allows trees to make food during photosynthesis. When stomata close, as a mechanism of drought-tolerance to reduce water loss, starvation occurs due to the halt of photosynthesis.



During periods of low water availability, roots may die back, or grow closer to the surface in search for moisture, exposing them to compaction near the surface. Replacement of root tissues takes time, so even if moisture levels increase, there may not be enough root tissue biomass present to absorb enough of it. When soil moisture levels are low or roots are not present to obtain it, moisture continues to be lost through leaves. The upward pull through vascular tissues can create so much pressure that air pockets form and tubes within the tissues break. It takes time for these tissues to be rebuilt as the tree grows, so trees are left with reduced ability to translocate available moisture. Trees can withstand mild or infrequent droughts through a variety of moisture conserving techniques (premature leaf drop, stomatal closure, etc.), but prolonged or repeated droughts often result in mortality, sometimes years later.

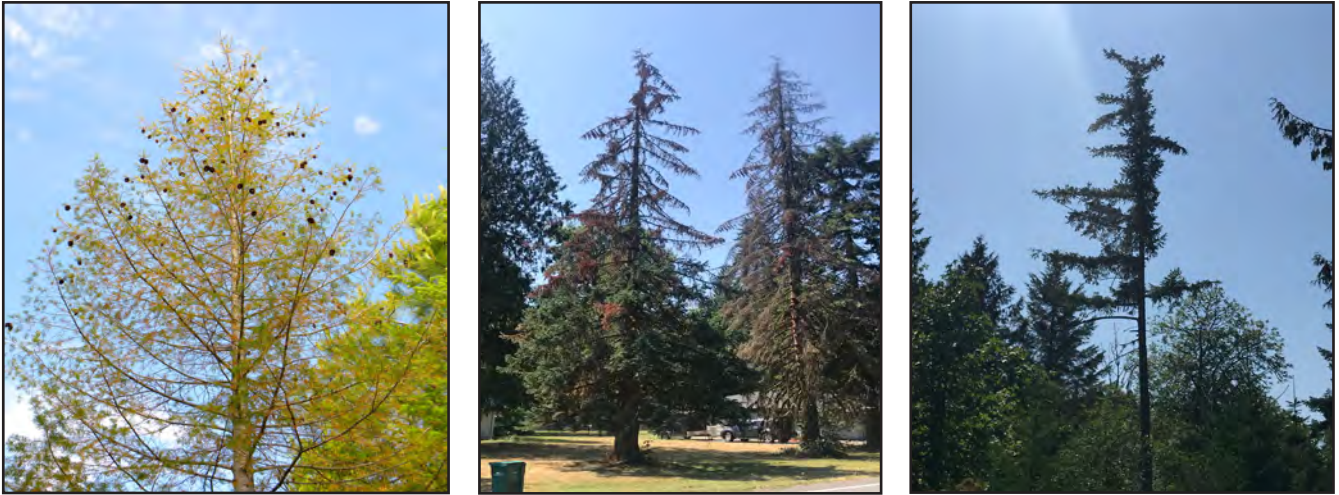


Figure 12. Symptoms of drought: thin canopy, topkill, asymmetrical crown (Christine Buhl, ODF).

How to manage for future drought stress:

- Plant: native species, seed sources local to your region, and species adapted to the various conditions and microclimates (soils, aspect, sun or wind exposure, etc.) at your site. Do not continue to replant with species that are struggling to survive or don't naturally regenerate. Pay attention to which species are doing well.
- Maintain: thin trees early and leave enough space between trees to handle future droughts. Reduce competition from other competing plants especially grasses and invasive species. Do not fertilize during droughts (increased growth increases moisture requirements).
- Prevent and control: be aware of the major insects and diseases that occur in your tree species and in your region (see page 28). Follow management guidance. Remove weak, injured or extremely stressed trees.

Storms

Winter storm events in the Willamette Valley caused tree blowdown and flooding. Damage was particularly evident in Douglas, Coos and Lane counties. Work was done to clear roadways but many interior areas still contain debris that attracts insects that preferentially attack downed material, promoting population buildups that may spread into adjacent standing trees.

The primary species of concern is Douglas-fir beetle which attacks large diameter (>10 inches diameter at breast height) Douglas-fir. ODF consulted with small private, industrial and public landowners in affected areas to inform of possible mitigation options. More on management of this insect on page 16 and in ODF Forest Health fact sheets (Douglas-fir beetle, Storm damage, MCH).



Figure 13. Blowdown near Roseburg from 2019 winter storm (Christine Buhl, ODF).

ABIOTIC AGENTS

Wildfire

2019 provided a break in a sequence of high severity fire seasons in Oregon, resulting in fewer acres of damage from wildfire than experienced in over 15 years. Across all ownerships, nearly 2,300 fires damaged approximately 80,000 acres, nearly 7 times less than the 10-year average of 546,000 acres. Lighting was the cause of approximately 50% of wildland fires in 2019, and accounted for 75% of the acres. Debris burning and escaped camp fires continue to be the primary causes of human-caused fires. On ODF protected lands, aggressive initial attack kept 97% of the fires at less than 10 acres. The largest fire on ODF protected lands in 2019 was the Milepost 97 fire in Douglas County (Fig. 14) near



Figure 14. Milepost 97 wildfire in Douglas County (Kyle Reed, ODF).

Roseburg at 13,119 acres, costing \$21.8M to suppress. With a reduced fire season in Oregon, many wildland firefighters were readily able to assist with fires in other states and Canada. See wildfire map on next page.

Fires are a natural part of an ecosystem and there is a natural fire cycle for each type of forest found in Oregon (Fig. 15). For example, coastal spruce-hemlock forests may only burn naturally around every 400 years or so, but when they do burn it is often at a high intensity because of the amount of fuel that has accumulated over time and the steep terrain. At the other end of the spectrum, ponderosa pine dominated stands can withstand higher regularity of burning (about 5-25 years) due to their thick bark. Because these fires are more frequent, the fuels don't tend to build, resulting in fires with lower intensity. Each of these systems has evolved to withstand wildfire or generate a new seral complement of species that shifts as the stand ages. When natural wildfire cycles are suppressed, these systems become less resilient and more predisposed to catastrophic wildfires that create an economic burden on local communities and remove the ecological benefits of fire (nutrient cycling, reduced competition for resources, loss of less resilient trees, creation of wildlife snags, etc.).



Figure 15. Coastal forest adapted to infrequent fires (left) and ponderosa forest adapted to more frequent fires (right) (Christine Buhl, ODF).

FOREST INSECT AND DISEASE MAP

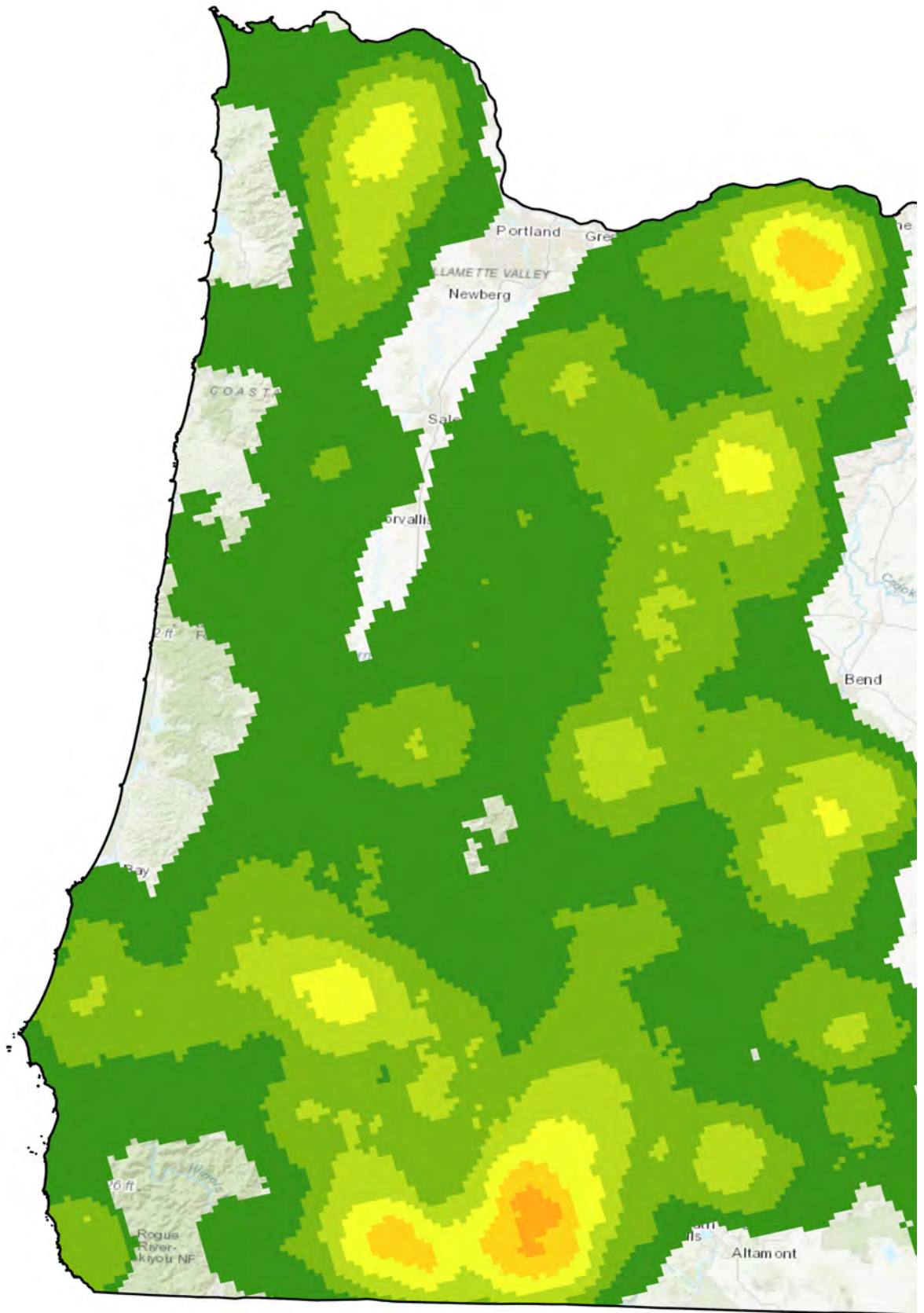
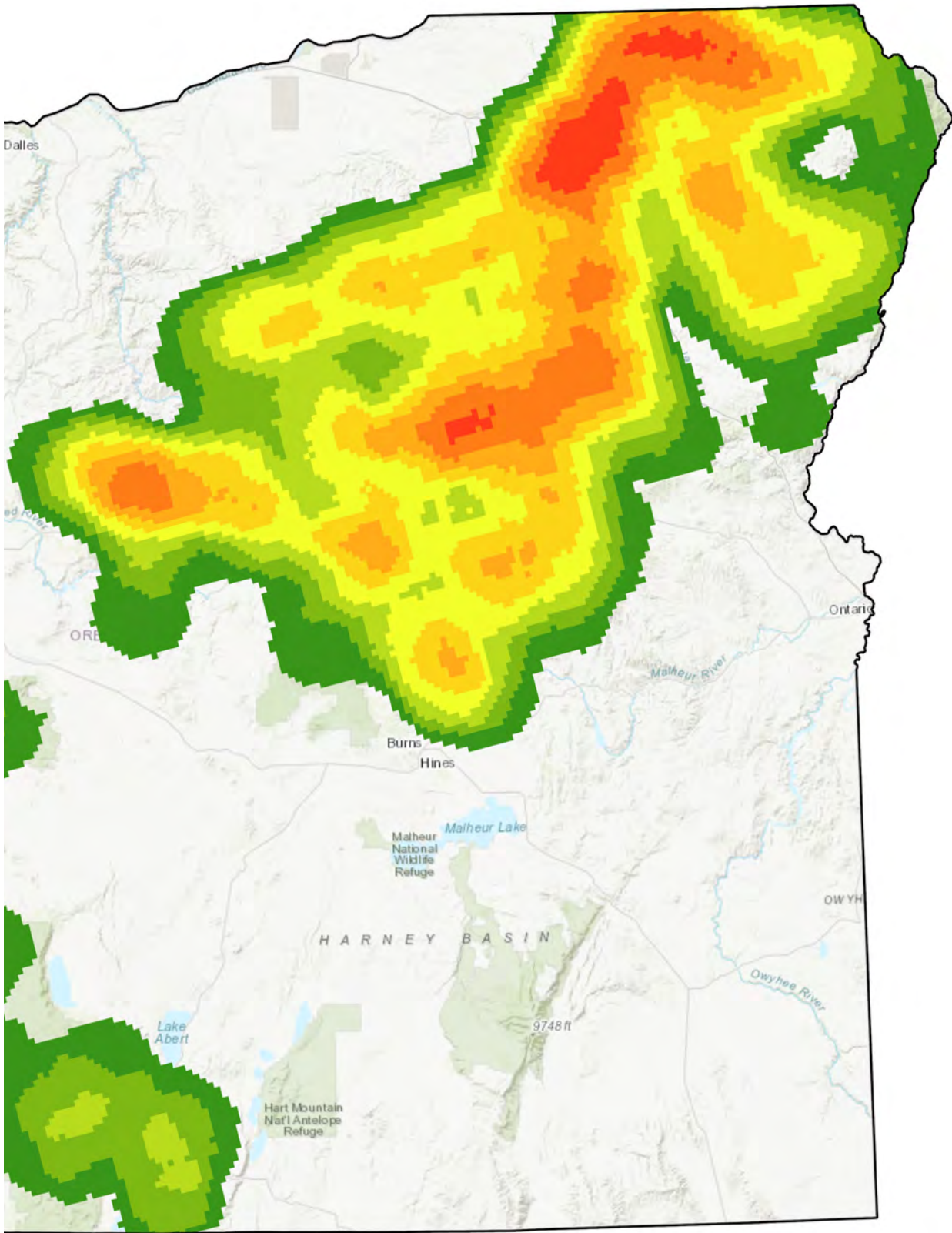


Figure 16. Map of tree damage/mortality intensity as detected by aerial surveyors in 2019. Damage shown on the map is not comprehensive as some agents cannot be detected by aerial survey. Intensity increases from green to red.



The highest intensity of damage can be seen in the northeast and is attributed mainly to bark beetle attacks in true fir. High damage areas in southern Oregon are attributed to bark beetle attacks in pine and drought-stressed Douglas-fir. In the Columbia River Gorge it's bark beetles attacking pine at lower elevations and true fir at higher elevations. In the Willamette Valley much of the mortality is attributed to drought stress in Douglas-fir and true fir, followed by bark beetles.

FOREST INSECTS

In 2019, Oregon statewide aerial surveys detected approximately 700,000 acres with damage or mortality from forest insects, which represents over 90% of the total acres of forest damage detected in aerial surveys. However aerial survey does not detect many tree diseases such as root diseases that are also extensive on the forested landscape. In most cases these insects are opportunistic, preying on already stressed or dying trees and are not the primary reason for tree decline or death. Most of these attacking insects are native or, if introduced, have been established on our landscape for quite some time. Many of the following insects only become “pests” when stressors such as drought, fire, mechanical damage and disease weaken trees to the point where they can be killed by insects.

BARK BEETLES

Douglas-fir beetle (*Dendroctonus pseudotsugae*) continues to kill drought-stressed Douglas-fir across the state. The heaviest hit areas are in the southern Willamette Valley starting around Lane and Douglas counties. This insect also preferentially attacks freshly fallen, large-diameter Douglas-fir - which are often created in winter storm blowdown events as we saw in



Figure 17. Brown piles of frass indicates bark beetle attack (left) and MCH pouch (right) (C. Buhl, ODF and Darrell Ross, OSU).

winter 2018-2019. The typical cycle is for the beetle to lay eggs in downed material the April following the blowdown event. Eggs hatch and eventually develop into adults of the next generation that attack standing trees the next April to repeat the cycle. Reddish-brown piles of boring dust (frass) in bark crevices indicate attack (Fig. 17). Trees downed for over a year and already attacked trees do not become re-infested and are therefore not reservoirs. To prevent local population buildups of this pest it is advised to remove downed Douglas-fir logs before April 2020 to prevent beetles from emerging and attacking standing trees. An anti-aggregation pheromone, MCH (Fig. 17), can also be stapled to trees in blowdown areas in a grid pattern at 30 foot spacing to effectively disperse beetles across the landscape as they search for areas that do not emit MCH. In their search many may beetles die, thereby also reducing the population. MCH is an inexpensive, general use pesticide that does not require a license and may be purchased online. Notification of planned MCH application on private land must be submitted to ODF via the FERNS notification system two weeks prior. More on MCH application strategies in USDA MCH Handbook: <https://tinyurl.com/USFS-MCH>

Ips bark beetles (*Ips pini* and *I. paraconfusus*) also continue to be a problem in pockets around central Oregon up to the Gorge and in the Willamette Valley wherever pine slash has not been managed properly. See more on management of this insect in ODF FH fact sheets (Ips Beetles, Slash Management). Some areas in eastern Oregon are still experiencing pockets of **western pine beetle** (*D. brevicomis*) outbreaks in ponderosa pine (Fig. 18), and **fir engraver** (*Scolytus ventralis*) continues to kill true fir that are struggling from drought stress or root disease across the state.

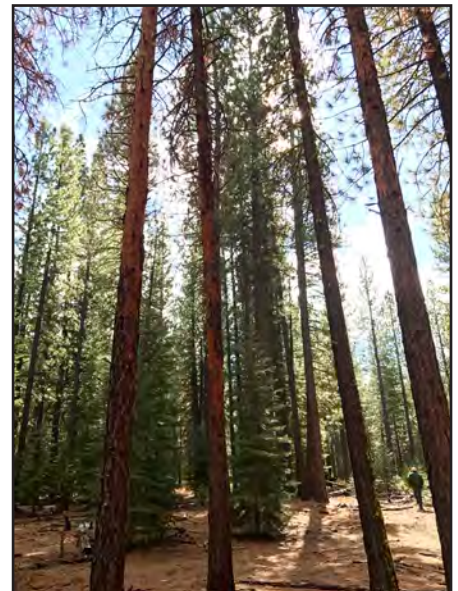


Figure 18. Western pine beetle outbreak in eastern Oregon (Christine Buhl, ODF).

WOODBORERS

Emerald ash borer (EAB, *Agrilus planipennis*) is an exotic, invasive beetle that has been confirmed as far west as Colorado, and much preparation is underway for its potential arrival in Oregon. A cooperative statewide EAB survey was conducted in 2019. EAB traps and lures were provided by USDA-APHIS with ODF coordinating the survey with local cooperators. Local government officials in Portland, Hillsboro, St. Helens, Corvallis, and Ashland participated alongside ODF and USDA-APHIS in placing EAB traps in Oregon. Since Oregon began surveying for EAB in 2008, the exotic woodborer has never been detected in the state, including in the 2019 cooperative survey.



Following the completion of the Oregon Emerald Ash Borer Readiness and Response Plan in 2018, ODF Forest Health received funding from the USFS to collect and store seeds of Oregon ash (*Fraxinus latifolia*) before the arrival of EAB in Oregon. The seeds will be stored in freezers for genetic conservation (USDA Seed Lab, Fort Collins) and research (USFS Dorena Genetic Resource Center). In 2019, approximately 350,000 seeds were collected from over 100 mother trees across 12 populations in western Oregon. In 2020, ODF plans to collect another 600,000 seeds from an additional 200 mother trees to be collected and stored. This is a unique opportunity to be proactive and prevent the loss of an ecologically important native species before EAB is detected in the state and Oregon ash is already threatened. For more on the risk and mitigation of EAB, visit Oregon's EAB Readiness and Response Plan: www.OregonEAB.info



Figure 19. Oregon ash forest (top), and their seeds (bottom) (Wyatt Williams, ODF).

Did you know?

Firefighters are not strangers to many insects that fly in during and after wildfires, but what are they doing? Beetles commonly called “firebugs” (*Melanophila* spp.) often appear after (and sometimes during!) wildfires to lay eggs in damaged, and thus weakly defended, trees. They have heat-detecting organs and can detect volatiles released from burning trees. There are also a myriad of other bark beetles and woodboring beetles and wasps that can detect the smell of these injured trees. Some of these insects are large, have menacing-looking jaws or stingers and may “taste” a nearby human to determine if they are trees. Large woodboring wasps may make stinging reflexes if handled but, have no fear, they are all bark and no bite! Even though their “stinger” is meant to drill into wood, it cannot penetrate human skin. Even long after the fire has been put out the larvae of large woodborers can often be heard chomping through dead and dying trees. Their mandibles are so effective at chewing through wood that the first pattern for chainsaw teeth was developed from the jaws of these so-called “timber worms”. Often white boring dust in bark crevices indicates infestation from one of these woodborers.



FOREST INSECTS

DEFOLIATORS

Central Oregon saw an increase in defoliating insects in 2019 with the continuation of an active Pandora moth outbreak and the addition of isolated activity of pine-attacking sawflies and needleminers. **Pandora moth** (*Coloradia pandora*) is estimated to be in year six of an outbreak cycle that tends to collapse naturally after 6-8 years. Defoliation observed in 2019 was reduced to isolated pockets. Since these insects have a two year life cycle, with only one year of feeding by the caterpillar larvae (adults do not feed), pine trees can grow needles every other year, which assists in toleration of damage. However prolonged drought has added a baseline of underlying stress. The added stress of defoliation increases chances of tree mortality or reduced resistance or tolerance to future stress such as attacks from bark beetles. Treatment for Pandora moth is not advised as it may have impacts on beneficial, non-target insects. Instead strategies to improve tree resilience such as reducing competition for water by thinning tree stands or removing weeds, and by preventing buildup of Ips bark beetles in pine slash (see ODF Slash Management fact sheet) are recommended. In Oregon, moths are present in odd-numbered years and caterpillars during even-numbered years and may be seen feeding on needles this March - April (Fig. 20).



Figure 20. Pandora moth caterpillars (Donald Owen, California Department of Forestry and Fire Protection).



Figure 21. Defoliation damage (left) from pine sawfly larvae (right) (Robbie Flowers, USFS).

About 4,000 acres of **pine sawfly** (*Neodiprion nanulus contortae*) damage was observed along Highway 97 near Chemult (Fig. 21). Sawfly larvae feed, initially as a group, on older foliage leaving branches with a lion's tail appearance. This preference for older needles allows trees to retain their current year needles each year and, therefore, defoliation usually results in reduced growth rather than tree mortality. The last sawfly outbreak close to this area was in 1978. Outbreaks from sawflies often decline on their own within 2-4 years.

Damage from the larvae of **ponderosa needleminer moths** (suspected to be *Coleotechnites ponderosae*) was observed across about 750 acres in the Warner Mountains (Fig. 22). Damage from these insects can be spotty on the landscape due to variable resistance among trees but most trees usually recover from this defoliation without serious injury.



Figure 22. Ponderosa needle miner damage (Robbie Flowers, USFS).

In northeast Oregon an active **Douglas-fir tussock moth** (*Orgyia pseudotsugata*, Fig. 23) outbreak may be peaking in most areas. Annual surveillance trap monitoring, aerial and ground surveys recorded the start of this outbreak in 2018. Outbreaks from this insect typically collapse on their own within three years due to natural controls such as pathogens and natural enemies. Surveys indicated 9,400 acres of damage in 2018 and 14,200 acres in 2019. Mortality has been highest in pockets of Douglas-fir and true fir-dominated stands of trees growing in zones more suited for pine.



Figure 23. Douglas-fir tussock moth larva (Christine Buhl, ODF).

Gypsy moth (*Lymantria dispar dispar*) is an exotic defoliating insect that feeds on several hundred species of trees and shrubs, including conifers. If it were to establish in western states, it has the potential to dramatically change forest management and ecology, leading to increased aerial pesticide use and increased costs of timber harvest. While European gypsy moth is established in the eastern U.S. and is regularly detected in Oregon, gypsy moth eradications in Oregon have been successful since monitoring began in the 1970s. Today, there are no established populations of gypsy moth in Oregon due to an excellent early detection and rapid response system.

European gypsy moth was detected in 2018 by the Oregon Department of Agriculture in NW Corvallis. Traps captured 27 adult gypsy moths around two apartment complexes. ODF Forest Health staff assisted ODA in a ground-based treatment of 46 acres in May 2019 using *Bacillus thuringiensis kurstaki*, a bioinsecticide. ODF provided technical expertise as well as on-the-ground education and outreach. ODA reports that the treatment was largely successful with only three adult gypsy moths captured in the area after the ground-based treatments were completed. Monitoring of the site will continue in 2020.

SAP-SUCKING INSECTS

Balsam woolly adelgid (BWA, *Adelges piceae*) is an exotic insect that has been established in Oregon since 1930 and continues to spread in true fir at higher elevations of the Cascade crest and peaks in northeast Oregon. In 2019 near the Anthony Lakes area, where we would expect to see BWA, another insect was also present. **Fir mealybugs** were observed covering subalpine fir needles and twigs. Many stems were also covered with the insects or sooty mold. Similar to BWA, mealybug excrement allows growth of sooty mold and feeding damage causes gouting. Mealybugs were also found infesting adjacent whitebark pine.



Figure 24. Mealybug crawlers (Kristen Chadwick, USFS).

FOREST INSECTS

Noticeable damage of Sitka spruce from **spruce aphid** (*Elatobium abietinum*) took place from Astoria to Newport and inland within the fog belt. Although we have not seen an outbreak from this pest for quite some time, it has attacked more acres along the coast historically (Fig. 26) and trees have recovered. Spruce aphid is originally from Europe but has been established in the Pacific Northwest since the early 1900's. Since then attacks have been infrequent in Oregon although occasional outbreaks have been observed in Washington and Alaska. This insect is largely controlled by generalist predators such as ladybeetles and spiders, low temperatures in the winter, and early spring frosts. The mild winter experienced along the NW coast in 2018-19 may be responsible for this latest outbreak.

Spruce aphid only damages older foliage, therefore spruce are able to retain their current-year needles (Fig. 25). Although tree growth may be reduced, tree mortality is uncommon. Populations of this insect are largely controlled by low winter temperatures which are predicted to become less common, thus it is possible that multiple, sequential years of outbreaks may occur in coming years and some trees may die before natural predator populations can respond and reduce aphid numbers. ODF and OSU Forestry Extension are actively monitoring spruce tree plots to assess how much damage the trees can withstand. Chemical treatment may be warranted in some cases but is too expensive and laborious to apply for most landowners, and may have non-target impacts on natural enemies which will prolong the outbreak.



Figure 25. Sitka spruce on NW Oregon coast heavily defoliated by spruce aphid (above) but a closer look at the same tree shows that the current year needles are not damaged (right).

Historically, Oregon has experienced far more extensive damage from this insect but trees were able to recover (below) (Christine Buhl, ODF).

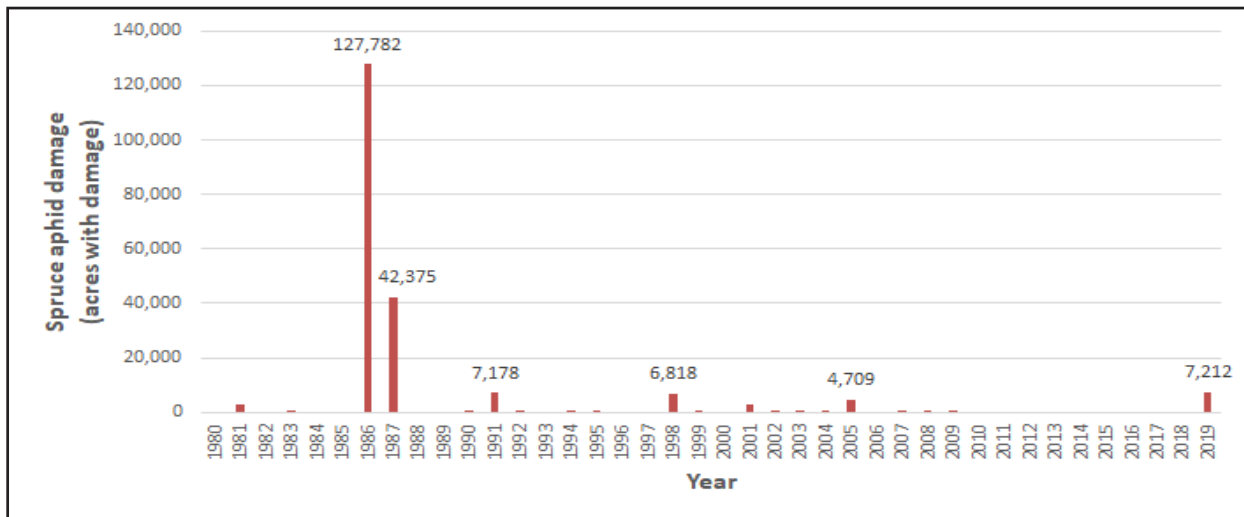


Figure 26. Historic spruce aphid damage.

FOREST DISEASES

Phytophthora ramorum is an exotic invasive non-native pathogen that causes the **sudden oak death** (SOD) disease in tanoak. SOD was first discovered in northern coastal California in the 1990s and the disease has since spread to 15 counties. *P. ramorum* was discovered in 2001 in Curry County, Oregon. Immediately, an interagency program formed with the goal of complete eradication. Spread of *P. ramorum* is managed through the designation of a SOD Generally Infested Area (GIA) and SOD quarantine area under the authorities of the Oregon Department of Agriculture (ORS 603-052-1230) and the U.S. Department of Agriculture Animal Plant Health Inspection Service (7 CFR 301-92). These state and federal quarantines regulate the intrastate and interstate movement of host plant material outside of the quarantine area. Oregon regulations require infested sites on state and private lands to undergo eradication treatment. Since 2001, approximately 7,320 acres have been treated to eradicate *P. ramorum* and slow its spread. Treatments include cutting and burning infected and potentially exposed host material (Fig. 27).



Figure 27. Piles of tanoak ready to burn as part of a local eradication treatment to slow the spread of SOD (Casara Nichols, ODF).

Recent developments for the SOD Program include the continued detection of EU1 infestations, a new citizen science program, an updated economic impact assessment, and resistance testing. Since 2015, ODF has been aggressively treating all known EU1 infestations with large buffers of 300 - 600 feet. Eradication treatments for EU1 infestations totaled 270 acres in 2017 and 203 acres for 2018. In 2019, ODF completed treatments on 117 acres with more scheduled treatments for 2020.

Starting in September 2018, ODF and Oregon State University Extension collaborated to develop a SOD citizen science pilot project and outreach education program. We launched our outreach with a well-attended community workshop in Pistol River followed by citizen science trainings in Gold Beach and a science talk by Dr. Everett Hansen (Fig. 28). The citizen scientist volunteers learned standard sampling protocol to set monitoring bait stations, collect, record and send samples to the OSU LeBoldus forest pathology lab for disease screening every two weeks for a three-month period. Citizen scientists deployed 20 bucket baits on 5 sites at the leading edge of the disease and baited 4 stream reaches in the first year of the project and found no new detections of *P. ramorum*. The second year of the project is currently underway. Workshop success was measured with pre- and post-workshop evaluations. Before the workshop 34% of participants indicated that they understood disease concepts “very much”, this increased to 72% after the workshop. First year citizen science project results indicate that citizen scientist volunteers are motivated to help with early detection strategies by following sampling protocols and spreading awareness in the community.



Figure 28. Citizen scientists learning about SOD symptoms in tanoak leaves and bark (Norma Kline, OSU).

FOREST DISEASES

SOD continued...

On behalf of the Oregon SOD Task Force, ODF contracted with Highland Economics and Mason, Bruce and Girard to complete an assessment of the economic impacts of SOD on Oregon's forests and associated industries. Until now the disease has not had a significant impact on the economy of Curry County, according to the assessment. It states there has been no decline in timber harvest, export and log prices, or recreation and tourism revenue. However, it appears certain private properties where tanoaks have died may have lost real estate value. The assessment concluded that current efforts are keeping the infestation's spread to between 0.5 - 4.5 mile(s) a year. According to the assessment, with continued treatment, SOD's spread north of the Rogue River could be delayed until about 2028. Without any treatment, the disease would most likely appear north of the Rogue just four years from now and enter Coos County by 2028. Other impacts from discontinuing treatment that could happen as early as 2028 include:

- Sanctions on southwest Oregon timber exports by China, Japan, and/or Korea
- Loss of 1,200 jobs related to timber export, translating to \$57.9 million in lost annual wages
- Reduction of timber harvest by 15%, with proportional loss of forest products harvest tax revenue, forest sector jobs and wages
- Collapse of rural residential property value; loss of real estate transaction revenues
- Decline in recreation and tourism income out of proportion to the extent of SOD infestation if an unfavorable public perception of the region takes hold
- The report also highlighted that the disappearance of tanoak from southwest Oregon forests impacts the local ecology and Native American culture in ways not reflected in purely economic terms.



*Figure 29. ODF staff collected tanoak acorns in 2016-2018 from tanoak trees both exposed to the disease, within the SOD GIA, and from areas free of disease, such as along the Rogue River. Several thousand seedlings produced from these acorns were out-planted on industrial land in the GIA where they will be exposed to *P. ramorum* and monitored for genetic resistance to the disease (Wyatt Williams, ODF).*

Sudden oak death information:

http://www.oregon.gov/oda/cid/plant_health/sod_index.shtml

<https://catalog.extension.oregonstate.edu/em9216>

http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/

<http://www.suddenoakdeath.org>

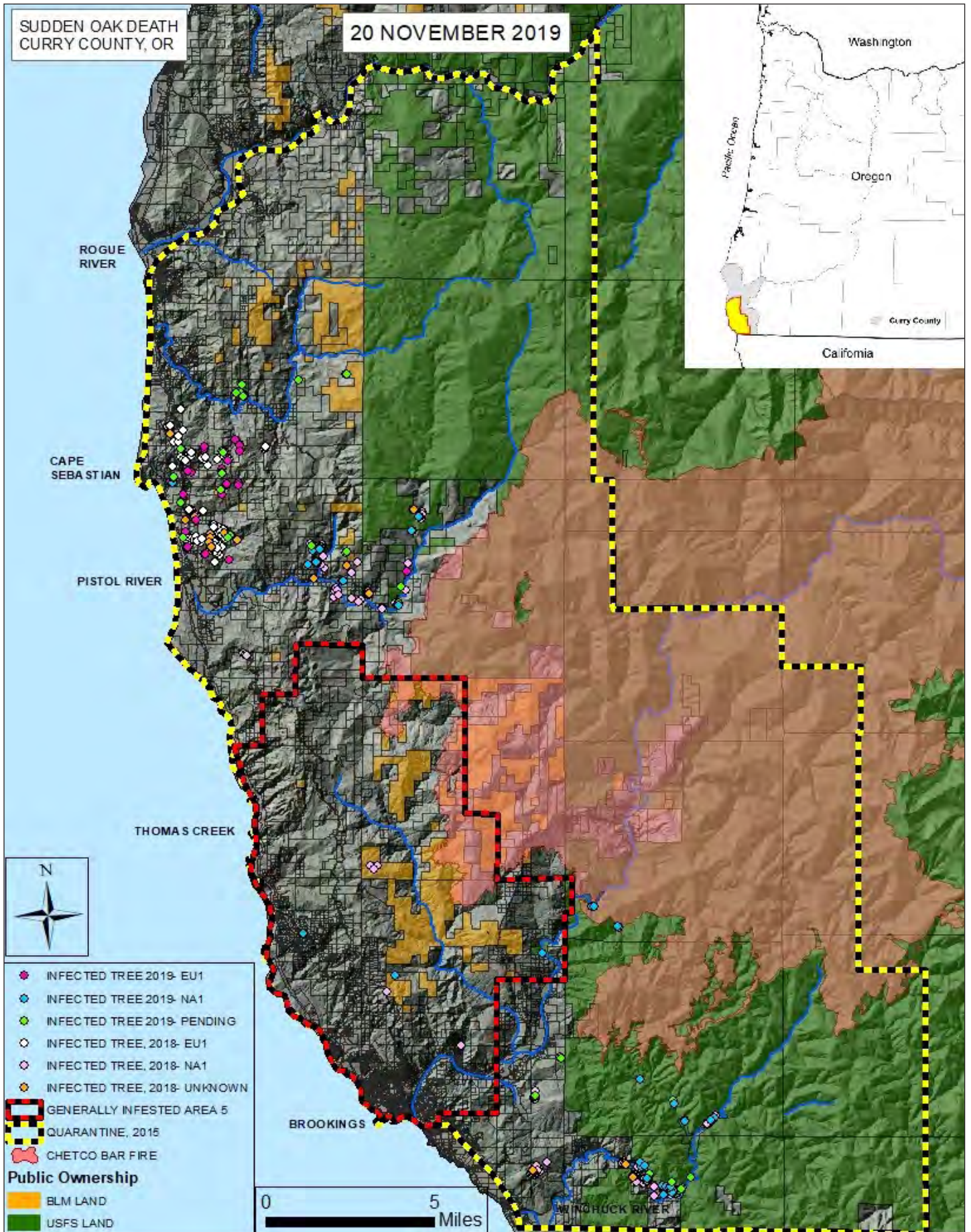


Figure 30. Map of SOD infection area (red) and quarantine area (yellow). EU1 and NA1 are two different lineages of *P. ramorum*. In Europe, the EU1 lineage kills or damages conifer tree species and is considered more aggressive than the NA1 lineage.

FOREST DISEASES

Swiss needle cast (SNC), a foliar disease affecting Douglas-fir in the Pacific Northwest, is caused by the native fungus *Nothophaeocryptopus gaeumannii*. The fungus is common where its only host, Douglas-fir, is grown. It has become particularly damaging to Douglas-fir forests on the western slopes of the Oregon Coast Range. The host – pathogen interaction is unique, because both the fungus and the host tree are native in the Pacific Northwest (PNW), where the disease originated.

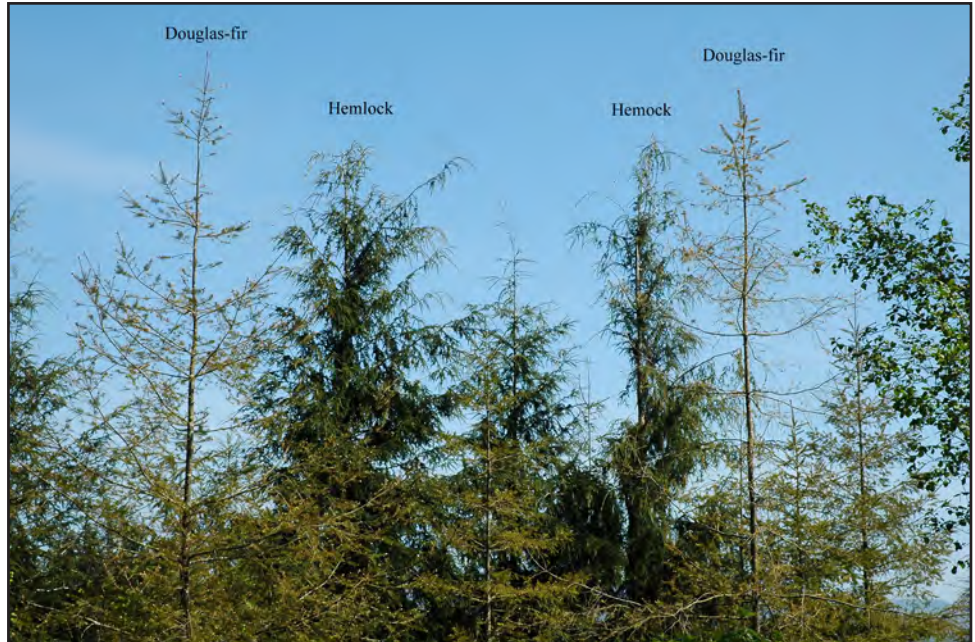


Figure 31. SNC causes foliage loss and sparse yellow crowns in Douglas-fir in Oregon's Coast Range. Low foliage retention can reduce tree volume growth by more than 50%. Western hemlock is unaffected (Alan Kanaskie, ODF).

Trees affected by SNC exhibit chlorotic foliage in the late spring and cast needles prematurely, resulting in sparse crowns. Disease severity and growth impacts are assessed using the number of years of retained foliage. While healthy trees generally have a minimum of 3 years of retained foliage, severely distressed trees can have very low foliage retention of below 2 years (Fig. 31). SNC rarely kills trees but reduces diameter and height growth. Growth declines occur following foliage loss. Previous analyses (1998-2008) have shown growth losses exceeding 50% when only 1 year of foliage remains on the tree. Growth loss due to SNC in 10-70 year old Douglas-fir in the Oregon Coast Range is estimated at more than 190 million board feet per year. SNC also alters wood properties, which can lower the value of certain lumber products, hinder the development of stand structure and wildlife habitat, and limit stand management options.

Over a 3-year period, starting in 2013, the SNC Cooperative (SNCC) at OSU established a 106-plot research network in 10-25 year old Douglas-fir stands (Fig. 32). The plots are distributed from the Oregon-California border to southwest Washington and 35 miles inland. The SNCC will collect data from these plots for at least 10 years. The first five-year period of plot re-measurement is currently taking place and has provided information about disease severity, growth loss and its geographic distribution on 66 plots throughout the Coast Range. Analysis of these new data showed that the maximum cubic volume growth losses during the 2013-2019 period was ~36%. The lower maximum growth losses (relative to the 1998-2008 period) are thought due to fewer under-performing stands in the dataset/population because merchantable stands have been salvaged and pre-merchantable stands have been removed in coastal zones.

Swiss needle cast information, GIS data and interactive map:

<http://tinyurl.com/odf-foresthealth>

<http://sncc.forestry.oregonstate.edu>

<https://www.arcgis.com/apps/MapJournal/index.html?appid=da5cda5003d24544b9231dbb8edf82fb>

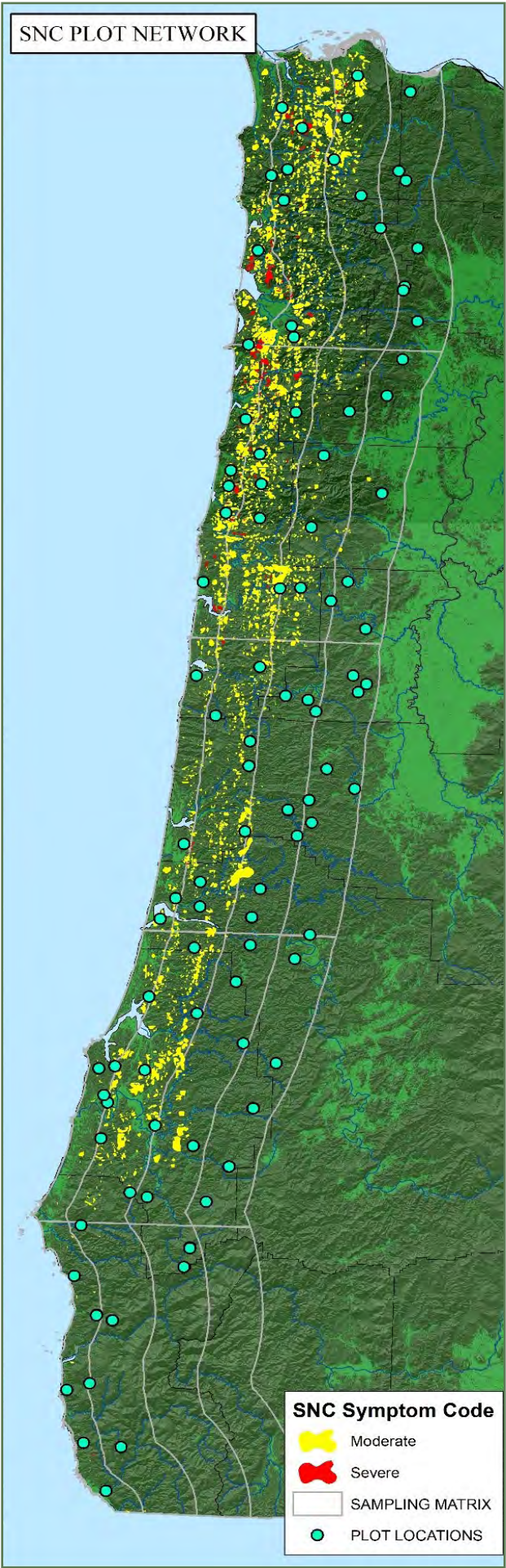


Figure 32. Map of SNC plot locations and SNC damage observed in Douglas-fir during the 2018 SNC aerial survey (left). The next aerial survey will take place in late spring of 2020.

During recent SNC aerial surveys, observers have noted that SNC infected Douglas-fir stands appear more dingy brown with thin crowns (above top) compared to previous years where symptomatic stands appeared more yellow in color (above bottom) (ODF).

EXOTIC INVASIVE PLANTS

Several hundred species of exotic plants have been accidentally or intentionally introduced over centuries to Oregon's forests from activities of European explorers, settlers and their American descendants. Today, new exotic plant species are still arriving and establishing in Oregon. While the effect of most of these introduced species is not well understood, several exotic plants have become serious economic and environmental pests in Oregon's forests. Himalayan blackberry, an escaped agricultural crop, and Scotch broom, an intentionally-introduced landscape plant, are the state's costliest noxious weeds. According to the Oregon Department of Agriculture (ODA), nearly \$80 million in control costs and lost revenue are attributed annually to these two plants, more than all of the other noxious weeds combined.

The ODA Noxious Weed Program enforces the state's noxious weed laws and administrative rules set by the State's Noxious Weed Board. There are over 130 species of exotic plants on the Oregon Noxious Weed List (see Oregon Administrative Rule 603-052-1200). Class A noxious weeds require mandatory reporting to the ODA and eradication. All plant parts of List B noxious weeds, including seeds, are prohibited for purchase or sale in Oregon. Many troublesome exotic plants that affect Oregon's forests and timber production are not on the state's regulated noxious weed list. These include foxglove (Fig. 33), woodland groundsel, wall-lettuce, oxeye daisy, English hawthorn, English holly, reed canary grass and several species of clover, vetch and perennial grasses, all of which compete with tree seedlings. For more information on noxious weed laws visit: <https://tinyurl.com/oregonweeds>



Figure 33. Foxglove (*Digitalis purpurea*, top) is an attractive flowering plant from Europe that quickly establishes in replant areas and crowds out tree seedlings (bottom). It is not listed on Oregon's noxious weed list and, thus, is not regulated (Wyatt Williams, ODF).

Gorse (List B noxious weed)

Gorse (*Ulex europaeus*) was introduced intentionally from the United Kingdom to Bandon, OR in the 1870s. Like Scotch broom, seeds of gorse survive decades in the soil and are easily transported via heavy equipment. Unlike Scotch broom, gorse has thick, sharp spines (Fig. 34) and is very prone to fire due to high natural oil content. The Bandon fire of 1936, which burned nearly every structure in the town, was fueled primarily by this noxious weed. As it is a prolific seed producer, once gorse establishes a new population, it is extremely hard to eradicate and can become a major forest pest (Fig. 35).



Figure 34. Close-up of gorse plant in flower (Wyatt Williams, ODF).

In March 2019, ODF Forest Health staff conducted a special aerial survey over 370,000 acres in Curry County for gorse. Mid-March is the ideal time for surveying because peak gorse bloom usually occurs at this time, and Scotch broom, which has similar yellow flowers, typically blooms much later in the season (April-May). In 2019 we mapped 141 acres of gorse across 10 polygons, which is lower than in previous surveys. There are two plausible reasons why the detection was low: (a) we were surveying along the “front edge” of the invasion for our partners (Curry County and the Gorse Action Group), and (b) poor signature of yellow flowers. Despite the fact that gorse was in its peak flowering stage, unusually warm winter weather in late December 2018 caused some populations to flower early. This warm weather event was followed by a snowstorm in February, which may have led to petals falling off the shrubs, providing less-than-ideal conditions for aerial survey.



Figure 35. Gorse invading a timber plantation near the Elkhorn River in Port Orford (Wyatt Williams, ODF).

ODF Forest Health staff participated in steering group meetings for the Gorse Action Group in 2019. The group’s objective is to control and reduce the spread of gorse in the south coast region of Oregon, to minimize its impacts on the economy and environment. More information can be found here: www.gorseactiongroup.org.

Orange hawkweed (List A noxious weed)

Orange hawkweed (*Hieracium aurantiacum*, Fig. 36) is a perennial plant in the sunflower family (Asteraceae) and proliferates in full sun, especially after a disturbance event, making it an opportunistic invader following timber harvest and road building activities. Orange hawkweed is a Class A noxious weed in Oregon. Because of its legal status as public menace, private and government landowners and land managers are required by law to report and manage this plant (ORS 569, OAR 603-052-1200).

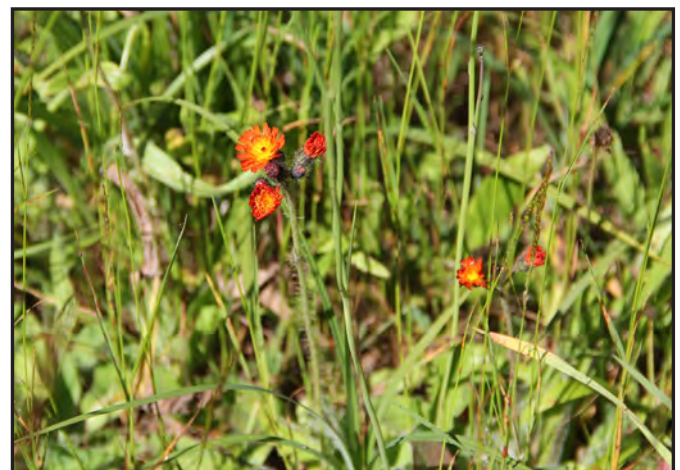








Figure 36. Orange hawkweed in bloom (Wyatt Williams, ODF).

In 2017, ODF staff documented orange hawkweed for the first time in Clatsop County in northwest Oregon. In 2018, staff from ODF Forest Health and the Clatsop State Forest conducted a delimitation survey for the noxious weed. During the spring months in 2018, the population was monitored on a regular basis until flowers began to appear in early July. The population appeared to be limited to less than 50 plants within two clumps, both less than 21 ft². All flowers were clipped from plants, bagged and disposed of before seed could be set. The plants were then spot-sprayed with herbicide. At the time of peak flowering (July 2018), a survey of dozens of miles of forest roads in the area yielded no additional populations of orange hawkweed. In July 2019, the orange hawkweed treatment site was again surveyed and the road survey was also repeated. No orange hawkweed was detected at the site nor in the vicinity, and was declared eradicated from the area.

IMPORTANT INSECT AND DISEASE PESTS





	DOUGLAS-FIR	TRUE FIR	PINE
INSECTS	 <ul style="list-style-type: none"> • Douglas-fir beetle • Douglas-fir tussock moth • Western spruce budworm • Flatheaded fir borer • Cooley spruce gall adelgid* • Douglas-fir pole & engraver beetles* 	 <ul style="list-style-type: none"> • Douglas-fir tussock moth • Western spruce budworm • Fir engraver • Balsam woolly adelgid 	 <ul style="list-style-type: none"> • Ips beetles (pine engraver & California five-spined) • Mountain pine beetle • Western pine beetle (ponderosa only) • Pine butterfly • Black pineleaf scale • Sequoia pitch moth*
DISEASES	<ul style="list-style-type: none"> • Laminated root rot • Blackstain root disease • Armillaria root disease • Swiss needle cast • Rhabdocline needle cast • Douglas-fir dwarf mistletoe • Heart and stem decays 	<ul style="list-style-type: none"> • Annosus root disease • Interior needle blight • Fir needle rust • Fir broom rust • Heart and stem decays 	<ul style="list-style-type: none"> • White pine blister rust (5-needle pines) • Diplodia tip blight • Dothistroma needle blight • Western gall rust • Blackstain root disease • Armillaria root disease • Pine dwarf mistletoe





	TANOAK	WHITE OAK	MAPLE
INSECTS	<ul style="list-style-type: none"> • Gypsy moth 	<ul style="list-style-type: none"> • Gypsy moth • Oak looper* • Gall-making wasps & flies* • Leaf miners* 	<ul style="list-style-type: none"> • Gypsy moth • Various defoliators* 
DISEASES	<ul style="list-style-type: none"> • Sudden oak death (<i>Phytophthora ramorum</i>) • Armillaria root disease 	<ul style="list-style-type: none"> • Armillaria root disease • Inonotus trunk rot 	<ul style="list-style-type: none"> • Tar spot • Ganoderma trunk rot • Armillaria root disease

*Secondary or aesthetic pests that are not typically tree-killers

BOLD: non-native, exotic insects and diseases

IN NATIVE OREGON TREES

HEMLOCK	SPRUCE	'CEDARS'	LARCH
 <ul style="list-style-type: none"> • Western hemlock looper 	 <ul style="list-style-type: none"> • Spruce beetle • Spruce aphid • Cooley spruce gall adelgid* 	 <ul style="list-style-type: none"> • Cedar bark beetles* • Amethyst borer* • Western cedar borer* 	 <ul style="list-style-type: none"> • Larch casebearer
<ul style="list-style-type: none"> • Annosus root disease • Hemlock dwarf mistletoe • Hemlock needle rust • Heart and stem decays 	<ul style="list-style-type: none"> • Spruce broom rust • Heart and stem decays 	<ul style="list-style-type: none"> • Port-Orford-cedar root disease (POC only) • Cedar leaf blight (western redcedar only) 	<ul style="list-style-type: none"> • Larch needle cast • Larch needle blight • Larch dwarf mistletoe

ALDER	ASH	POPLAR	MADRONE
<ul style="list-style-type: none"> • Gypsy moth • Western tent caterpillar* • Alder flea beetle* 	<ul style="list-style-type: none"> • Emerald ash borer • Gypsy moth 	<ul style="list-style-type: none"> • Gypsy moth • Satin moth* • Webworm* 	<ul style="list-style-type: none"> • Gypsy moth 
<ul style="list-style-type: none"> • Armillaria root disease • Nectria canker • Alder collar rot • Heart and stem decays 		<ul style="list-style-type: none"> • Heart and stem decays 	<ul style="list-style-type: none"> • Madrone leaf blight • Madrone branch dieback • Madrone stem cankers

Don't know your tree? ID here:

Oregon tree ID: http://oregonstate.edu/trees/name_common.html

FOREST HEALTH CONTACTS

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2600 State Street, Salem, OR 97310

<http://tinyurl.com/odf-foresthealth>

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Robert Schroeter	Aerial Observer	541-858-6123	robert.schroeter@usda.gov

USDA Forest Service – Central Oregon Service Center

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Mike Simpson	Ecologist	541-383-5575	michael.simpson@usda.gov

USDA Forest Service – Blue Mountains Service Center

3502 Highway 30, La Grande, OR 97850

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Mike Johnson	Entomologist	541-962-8538	jay.m.johnson@usda.gov
Michael McWilliams	Pathologist	541-962-8510	michael.mcwilliams@usda.gov



Why is my Tree Dying?

Western redcedar (*Thuja plicata*)

April 2019

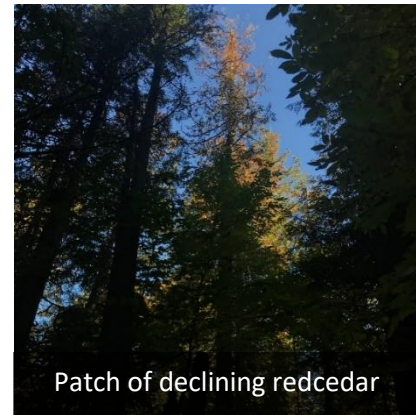


Common cause(s): not determined, but possibly a combination of factors including changing climate

Symptoms: top dieback, flagging, crown thinning, yellowing, whole-tree mortality

Summary

Top-dieback, branch mortality, crown thinning and whole-tree mortality in all ages of western redcedar has been observed recently at lower elevations in the Willamette Valley and beyond. Although it is common to see 'spiked' or dead tops in older western redcedar, usually there are living lateral branches and a functional crown. No single factor has been identified in these more recent die offs, but a combination of poor or unsustainable growing conditions may be to blame. Redcedar may simply be growing in areas or within microclimates outside of their preferred range or areas that are no longer sustainable for long-term growth under current climate conditions.



Patch of declining redcedar

Climate change and drought events increase the intensity and duration of high temperatures as well as the amount, frequency and/or consistency of precipitation. Trees have adjustable pores (stomata) in their leaves, which open for gas exchange during photosynthesis. Opening these pores causes water vapor loss. The rate of loss depends on vapor pressure deficit which is the difference between moisture levels in the air currently and when the air is saturated. When it's hot and dry this deficit increases and causes tension in the water columns, in vascular tissues, that extend from the leaves to the roots (like the tension you get from sucking on a straw). Low moisture availability further increases this tension. The water columns may eventually break (air gets introduced into the straws) after repeated or severe droughts and this reduces the ability for a tree to transport water to its leaves.

Common pests

Several secondary insects and diseases are known to infest dead or dying western redcedar, although none are typically implicated as primary causes of tree mortality. These common secondary insects include cedar bark beetles (*Phloeosinus* spp.), western cedar borers (*Trachykele blondeli*), Amethyst cedar borers (*Semanotus amethystinus*), as well as flathead cedar borers (*Chrysobothris nixa*) which are more often pests of ornamental arborvitae. Rarely do these insect infestations result in tree mortality. Diseases of redcedar are often opportunistic root and butt rot pathogens that degrade wood once the tree has died. Common diseases include pencil rot (*Postia sericeomollis*), red ring rot (*Phellinus pini*), yellow ring rot (*Coniferporia weirii*), armillaria root disease (*Armillaria* spp.) and cedar leaf blight (*Didymascella thujina*). Note, damage from squirrels, porcupines and bears can also cause flagging and topkill due to bark stripping activity.



Woodborer gallery



Why is my Tree Dying?

Western redcedar (*Thuja plicata*)

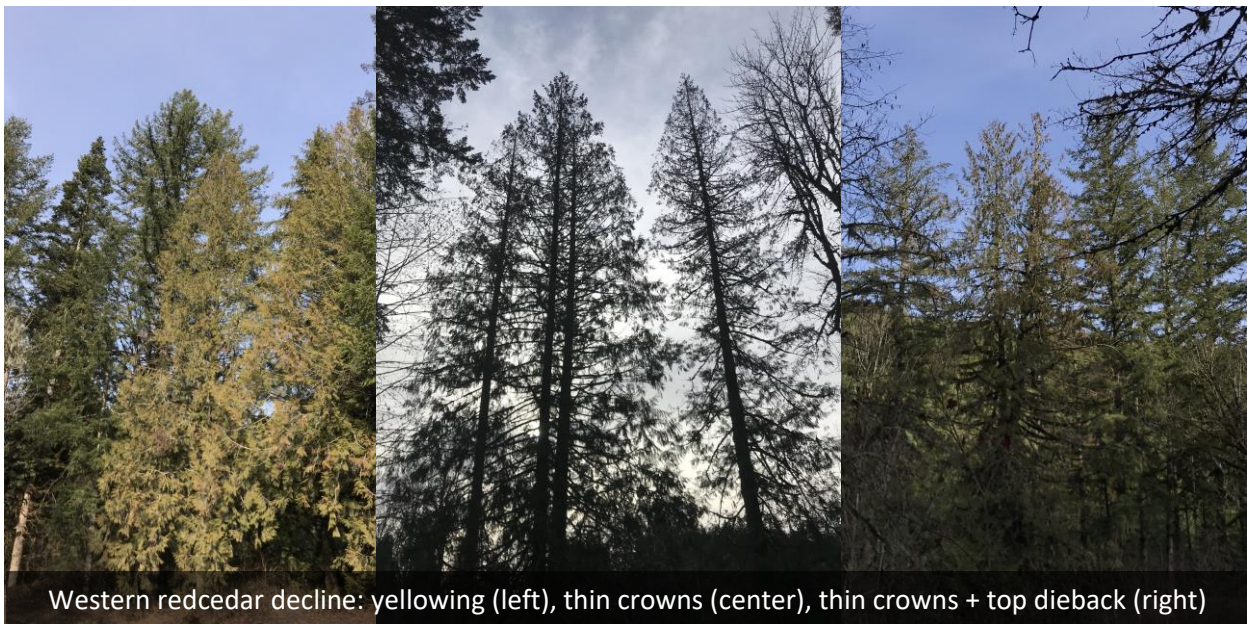
April 2019

Why am I seeing this now?

Changing climate may be repeatedly stressing trees and/or altering the suitability of some habitats to support western redcedar. Most of Oregon has been in a drought since 2012, and climate predications indicate a continuation in trends toward higher temperatures and inconsistent precipitation.

Where should I grow western redcedar?

Western redcedar is very shade tolerant. Trees can thrive in sunny locations with sufficient moisture, but they are more at risk during hotter droughts. This species requires moist conditions and thrives in coastal fog belts and moist inland areas up to about 4000 feet elevation. It tolerates most types of soils and outcompetes many other species in wet soils. Western redcedar is shallow rooted and may not do well in soil crowded by roots of other plants (including trees) that are competing for water. Alternate species for redcedar include incense cedar, sequoia, bigleaf maple in generally dry sites and western white pine, maple, alder, ash or cottonwood at wetter sites that do not dry out in the summer.



Western redcedar decline: yellowing (left), thin crowns (center), thin crowns + top dieback (right)



Woodland Fish & Wildlife

Forest Bee Pollinators

Author: **Christine Buhl**, Ph.D., Oregon Department of Forestry (ODF) Entomologist

Introduction

Often, our first thought of pollinators usually takes us to honey bees in agriculture. Honey bees play such a large role in agriculture that sometimes the many wild bees that occur in other habitats such as forests are overlooked. There are over 4,000 known species of wild bees in North America (O'Toole 1991), many of which occur in temperate forest ecosystems. While this publication focuses on bees, there are also many other important insect and non-insect animals that serve as pollinators.



Bumble bee (Bombus sp.) visiting waterleaf (Hydrophyllum sp.) in Oregon west side forest. C. Buhl, ODF



Sweat bee (Augochlorella sp.) visiting native hawkweed (Heracium sp.) along a forest road. C. Buhl, ODF

Bees In Forests

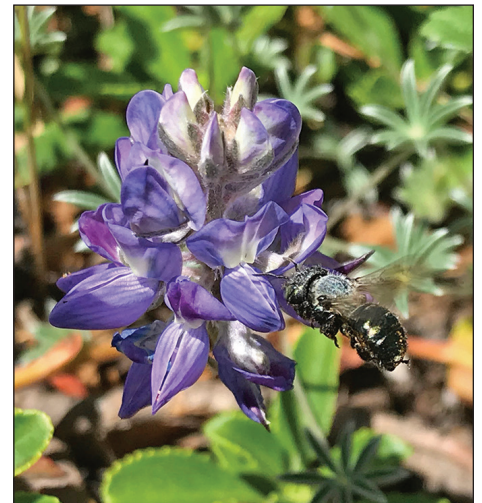
In the Pacific Northwest (PNW) alone, over 500 species of bees have been identified with an estimated 300 more awaiting formal description (Stephen et al. 1969). Despite having so many bees, we know surprisingly little about which bees occur where and in what abundance. Even less is known about the bees that utilize forest habitats (Rivers et al. 2018a). Relationships between wild bees and forest ecosystems are better studied in the tropics; but in temperate forests, where most trees are wind-pollinated, bees have been largely ignored. New research in PNW forests indicates high bee abundance and diversity, even in intensively managed forests (Rivers et al. 2018b) or forests damaged by wildfire (Galbraith et al. 2019). Forests are a great place to find certain species of



Bumble bee (Bombus sp.) visiting inside-out flower (Vancouveria sp.) in Oregon west side forest. C. Buhl, ODF

native bees. These forested ecosystems offer forage and a place to make nests or hibernate. A variety of understory forbs and woody shrubs as well as some broadleaf trees provide nectar and pollen. Exposed soil and woody debris provide space for nesting, and cavities such as old rodent nests provide refuge during periods of hibernation. The types of bees found in forests vary depending on the microclimate (temperature, light, moisture, etc.), as well as the availability of preferred forage and nesting materials. As such, bee communities will vary for different levels of forest management – meaning that bee communities found in clearcuts will differ from those found in closed-canopy young forests or late successional forests.

Major disturbances such as logging and wildfire mimic early successional



Mason bee (Osmia sp.) visiting lupine (Lupinus sp.) in recently logged Oregon east side forest. C. Buhl, ODF



Bee forage (*Pedicularis* sp.) in the forest. C. Buhl, ODF



Mining bee (*Andrenidae*) emerging from ground nest C. Buhl, ODF

forest dynamics. Disturbance increases abundance and diversity of many bee species (Galbraith et al. 2019, Hanula et al. 2015) by: 1) exposing bare soil for ground-nesting bees and germination of forage plants, 2) increasing both light availability for forage plants and thermal environments for bee nests, and 3) leaving behind pithy (soft and easily excavated) stems and woody debris for nesting. It may be surprising to know that the majority of wild bees nest in the ground or in cavities of various materials. Exposed loose or hard-packed loam, sand, or rocky soil is utilized by a variety of bee species for nesting. Wood-nesting bees bore into wood or utilize existing cavities made by woodpeckers, wood-boring beetles, or natural decay. Other bees rely on the pithy stems of various herbaceous or woody plants for their nests. Although shallow ground nests and nests in aboveground materials may be consumed by fire, fires often move over the landscape quickly and may not have enough time to penetrate the soil of deeper nests (Cane 1991, Cane and Neff 2011). Following severe fires, bees from adjacent areas often quickly recolonize fire-damaged areas to take advantage of newly available nesting and foraging habitat.



Ground nest. Sarina Jepsen, Xerces



Stem nest. Justin Wheeler, Xerces

Bee Life History

Bee life history is highly variable among bees as a collective group. Some bees such as bumble bees are highly eusocial, while others such as mason bees tend to be more solitary. However, this is a generalization and it should be noted that variations in social behavior occur even among species within the same genera. Eusocial bees include honey bees and bumble bees and some species of sweat and carpenter bees. Much of what we know about bees is from honey bees. Honey bees are a special case because they are ‘managed bees’, meaning that we augment their life history by maintaining them in unnaturally large numbers within man-made hives and provide some amount of care to gain their service as crop pollinators and honey producers. In the wild, honey bees nest in much smaller numbers and in cavities such as tree abscesses. The life history of honey bees is widely known, but in North America these bees represent just one species - *Apis mellifera*; despite there being 20,000 known species of bees worldwide!

All bees develop from eggs into larvae, pupae, and then adults. But from here, life history varies widely often due to sociality. Only 10% of bee species are eusocial (UC Berkley Bee Lab). Eusocial bees live and work together to raise a colony of individuals that are divided among castes. A colony consists of a queen bee, female worker bees, and male drone bees. The queen produces unfertilized eggs, which become drones, and fertilized eggs, which develop into workers and additional queens that eventually leave to form their own colonies. Workers forage for nectar and pollen, care for the brood, and maintain and defend the colony. Drones mate with the queen and then die. Without a queen a colony would swiftly collapse. In managed honey bee populations, a single queen may live for several years, but queens of wild populations of eusocial species live for a year or less. Non-queen

castes live for weeks to months. In wild populations of eusocial bees, the colony dies at the end of the season and only mated queens live to overwinter. These queens then emerge in spring to nest and start a new colony. Eusocial bees are often multivoltine meaning that they can produce multiple generations within the span of a year.

An estimated 70% of bee species are solitary and nest in the ground and another 5% of solitary bees nest in stems (UC Berkley Bee Lab). It is common for many solitary bees to occupy one location, giving the appearance of communal living. However, these solitary bees are not working together but simply aggregating, in separate nests, in a highly desirable area. Solitary bees have no colony or complex caste system. They lay individual eggs, and young develop and overwinter in their individual cells. Most solitary bees are univoltine, meaning that there is only one generation a year. They emerge as adults in the spring to mate and lay eggs that become the next generation of brood. Solitary bee eggs typically develop in less than 1 week, the hatched bees then spend 2-3 weeks as larvae. Some species over-

winter in a late larval resting phase before pupating in the spring. Most solitary bee adults are active for 4-6 weeks during the blooming season. Production of brood in solitary bees typically takes place over the course of weeks versus a span of months for eusocial bees, during which fewer environmental fluctuations may occur that can impact solitary bee population numbers.

Pollination

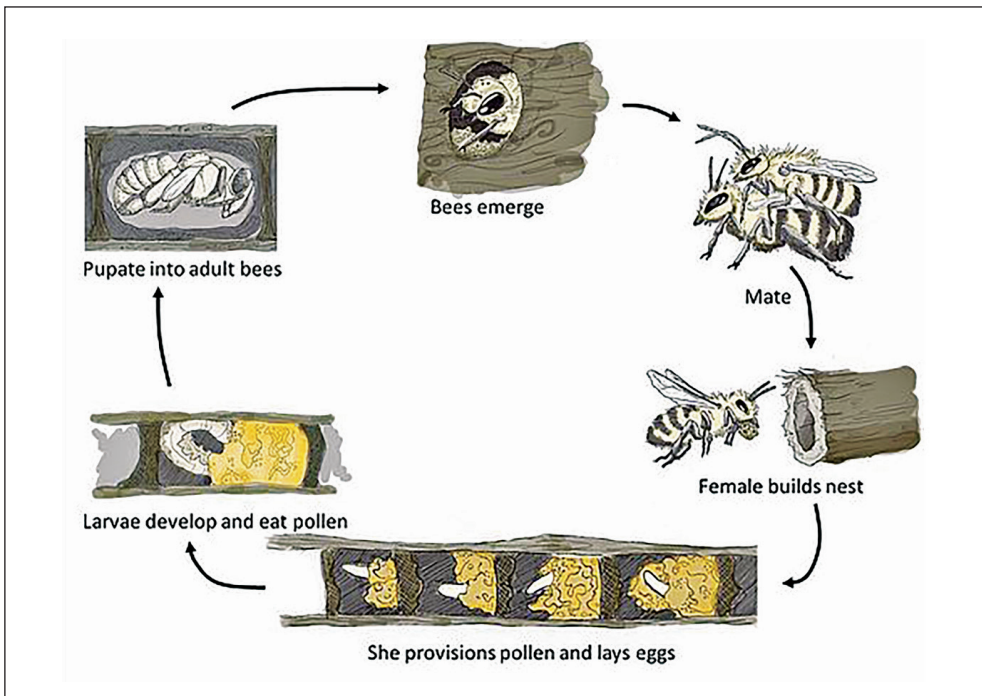
Bees are prized for the essential ecosystem service they provide as pollinators. Some plants can self-fertilize, while others are pollinated by wind, or water. However, many plants require the aid of animals to transfer pollen. Across the globe many types of animals are capable of pollination; among these are bats and other mammals, birds, lizards, and various insects such as moths, butterflies, flies, beetles and of course bees. Pollination is also provided passively by many other animals, often when pollen sticks to their bodies as they move past plants in their search for food or shelter. Of all the flowering plants worldwide, an estimated 90% are pollinated by animals (Ollerton et al. 2011). The largest



Bee forage (Dodecatheon sp.) in the forest C. Buhl, ODF

proportion of these pollination services is provided by bees. An estimated 75% of our crop plants (including feed for livestock) rely on bees for pollination (Klein et al. 2007). Pollination allows plants to reproduce, maintains genetic variability, produces products for human consumption and commerce, and contributes to environmental aesthetics.

In North America and elsewhere honey bees are known to be a pollination powerhouse although contributions by other bee species is becoming better realized (Ollerton et al. 2012). Although there are fossil records of honey bees species in North America that have long since become extinct, in the modern era, honey bees were not present in North America. Honey bees were brought from Europe by settlers to serve as generalist pollinators of many crops such as apples, melons, berries, nuts, and even cruciferous vegetables such as broccoli and cabbage. Honey bees were not brought to the west coast until the 1860s (Kellar 2014), up until which time native, wild bees provided most of the pollination services. Wild bees often outnumber honey bees, and during a period of honey bee decline (2006-2011) due to colony collapse disorder, almond



Solitary bee life cycle. Sarah Scott, USGS

Bee Declines

In 2006 reports of large honey bee colony losses, mainly in the form of missing workers, suddenly spiked in North America and was termed 'colony collapse disorder'. This prompted additional concern regarding the decline of our native, wild bees. There is no single factor to explain these losses, but the event did start a larger conversation around a complex of factors that cause sustained honey bee colony losses. These include reduction of foraging and nesting habitat, diseases and parasites, insecticide poisoning, etc. Bee population declines highlighted a need for a better understanding of pollinator health and their habitat needs, prompting a concerted effort for bee conservation beyond applications in agriculture. Since then, nationwide research efforts on bee health and habitat have expanded beyond just the honey bee/agriculture system to include bee communities in ecosystems such as forests. Research to formulate guidance for forest landowners to enhance bee habitat is still in development. In the meantime, some basic principles can be employed.

production actually increased (Olerton et al. 2012). Only honey bees are commonly managed for crop pollination, although some bumble bees and a few solitary bees are also successfully managed on a smaller scale. In eastern Oregon, farmers have successfully used native as well as established, non-native alkali bees to pollinate adjacent alfalfa crops. This solitary bee nests in the soil, so clearing ground space for these nests adjacent to alfalfa fields is all that is needed to keep these pollinators around.

Pollination is a beneficial side effect of bees visiting plants to feed on and collect

nectar and pollen for their young. Bee species vary widely in the type, location, and quantity of pollen-collecting hairs and pollen-basket structures on their bodies (present under abdomens and on legs). Nectar quantity and nutrient quality can vary depending on a variety of factors such as time of day, season, plant moisture level, plant species or even cultivar. Bees are generally most attracted to flowers that are white, yellow, blue, purple and in the ultraviolet spectrum, although flower shape is more often the driving attractant. Accessibility to nectar, and therefore, flower preference, is dictated by the shape of

the flower. Bees have variable tongue lengths that differ by species. Bees with longer tongues can access nectar from deeper, tube-like flowers versus those with shorter tongues that visit shallow or disk-like flowers (Roof et al. 2018). Some sneaky bees will cut holes at the base of a flower tube to steal nectar, this is called 'nectar robbing' because contact with pollen-containing structures at the opening of the flower is avoided. Some flowers are anatomically difficult to enter or have spring-like mechanisms that can prevent entry for some pollinators. For example, many plants in the pea family can be pollinated by bumble bees because these bees are generally large in size and can manipulate opening these flowers, whereas smaller bees cannot. Some bees employ 'buzz pollination', a type of sonication with forces up to 30 Gs that loosens hard-to-reach pollen grains from the sticky filaments that they are attached to (Harder and Barclay 1994). Conifers, which dominate most of our PNW forests, rely on wind for pollination and produce protein-poor pollen that is unattractive to bees. Despite this, wind-pollinated conifer and hardwood species are visited by some bee species for resin, which they use to line the cells housing their individual eggs. However, early flowering trees such as maple and willow, often provide nectar for some early-emerging bee species. Beyond



Bee tongue lengths. Encyclopedia of Life

Common bee groups in Oregon, some of which are known to occur in and along forests
 (note that some pollinating flies such Syrphidae hover flies superficially resemble bees):

Genus	Common name	Tongue	Nest Preference				Flight period
			Ground	Stem	Wood	Other crevice	
<i>Agapostemon</i>	Metallic green bee	short	X				April-Sept
<i>Andrena</i>	Mining, digging bee	short	X			X	March-Aug
<i>Augochlorella</i>	Striped metallic sweat bee	short	X			X	March-Sept
<i>Colletes</i>	Plasterer, Polyester	short	X				April-Sept
<i>Halictus</i>	Sweat	short	X				April-Sept
<i>Hylaeus</i>	Yellow-faced, Plasterer, Polyester	short		X	X	X	April-Sept
<i>Lasioglossum</i>	Sweat	short	X				March-Sept
<i>Nomia</i>	Alkali bee	short	X				May-Sept
<i>Perdita</i>		short	X				March-Oct
<i>Anthidium</i>	Wool carder	long	X	X	X		March-Aug
<i>Anthophora</i>		long	X				March-Sept
<i>Apis mellifera</i>	Honey bee	long				X	March-Sept
<i>Bombus</i>	Bumble bee	long	X			X	March-Sept
<i>Ceratina</i>	Small carpenter	long		X	X		March-Sept
<i>Eucera</i>	Longhorned	long	X			X	March-Aug
<i>Habropoda</i>	Dune digger	long	X				March-July
<i>Heriades</i>		long			X		June-Aug
<i>Hoplitis</i>	Leafcutter, mason, resin	long	X	X	X		April-Aug
<i>Megachile</i>	Leafcutter	long	X	X	X		April-Oct
<i>Melissodes</i>	Longhorned	long	X				June-Oct
<i>Osmia</i>	Mason	long	X	X	X	X	March-Aug
<i>Xylocopa</i>	Carpenter	long			X		April-Sept
<i>Dufourea</i>		some long	X			X	April-Sept

Mining/Digging bee



Mining/digging bee (*Andrena*) Oregon Department of Agriculture (ODA)

Sweat bee



Sweat bee (*Halictus*) ODA

Longhorned bee



Longhorned bee (*Eucera*) ODA

Bumble bee



Bumble bee (*Bombus*) ODA

Honey bee



Honey bee (*Apis mellifera*) ODA

Small carpenter bee



Small carpenter bee (*Ceratina*) ODA

Endangered And Invasive Bees

Currently the most threatened native bee species in the west include the western bumble bee (*Bombus occidentalis occidentalis*) and Franklin's bumble bee (*Bombus franklini*). The range of the western bumble bee historically spanned throughout all of the west coast states. Currently, the abundance of this species has declined by 84% and is isolated to the Sierra Nevada region. Franklin's bumble bee was present historically in the Siskiyou in Oregon and northern California but this species has not been found since 2006 and may very well be extinct. Another bee at risk is a species of leafcutter bee (*Ashmeadiella sculleni*). Additionally, there may be many other species not currently being monitored that may be at risk.

There are a variety of non-native bees that may become invasive as aggressors or competitors with native bees. Aggressors, such as the male European wool carder bee (*Anthidium manicatum*), physically attack other bees to guard forage space. Competitors, such as some mason bee species (*Osmia cornifrons* or *O. taurus*), are often sold to nesting box enthusiasts although we have comparable natives such as the blue orchard/orchard mason bee (*O. lignaria*).

European wool carder



forests, street trees such as linden and various maples, fruit-bearing and ornamental trees such as cherry, crabapple, and apple, and larger specimen trees such as catalpa and tulip trees are reliant upon and heavily visited by pollinating bees.

Guidance

Foraging and nesting areas may not overlap everywhere on the landscape but providing a mosaic of habitat types connected by corridors, or sections of the landscape where bees can move easily between foraging and nesting habitats, can allow for higher bee species abundance and diversity at a site. Larger bees are able to travel longer distances to utilize multiple habitats, but for others, forest edges may be a richer source of bee abundance and diversity. Bumble bees have been known to travel up to 20 miles, although their typical foraging distance is less than 1 mile (Goulson 2010). Some smaller species of bees may travel less than 170 feet to forage. For these species, when searching for suitable habitat, even small separations between sources of forage become impassable 'deserts'. Bee species abundance, diversity

and richness have been shown to widely fluctuate at sites. This is to be expected since features such as forage type, nesting site and material availability at a site change over time, and bee populations are not stationary and will travel to get their needs met. With the wide diversity of bee species and life histories present, dynamic assemblages of bees can be accommodated as long as we can provide a variety of habitat conditions.

Create or enhance pollinator habitat in and along forests:

- Allow flowering plants (for forage) to grow or soil to remain bare (for nests), especially along sunlit roads and forest edges. Areas that might be inadequate for other objectives or lay fallow may serve as great bee habitat (Hanula et al. 2016). For example, old roads, skid trails and landings whose compacted soil is less suitable for tree establishment may serve as bee nesting habitat or allow root establishment for small forage plants. Pollinators in the immediate area benefit from any additional forage or nesting space although measure-

able increases in landscape-level bee populations occur with the addition of a quarter acre or more of pollinator habitat.

- Planting a variety of flower types will provide more forage for a variety of bees but it is best to focus on several species of plants that will do well at your site and provide the most continuous flowering window during the year. Plant species native to the area to provide the most suitable forage for local species. Observe what plant species are already doing well (and being visited by bees) at your site.
- Plant similar species or flower shapes in large patches or strips rather than in dispersed distributions. This creates a stronger signal that attracts pollinators and reduces the requirement to travel as much between flower patches to visit their preferred flower types. Bees often fixate on one type of flower to repeatedly visit during a flight. Avoid fragmentation by connecting flower patches with travel corridors that contain "like" forage to provide a trail system.

- Do not fully sanitize a stand. Leaving some pithy stems (cut stems so that pith is exposed), coarse woody debris, snags and stumps with cavities can provide valuable nesting sites. However, be aware of the potential risks of leaving an abundance of these materials onsite and contributing to wildfire fuels and forest health issues (e.g., Ips bark beetle outbreaks can develop in fresh, small-diameter pine slash and spread to standing pines).
- Leave or create patches of bare soil or sand for ground-nesting bees to colonize. Bees will not readily dig past duff layers to access soil, although they will still access exposed soil between barriers such as rocks. Various bee species will utilize all types of ground nesting habitat, from flat or piled patches of loamy soil to sandy embankments to rock walls. Nesting boxes may also be installed to serve specific species (more specifics on these structures at <https://www.xerces.org/publications/fact-sheets/nests-for-native-bees>).
- Provide access to water that is free from insecticide drift or leaching for a safe source of water for drinking and fortifying mud tunnels or cells. In areas where there are unsafe water sources, draw bees away by setting aside containers filled with water and materials (stones, marbles, etc.) for bees to land on while drinking.



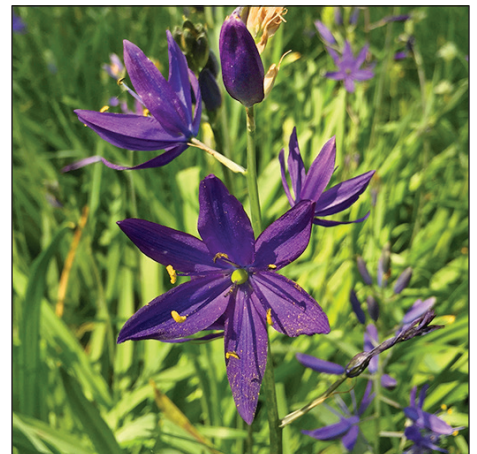
Lupine (*Lupinus sp.*) C. Buhl, ODF



Manzanita (*Arctostaphylos sp.*) C. Buhl, ODF



Oregon grape (*Berberis sp.*)
Mary C. Legg, Bugwood.org



Camas (*Camassia sp.*) C. Buhl, ODF



Trillium (*Trillium sp.*) C. Buhl, ODF



Currant (*Ribes sp.*) C. Buhl, ODF



Willow (*Salix sp.*) C. Buhl, ODF

- Avoid grazing or mowing when plants are actively blooming.
- Remove invasive or overly aggressive plants that reduce forage plant diversity. Although many of our native bees often visit exotic plants such as Scotch broom and Himalayan blackberry, exotic invasive species and aggressive native species reduce native plant diversity thereby reducing forage for specialist pollinator species that have co-evolved with a particular native plant.

Suggested pollinator plants for forest and forest-adjacent systems, recommended forage plant species vary by ecoregions within the PNW, Xerces society (www.xerces.org) and Natural Resource Conservation Service (www.nrcs.usda.org) maintain region-specific plant species lists (see table on page 9).

Avoid pesticide poisoning

Guidance below applies to insecticides, but be aware that other pesticides (herbicides, fungicides, etc.) may also contain harmful inert ingredients or have otherwise harmful non-target impacts on bees.

- Carefully read and follow insecticide labels for warnings on toxicity to bees and other pollinators. Oregon State University’s “How to Reduce Bee Poisoning from Pesticides” app (also a printable PDF) makes it easy to search the bee toxicity warnings for active ingredients found in various pesticides.
- Utilize selective rather than broad-spectrum insecticides with lower residual times to reduce effects on non-target organisms.
- Avoid insecticide drift and leaching that may reach bees in nectar, pollen, water, soil, etc. by:
 - o Applying insecticides during days with minimal wind and no temperature inversions.

- o Shutting off sprayers when turning equipment or when passing potential forage plants (including ‘weeds’ that are not the target of sprays but may be visited by bees), patches of bare soil, and water sources.
- o Providing alternatives to ephemeral water sources such as water pooling in equipment tracks or along ditches.

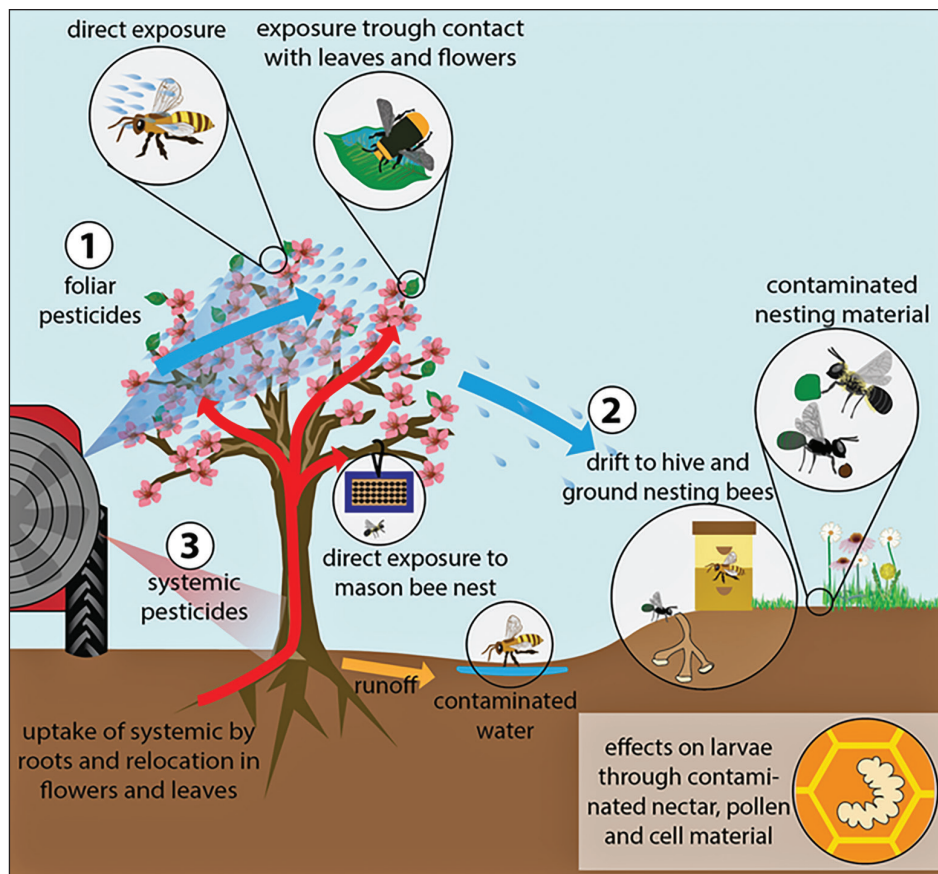
- Apply insecticides after blooming period ends. Applying insecticides directly or indirectly (via drift) on flowering trees such as linden, maple or flowering shrubs and forbs can expose bees to toxins that can be deadly. Systemic insecticides to treat pests on foliage or other plant parts may

also travel to nectar and pollen being collected by bees.

- Avoid applying insecticides during the time of day or season when flowers are blooming and bees are most active. Generally, bees are most active during warm (>60°F) daytime hours in spring and summer, although some species are also active just outside of these windows.
- Report any suspected bee poisoning to the National Pesticide Information Center (PARC) 503-986-6470 or via calling information at 211.

Where Do We Go From Here?

This document is meant to improve understanding of bees on our landscape and promote the idea of incorporating polli-



Routes of pollinator pesticide exposure. Iris Kormann, Oregon Bee Project



Forest reprod site seeded with pollinator forbs and leaving exposed soil and materials for nesting. C. Buhl, ODF



Burned slash pile where plant seeding and bee nesting can occur. C. Buhl, ODF

nator-friendly practices into our forest management objectives when possible. As research becomes available, we can fine-tune guidance to assist landowners in applying the most effective strategies. For example, there are many pollinator plant species lists available, but few of these are based on studies of proven, region-specific, plant species that will thrive and attract native pollinators (Garbuzov and Ratnieks 2014). Information is also lacking on patch size requirements for forage and ground nests to attract pollinators. In this early stage, landowners are encouraged to be proactive

about implementing pollinator-friendly practices and trying out new strategies to find the best fit.

One of the largest knowledge gaps is baseline data of wild pollinator communities. In other words, what bee species occur where and in what abundance? For example, very little is known about habitat requirements for wood-nesting bee communities and how prolific they are in different types of forest stands. A major caveat to collecting baseline data is that bee populations are highly dynamic. This means species composition and abun-

dance can be highly variable at a specific location from year to year without a single identifiable driver, such as phenological timing. Concerted citizen science efforts (Oregon Bee Atlas, Xerces Society surveys, etc.) are underway to address each of these research needs and are gaining momentum as the conversation on pollinator health spreads.



Bumble bee hand-netted in a managed forest. C. Buhl, ODF

One of the largest knowledge gaps is baseline data of wild pollinator communities.



Blue vane trap used for collecting bees. C. Buhl, ODF

Region-specific plant species list

Common name	Latin name	Flower depth	Bloom period
Buckthorn/Cascara	<i>Rhamnus purshiana</i>	short	April-May
Buttercup	<i>Ranunculus occidentalis, orthorhyncus, uncinatus</i>	short	March-July
Camas	<i>Camassia leichtlinii, quamash</i>	long	April-May
Ceanothus/Buck/Deer/Snow brush	<i>Ceanothus cuneatus, integerrimus, sanguineus, thyrsiflorus, velutinus</i>	short	April-Aug
Cinquefoil	<i>Potentilla glandulosa, gracilis</i>	short	April-July
Columbine	<i>Aquilegia flavescens or formosa</i>	long	April-June
Currant/Gooseberry	<i>Ribes aureum, bracteosum, divaricatum, lacustre, lobbii, sanguineum, speciosum, viscosissimum</i>	short	Feb-July
Dogwood	<i>Cornus nuttallii, sericea</i>	short	April-June
Elderberry	<i>Sambucus caerulea, racemosa</i>	short	March-July
False Lily of the Valley	<i>Maianthemum dilatatum</i>	short	April-May
False Solomon's Seal	<i>Maianthemum racemosum, stellatum</i>	short	March-June
Fireweed	<i>Chamaenerion angustifolium</i>	long	June-Sept
Foamflower	<i>Tiarella trifoliata</i>	short	April-July
Goldenrod	<i>Solidago spp. (many natives)</i>	short	July-Sept
Honeysuckle*	<i>Lonicera ciliosa, hispidula, utahensis</i>	long	April-July
Huckleberry	<i>Vaccinium deliciosum, membranaceum, ovatum, parvifolium</i>	long	April-Aug
Indian Plum	<i>Oemleria cerasiformis</i>	long	March-April
Lupine	<i>Lupinus albicaulis, latifolius, polyphyllus, rivularis</i>	long	May-July
Madrone	<i>Arbutus menziesii</i>	short	April-May
Manzanita	<i>Arctostaphylos canescens, columbiana, nevadensis, patula, viscida</i>	long	March-May
Maple	<i>Acer circinatum, macrophyllum</i>	short	March-June
Mariposa lily	<i>Calochortus</i>	long	May-July
Milkweed	<i>Asclepias cordifolia, fascicularis, speciosa, cryptoceras</i>	long	April-Sept
Nettle-leaf horsemint	<i>Agastache urticifolia</i>	long	May-June
Ninebark	<i>Physocarpus capitatus</i>	short	April-June
Oceanspray	<i>Holodiscus discolor</i>	short	June-Aug
Oregon Grape	<i>Berberis aquifolium, nervosa and Mahonia repens</i>	short	March-June
Oregon myrtle/California or bay laurel	<i>Umbellularia californica</i>	short	April-May
Oxalis/Woodsorrel	<i>Oxalis oregana, suksdorfii</i>	short	March-Aug
Rasp/Black/Thimble/ Salmonberry*	<i>Rubus leucodermis, ursinus</i>	short	March-July
Rhododendron/Azalea	<i>Rhododendron macrophyllum, occidentale</i>	long	April-Aug
Rose	<i>Rosa gymnocarpa, nutkana, pisocarpa, woodsii</i>	short	March-July
Salal	<i>Gaultheria shallon</i>	long	May-July
Serviceberry	<i>Amelanchier alnifolia</i>	long	April-July
Shootingstar	<i>Dodecatheon hendersonii</i>	long	Feb-May
Smooth Sumac	<i>Rhus glabra</i>	short	April-Oct
Snowberry	<i>Symphoricarpos albus, mollis, oreophilus</i>	long	April-June
Thistle*	<i>Cirsium brevistylum, edule, remotifolium, undulatum</i>	short	May-Aug
Trillium	<i>Trillium albidum, ovatum</i>	long	Feb-May
Twinberry	<i>Lonicera involucrata</i>	long	June-Aug
Violet	<i>Viola adunca, glabella, sempervirens</i>	short	Feb-July
Waterleaf	<i>Hydrophyllum tenuipes</i>	long	May-July
Western Mountain Ash	<i>Sorbus sitchensis</i>	short	June-July
Western Viburnum	<i>Viburnum ellipticum</i>	short	May-June
Wild strawberry	<i>Fragaria vesca, virginiana</i>	short	March-July
Willow	<i>Salix exigua, geyeriana, hookeriana, lasiandra, rigida, scouleriana, sitchensis</i>	short	Feb-May
Yarrow	<i>Achillea millefolium</i>	short	June-Sept
Yellow Coneflower	<i>Rudbeckia occidentalis</i>	short	June-Oct

For More Information

- **Oregon Bee Project** <https://www.oregonbeeproject.org/>
- **Xerces** <https://xerces.org/>
- **UC Berkely Bee Lab** <http://www.helpabee.org/>

How to reduce pesticide bee poisoning from pesticides

- <https://catalog.extension.oregonstate.edu/pnw591>

'Don't plant' and 'native versus non-native' lists,

- <https://www.invasiveplantatlas.org/list.html?id=122>
- <https://weedwise.conservationdistrict.org/2017/thistle-identification.html>



Agapostemon viriscens

Sources and Suggested Reading

Cane, J. H. (1991). Soils of ground-nesting bees (Hymenoptera: Apoidea): texture, moisture, cell depth and climate. *Journal of the Kansas Entomological Society*, 406-413.

Cane, J. H., & Neff, J. L. (2011). Predicted fates of ground-nesting bees in soil heated by wildfire: Thermal tolerances of life stages and a survey of nesting depths. *Biological Conservation*, 144(11), 2631-2636.

Encyclopedia of Life Observer Cards: Bees. www.education.eol.org/observer_cards/

Galbraith, S. M., Cane, J. H., Moldenke, A. R., & Rivers, J. W. (2019). Wild bee diversity increases with local fire severity in a fire-prone landscape. *Ecosphere*, 10(4), e02668.

Garbuzov, M., & Ratnieks, F. L. (2014). Listmania: the strengths and weaknesses of lists of garden plants to help pollinators. *BioScience*, 64(11), 1019-1026.

Goulson, D. (2010). *Bumblebees: behaviour, ecology, and conservation*. Oxford University Press on Demand.

Hanula, J. L., Horn, S., & O'Brien, J. J. (2015). Have changing forests conditions contributed to pollinator decline in the southeastern United States?. *Forest Ecology and Management*, 348, 142-152.

Hanula, J. L., Ulyshen, M. D., & Horn, S. (2016). Conserving pollinators in North American forests: A review. *Natural areas journal*, 36(4), 427-439.

Harder, L. D., & Barclay, R. M. R. (1994). The functional significance of poricidal anthers and buzz pollination: controlled pollen removal from *Dodecatheon*. *Functional Ecology*, 509-517.

Kellar, B. (2014). *Honey Bees Across America*. Oregon State Beekeepers Association. <https://orsba.org/> Web Accessed 2019.

Klein, A. M., Vaissiere, B. E., Cane, J. H., Steffan-Dewenter, I., Cunningham, S. A., Kremen, C., & Tscharrntke, T. (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society of London B: Biological Sciences*, 274(1608), 303-313.

Moissett, B., & Buchanan, S. (2010). *Bee basics: an introduction to our native bees*. USDA, Forest Service.

Ollerton, J., Winfree, R., & Tarrant, S. (2011). How many flowering plants are pollinated by animals?. *Oikos*, 120(3), 321-326.

Ollerton, J., Price, V., Armbruster, W. S., Memmott, J., Watts, S., Waser, N. M., ... & Tarrant, S. (2012). Overplaying the role of honey bees as pollinators: a comment on Aebi and Neumann (2011). *Trends in Ecology and Evolution*, 27(3), 141.

O'Toole, C., & Raw, A. (1991). *Bees of the World*. Blandford Press.

Rivers, J. W., Galbraith, S. M., Cane, J. H., Schultz, C. B., Ulyshen, M. D. and Korman, U. G. (2018a). A review of research needs for pollinators in managed conifer forests. *Journal of Forestry* 110, 563-572.

Rivers, J. W., Mathis, C. L., Moldenke, A. R., & Betts, M. G. (2018b). Wild bee diversity is enhanced by experimental removal of timber harvest residue within intensively managed conifer forest. *GCB Bioenergy*, 10(10), 766-781.

Roof, S. M., DeBano, S., Rowland, M. M., & Burrows, S. (2018). Associations between blooming plants and their bee visitors in a riparian ecosystem in eastern Oregon. *Northwest science*, 92(2), 119-136.

Stephen, W. P., Bohart, G. E., & Torchio, P. F. (1969). *The Biology and External Morphology of Bees with a Synopsis of the Genera of Northwestern America*.

Wilson, J. S., & Carril, O. J. M. (2015). *The bees in your backyard: a guide to North America's bees*. Princeton University Press.

About the Woodland Fish and Wildlife Group

The Woodland Fish and Wildlife Group is a consortium of public agencies, universities, and private organizations which collaborates to produce educational publications about fish and wildlife species, and habitat management, for use by family forest owners in the Pacific Northwest.

Currently available publications can be viewed and downloaded, free of charge, at the organization’s website:

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STAFF REPORT

Agenda Item No.:	1
Work Plan:	Fire Protection
Topic:	Ongoing Topic; Fire Season Outlook and Readiness
Presentation Title:	2020 Fire Season Update
Date of Presentation:	September 9, 2020
Contact Information:	Doug Grafe, Chief, Fire Protection Division 503-945-7204 Doug.Grafe@oregon.gov

SUMMARY

Oregon revised statutes define the Department's Fire Protection policy, which requires a completed and coordinated system. This system relies on the partnership between the Department and forest landowners and a commitment to ongoing communication and collaboration with many other state and federal agencies. Fire management leaders from the Department will provide a briefing on some of the ongoing coordination and an up to date fire season status report during this agenda item. This briefing is for situational awareness for the Board.