

## Appendix 3: Performance Measures for the Board of Forestry

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### Summary

Performance measures are a select set of metrics that the Board of Forestry (Board) will use to evaluate management outcomes with respect to the objectives and intent expressed through the draft Western Oregon State Forests Management Plan (FMP) guiding principles, management approach, and goals. The ten performance measures listed below have component metrics that will be monitored and reported biennially to the Board under the process described in the Adaptive Management Plan. A background description, method of data collection, component metrics and targets, and related State Forests monitoring are provided for each performance measure. Targets or ranges of acceptable values would be set in the future as part of the FMP modeled outcomes and the draft Habitat Conservation Plan (HCP) commitments presented to the Board.

## Adaptive Capacity of Forests

### *Background*

Adaptive capacity is one of the key tenets of the FMP management approach so that State Forests maintain ecological function and productivity in response to stressors like climate change or drought and disturbance events such as fires, insect damage, or extreme weather. The proposed components to measure adaptive capacity will include forest attributes that increase forest diversity and complexity at stand and landscape scales.<sup>1</sup> Management influences adaptive capacity through harvest and thinning prescriptions, reforestation, retention of biological legacies, and landscape design. Management to increase adaptive capacity will vary by forest land management class (i.e., emphasis areas) to meet different objectives.

### *Methods*

Data for this measure will be gathered through the Enhanced Forest Inventory (EFI), with updates every five years. The EFI uses a densified network of USFS Forest Inventory and Analysis (FIA) systematic monitoring as its field-based data. Estimates from FIA data can be summarized at larger spatial extents, such as by district or emphasis area class. Finer-scale estimates (e.g., stands or watershed) can be modeled by lidar-based products in the EFI.

### *Metrics and Targets*

Four components (tree size distribution, tree species composition, stand structure, and tree growth rates) are proposed for two emphasis areas: general stewardship and habitat conservation areas (HCAs) (Table 1). Potential targets will be presented with modeled FMP outcomes to the Board.

### *Related Monitoring*

- The Forest Health Unit in the ODF Forest Resources Division provides updates to the Board and State Forests on invasive species, disturbances by insect and disease, and climate change vulnerability (e.g., western redcedar mortality).
- Wildfire risk on State Forests will be assessed in partnership with the ODF Fire Protection Division to provide an all-lands approach to strategic planning and monitoring.
- Retention of biological legacies (leave trees, snags, and downed wood) will be reported for the HCP and as a component of the Terrestrial Habitat performance measure.
- Management to improve or restore stands is reported in Operation Plans and for the HCP (e.g., harvests and replanting to reduce Swiss needle cast impacts).

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<sup>1</sup> D'Amato, A. W., & Palik, B. J. (2021). Building on the last “new” thing: exploring the compatibility of ecological and adaptation silviculture. *Canadian Journal of Forest Research*, 51(2), 172-180.

Table 1: Adaptive Capacity of Forests performance measure component metrics and targets

Component	General stewardship		Habitat Conservation Area		Data source	Notes
	Metrics	Targets	Metrics	Targets		
Size class distribution	Frequency across size classes	TBD: evenness across sizes desired	Frequency across size classes	TBD: evenness not necessarily desired	EFI: lidar-derived tree height classes	Alternative: age classes, but height is more accurate for uneven-age stands
Composition	Proportional basal area by tree species & stocking species proportions	Current & desired condition vary by district, report trends	Proportional basal area by tree species, stocking species proportions	Current & desired condition vary by HCA, report trends	FIA, EFI, and stocking surveys	Alternative: diversity indices
Stand structure	Canopy stratification (foliar height diversity)	TBD: tradeoff of stand complexity versus fire risk & other objectives	Canopy stratification (foliar height diversity)	TBD: increasing trend desired for HCP covered species habitat	EFI: lidar derived height diversity by stand	Alternative: heterogeneity indices
Growth rates to gauge species responses to climate change (i.e., drought & temperature stress)	Periodic annual increment for tree species	Stable or increasing trends desired	Periodic annual increment for tree species	Stable or increasing trends desired	Rolling mean of FIA tree size remeasurements summarized by species and region <sup>2</sup>	Lagging indicator, could consider ways to incorporate species responses to future climate conditions

<sup>2</sup> Stanke, H., Finley, A. O., Domke, G. M., Weed, A. S., & MacFarlane, D. W. (2021). Over half of western United States' most abundant tree species in decline. *Nature Communications*, 12(1), 451.

## Aquatic Habitat

### *Background*

For aquatic species covered in the HCP, the primary conservation action for achieving the biological goals of population persistence and resilience is expanding riparian management areas along streams. Passive management of these Riparian Conservation Areas (RCAs) will allow forests to mature over time to address limiting factors for covered species, including wood and gravel recruitment, stream shading, stream temperature, nutrient input, and streambank integrity. Implementing stream enhancement projects, including the promotion of natural beaver colonization, is another HCP conservation action targeting habitat improvement for covered species. Monitoring commitments in the HCP will track trends of aquatic habitat conditions for covered species based on field data to measure the effectiveness of these actions.

Conservation actions and associated monitoring in the HCP also focus on the impact of the transportation network on water quality and fish passage. Roads management can reduce hydrological connectivity by following best-management practices for design, construction, and maintenance to disconnect roads from stream systems. Barriers to fish passage can be reduced through culvert repair and are often prioritized based on fish presence and the miles of habitat upstream that are reconnected for access.

### *Methods*

HCP compliance and effectiveness monitoring would provide most of the data summarized in this performance measure. State Forests, in collaboration with ODFW, the research community, and federal services, will design HCP sampling efforts to select key watersheds to detect changes in aquatic habitat conditions for covered species. State Forests would conduct assessments of the transportation network to prioritize improvements according to HCP commitments.

### *Metrics and Targets*

Five components (physical habitat, riparian forest shading of streams, water temperature, transportation assessment, and beaver colonization) derived from HCP monitoring commitments are proposed (Table 2). Targets would be established in the future once baseline conditions are assessed in the initial years of the HCP.

### *Related Monitoring*

- State Forests has implemented stream enhancement projects with timber sales since the adoption of the Oregon Plan for Salmon and Watersheds. Restoration activities are reported annually to the Oregon Watershed Enhancement Board.

Table 2: Aquatic Habitat performance measure component metrics and targets

<b>Component</b>	<b>Metrics</b>	<b>Targets</b>	<b>Data Source</b>	<b>Notes</b>
Aquatic habitat conditions for covered species	Physical attributes in streams (channel complexity, wood, substrates)	Report trends from HCP effectiveness monitoring	Collaboration with ODFW Aquatic Inventories Project (AIP)	Attributes may be synthesized via a salmonid habitat limiting factors model. <sup>3</sup>
Channel shading from riparian forests	Modeled annual sun exposure	Report trends from HCP effectiveness monitoring	EFI models of shade from lidar surveys	
Water temperature	Average annual temperature within HCP permit area	Report trends from HCP effectiveness monitoring	Collaboration with ODFW statewide water temperature monitoring	A 3.5°F increase during the HCP permit term would be an unforeseen circumstance.
Transportation assessment in HCP permit area	Hydrological connectivity and fish passage barriers	Complete initial analysis so that improvements can be prioritized	HCP monitoring commitments	Roads and OHV trails would be included.
Beaver effects on aquatic habitat	Species occurrence and dam abundance	Report trends from HCP effectiveness monitoring	Collaboration with ODFW AIP to include beaver monitoring in key watersheds	

<sup>3</sup> Nickelson, T. E., & Lawson, P. W. (1998). Population viability of coho salmon, *Oncorhynchus kisutch*, in Oregon coastal basins: application of a habitat-based life cycle model. *Canadian Journal of Fisheries and Aquatic Sciences*, 55(11), 2383-2392.

## Carbon Storage

### *Background*

Carbon sequestration and storage in forests are key climate change mitigation strategies in Oregon.<sup>4</sup> The FMP carbon resource goal is to contribute to carbon storage on state forest lands and in harvested wood products. State Forests management impacts carbon sequestration and storage in the forest through timber harvest rotation age, no-harvest buffers, retention of biological legacies (i.e., large live trees, snags, and downed wood), and reforestation. Carbon storage in harvested wood products depends on the product type and timber harvest volume. Other sources of emissions, such as those required for operations and manufacturing, and the impact of substituting wood products for nonrenewable products are often included in full lifecycle carbon accounting but are beyond the means of our current data collection.

### *Methods*

Data for carbon pools within the forest will be gathered through the Enhanced Forest Inventory (EFI), with updates every five years. The EFI uses a densified network of USFS Forest Inventory and Analysis (FIA) systematic monitoring as its field-based data. Estimates from FIA data can be summarized at larger spatial extents, such as by district and emphasis area class. Carbon in harvested wood products will use models of long-term storage and decomposition by different product types.<sup>5</sup>

### *Metrics and Targets*

Three components (aboveground live tree carbon, carbon in harvested wood products, and carbon in other forest pools) are proposed for two emphasis areas: general stewardship and habitat conservation areas (HCAs) (Table 3). Targets will be determined in the process of modeling the outcomes of different FMP scenarios presented to the Board.

### *Related Monitoring*

- Statewide and regional carbon monitoring programs by other agencies also use FIA data to report on carbon trends over time by different pools. While these efforts report on different forest ownerships, they have not separated ODF-managed lands from the State/Local ownership category.

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<sup>4</sup> Oregon Global Warming Commission. 2021. Natural & Working Lands Proposal. <https://www.keeporegoncool.org/natural-working-lands>

<sup>5</sup> Morgan, T.A. et al. (2020). Oregon Harvested Wood Products Carbon Inventory 190-2018. Report prepared for USA Forest Service and Oregon Department of Forestry. [www.oregon.gov/odf/forestbenefits/Documents/oregon-harvested-wood-products-carbon-inventory-report.pdf](http://www.oregon.gov/odf/forestbenefits/Documents/oregon-harvested-wood-products-carbon-inventory-report.pdf)

Table 3: Carbon Storage performance measure component metrics and targets

Component	General stewardship		Habitat Conservation Area		Data source	Notes
	Metrics	Targets	Metrics	Targets		
Live tree carbon storage	Aboveground carbon per acre	TBD	Aboveground carbon per acre	TBD	FIA field data summarized by emphasis area	
Harvested wood product carbon storage	Carbon stored in products minus carbon released via decomposition	TBD	Carbon stored in products minus carbon released via decomposition	TBD	Storage modeled from annual cutout volume by district and emphasis area	
Other carbon pools (soil, dead wood)	Carbon per acre by pool	TBD	Carbon per acre by pool	TBD	FIA field data summarized by emphasis area	

## Community Engagement and Public Support

### *Background*

State Forests attained meaningful engagement and feedback with many groups while developing the FMP, including with the nine federally recognized Tribes of Oregon through the Government-to-Government framework (FMP Appendix A). This performance measure aims to continue this engagement to hear whether the public and Tribes believe we are meeting our FMP goals and providing GPV. The process to do so effectively and specifically for State Forests is under development.

The Board has gauged public values surrounding forest management through representative surveys of Oregonians and plans to continue this work through their update to the Forestry Plan for Oregon. At this time, State Forests will rely on the Board's survey efforts to listen to public values and support for forest management. Future investments in surveys may aim for repeatable analyses to demonstrate trends over time, but recently performed surveys provide an adequate baseline for current public views on forest management.<sup>6</sup>

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<sup>6</sup> Oregon Values and Beliefs Center. 2022. State Forest Management. <https://oregonvbc.org/state-forest-management/>



## Division Finances

### *Background*

Funding levels for FMP implementation vary with cyclical economic trends because State Forests is primarily funded through timber harvest revenues. There may be periods where revenues limit funding. Annual budget instructions for developing fiscal budgets reflect the Forest Development Fund (FDF) balance and the projected balance based on a 3-year revenue forecast (FMP, 4.1.1 Implementation Priorities).

### *Methods*

The Asset Management Unit reports fiscal metrics quarterly and forecasts State Forests revenue, expenses, and FDF balance with a range of projections annually.

### *Metrics and Targets*

The FDF balance in terms of the months of operating expenses will be the reported metric. The proposed target is to maintain a prudent FDF balance of 6-12 months of operating expenditures, which considers the cyclical nature of the timber markets and permits State Forests to adjust their services to maintain financial viability.

## Economic Opportunities

### *Background*

The FMP recognizes the importance of the economic benefits of forests to local communities through the Timber Production and Special Forest Products goals. Historically State Forests has tracked timber harvest volume as a surrogate measure of economic support for local communities, without modeling different components such as direct effects of jobs and wages from harvests, indirect effects from supporting industries, and induced effects from wages being spent. A socioeconomic outcomes analysis of modeled FMP scenarios will be presented to the Board that includes these components of timber harvest income and employment, as well as non-timber income and employment (e.g., recreation, hunting, special forest products, and other uses).

### *Methods*

To measure the benefits of State Forests to economic opportunities, economic impact models will be developed. For timber jobs, projected harvest levels would be used to estimate direct employment and income and the secondary effects that would be supported by the initial harvests. For non-timber jobs, the economic impact is less readily quantifiable and would rely on a literature assessment to estimate relative differences in FMP outcomes.

### *Metrics and Targets*

The socioeconomic outcomes analysis will provide a baseline understanding of the direct and indirect employment and income supported by State Forests. Appropriate targets will be set based on the Board's decision on the FMP.

### *Related Monitoring*

- Statewide reports on the timber industry with State Forests grouped together with the State/Local ownership category.<sup>7</sup>

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<sup>7</sup> Oregon Forest Resources Institute. (2019). The 2019 Forest Report. <https://theforestreport.org/wp-content/uploads/2019/07/OFRI-2019-Forest-Sector-Economic-Report-Web.pdf>

## Financial Support for Counties

### *Background*

This performance measure tracks the financial support provided by State Forests to counties through revenue sharing. There is volatility in annual revenue due to log prices and harvest timing by operators. While schools and local taxing districts also are recipients of these funds, distributions are administered by the counties and not easily tracked by State Forests.

### *Methods*

The Asset Management Unit reports revenue transferred from State Forests to counties annually and provides forecasts for expected transfers. These are reported in annual reports for the Council of Forest Trust Land Counties.

### *Metrics and Targets*

Revenues depend on the harvest planning decisions set during Implementation Planning rather than a Board decision. State Forests management is based on sustainable harvest targets rather than revenue targets. An even flow of timber volume may not translate to an even flow of annual revenue for counties. Trends or a range of acceptable values, averaged over several years due to inherent volatility, may be set from the FMP modeling outcomes.

## Harvest and Inventory

### *Background*

This performance measure is based on the FMP timber production goal to provide a sustainable and predictable supply of timber for economic opportunity, jobs, and availability of forest products. Harvest levels are the primary source of revenue for State Forests and will impact our ability to meet other integrated resource goals. The intent of this performance measure is to demonstrate how the planned harvest volume targets, cutout volume, and inventory growth accumulate over the course of decadal-scale Implementation Plans. Over time inventory growth should meet or exceed harvest volume. Management choices such as rotation age, harvest method, thinning, and stand improvement investments impact harvest volumes and inventory growth.

### *Methods*

Data sources include annual district reports based on Operations Plans for harvests and the EFI for inventory growth. Inventory changes and forecasts are generally modeled for Implementation Plans or FMP outcomes. Harvests and inventory changes will be reported both by emphasis area (i.e., general ground and HCAs) and in total for the plan area.

### *Metrics and Targets*

Harvest volume is reported annually, with a comparison to even-flow targets set by the Implementation Plans. Harvest levels targets are not set by the Board but developed through Implementation Plans approved by the State Forester. Inventory does not have a current target, but potential targets will be presented with FMP modeled outcomes to the Board.

## Recreation, Education, and Interpretation Opportunities

### *Background*

The FMP goal for the Recreation, Education, and Interpretation (REI) program is to create meaningful and enjoyable experiences that foster appreciation and understanding of state forest lands and contribute to community health, sustainable working forests, and economic wellbeing. The program has traditionally relied on visitor counts to track annual use and will continue to report these metrics for the performance measure. However, this metric does not fully capture the diversity of users and activities on State Forests as reflected in the FMP strategy to conduct new visitor use research and monitoring when strategic funding is obtained. New approaches to monitoring would offer more granular location and demographic data than annual counts that could be used to tailor REI resource allocations to visitors' interests.

### *Methods*

Data sources comes from the REI program's annual reporting. New visitor use monitoring would be developed with the consultation of social scientists and subject matter experts when strategic investments are made.

### *Metrics and Targets*

Annual visitor counts at campgrounds and at the Tillamook Forest Center (TFC) will be reported to show trends over time. The intent of a target is not necessarily that the annual number of visitors is increasing, but that the REI program resources are well-spent toward meaningful programs and targeted towards visitors' interests.

### *Related Monitoring*

- Visitor use surveys, community science observations, and trail counters were used to assess the Black Rock Mountain Biking Area for a year as a pilot study for a popular recreation site on State Forests.<sup>8</sup>

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<sup>8</sup> D'Antonio, A., Winder, S., Wood, S., & White, E.M. (2023). Characterizing Visitor Use at Oregon Department of Forestry Recreation Sites: A Pilot Case Study at Black Rock Mountain Biking Area. Report prepared for ODF.

## Terrestrial Habitat

### *Background*

The FMP wildlife goal has strategies to promote a diversity of forest types, functional landscapes, structural complexity of stands, and habitat for endangered species and species of concern. The intent of this performance measure is to illustrate trends in forest structure and landscape connectivity that would benefit many wildlife species across forest seral stages (i.e., structure-based biodiversity indicators<sup>9</sup>) even as species distributions shift with climate change.

The commitments in the HCP would differ by emphasis area with the expectation that wildlife strategies would be met across the landscape. For example, timber harvests with retention of trees, snags, and downed wood and RCAs would increase structural complexity in early seral stands. Active and passive management in HCAs would produce higher quality habitat for covered species with greater connectivity between late seral patches as forests within RCAs and HCAs mature over time.

### *Methods*

Data for this measure will be gathered through the EFI, with updates every five years. The EFI uses a densified network of FIA monitoring plots as a systematic sample of various forest metrics across the plan area. Trends over time would be based on rolling means of FIA plot metrics summarized by emphasis area. Landscape metrics or finer-scale estimates (i.e., large trees) are provided by lidar-based model predictions for the point in time of lidar data collection.

### *Metrics and Targets*

Four components (large trees, dead wood, hardwood trees and understory diversity, late seral forest connectivity, and habitat development for covered species) are proposed for two emphasis areas: general stewardship and HCAs (Table 4). Targets will be set to align with HCP commitments.

### *Related Monitoring*

- Compliance and effectiveness monitoring in the HCP provides more detailed information about habitat for covered species.
- Other wildlife monitoring would be included in district Implementation Plans and the Adaptive Management Plan.

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<sup>9</sup> Lindenmayer, D. B., Margules, C. R., & Botkin, D. B. (2000). Indicators of biodiversity for ecologically sustainable forest management. *Conservation biology*, 14(4), 941-950.

Table 4: Terrestrial Habitat performance measure component metrics and targets

Component	General stewardship		Habitat Conservation Area		Data source	Notes
	Metrics	Targets	Metrics	Targets		
Large trees	Occurrence of >30" DBH trees at multiple spatial scales	TBD: expected to increase over time with HCP leave tree prescriptions	Occurrence of >30" DBH trees at multiple spatial scales	TBD: expected to increase over time as restored stands mature	EFI: lidar-derived large tree presence	Trees of this size and larger are components of habitat models for covered species.
Dead wood (large downed wood and snags)	Basal area of snags and volume of downed wood	HCP compliance, expected that retention would be greater than before HCP.	Basal area of snags and volume of downed wood	TBD: increasing trend desired in management for diverse habitat	FIA and HCP compliance monitoring	Trends from FIA across plan area, estimates of change with HCP compliance monitoring
Hardwood trees and understory diversity	Proportional basal area of hardwoods and percent cover of native understory plants	TBD: expected to be maintained through retention and RCAs within harvest units	Proportional basal area of hardwoods and percent cover by native understory plants	TBD: increasing trend desired through HCA management for diverse habitat	FIA for tree basal area and understory species cover.	Elk nutritional models would be a potential synthetic metric for plants monitored by FIA
Connectivity between late seral forest patches	Northern Spotted Owl dispersal habitat by sub-geographic area	HCP compliance, 40% in each area measured at 5-year intervals	Habitat patch sizes by suitability category	Increasing proportion of larger habitat patches within HCAs	EFI: lidar-derived landscape map of late seral forests and dispersal habitat	Landscape resistance to Northern Spotted Owl movement would be a potential synthetic metric
Covered species habitat meets stay-ahead provision in HCP	Acres of habitat harvested versus ingrowth of habitat over time	Set in HCP	Acres of habitat harvested versus ingrowth of habitat over time	Set in HCP	HCP 5- and 10-year monitoring reports, habitat models based on EFI lidar-derived maps	