Oregon Department of Forestry

About Us

Contact Us

Oregon Board of Forestry

Oregon Roundtable on Sustainable Forests

Indicator List

Strategy A

Strategy B

Strategy C

Strategy D

Strategy E

Strategy F

Strategy G

ODF Home

Data Information and Reporting for Indicator F.a.

Oregon Indicator of Sustainable Forest Management F.a.
Tree mortality and damage from insects, diseases, and other agents

***Forestry Program for Oregon* Strategy F:**
Indicator F.a. is one of three indicators that will measure progress towards achieving *Forestry Program for Oregon* Strategy F: Protect, maintain, and enhance the health of Oregon's forest ecosystems, watersheds, and airsheds within a context of natural disturbance and active management.

Quick Links - Other Indicators for Stategy F Reporting

Indicator F.b.
Indicator F.c.

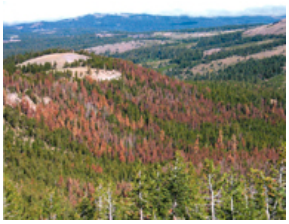
Desired Trend
Stable or decreasing long-term levels of Oregon forest tree mortality.

At-a-Glance: Condition, Trend, and Information

Condition:	Trend:	Information:
		
Mixed	**Mixed**	**Adequate**

Why is this indicator important?

Oregon forest lands have historically been impacted by a number of disturbance agents including insects, diseases, wildfires, weather events, animals, and others that in some cases have led to substantial tree mortality across the landscape. The activity of the majority of these agents constitute normal ecological processes, with results that can be both beneficial or detrimental to desired stand structures, species compositions, and forest ecosystem functioning. A healthy forest is one includes natural, periodic disturbance events, but as large-scale tree mortality can occur, it is important to keep policy makers and the public informed as to the current levels, how these compare with historic levels, and what, if anything, can be done to mitigate detrimental impacts to desired conditions.



Mountain pine beetle infestation on Oregon's forestlands

What does this indicator tell us about sustainable forest management?

Condition:

Mixed

Statewide aerial surveys of Oregon forest lands are conducted on over 28 million acres each year through a cooperative federal and state effort. Aerial observers assess the extent of tree mortality by detecting signatures (changes in foliage color), mapping these areas with their approximate boundary, and coding them with the suspected agent(s) and an estimate of the number of dying trees within. Tree mortality within mapped areas may range from the minimal detectable level (0.25 dying trees per acre) to complete overstory mortality. Annual aerial survey data is available in a consistent manner with Statewide coverage since 1980, and can be used to estimate the relative area and volume of tree mortality on Oregon forest lands (Figures 1 and 2).

In 2009, Statewide aerial surveys detected tree mortality on >600,000 acres, representing an estimated >20 million cubic feet. The majority of tree mortality observed over this time period has been attributed to bark beetles, primarily mountain pine beetle, fir engraver, and Douglas-fir beetle (Figures 3 and 4). The highest levels of bark beetle mortality in recent history occurred in the 1980s due to Douglas-fir beetle and true fir engraver attacks on trees previously affected by Western spruce budworm outbreaks and drought. Mountain pine beetle outbreaks co-occurred during this time, and again to a lesser degree, over the last decade. In each case, they primarily affected areas with dense, older lodgepole pines

and adjacent pine species. Tree mortality detected during this time, and historically, has occurred to a greater degree in the drier forest types of Southwest and Eastern Oregon (Figure 5).

Despite changing forest and climatic conditions in recent decades, the major insect outbreaks observed during this time period have generally fallen within their historic ranges in Oregon. Tree mortality estimates in 2009 were 32 percent lower by area and 53 percent lower by volume than the 30-year average, with the greatest reductions observed on federal and private lands relative to the previous year. Declines are consistent with reduced mountain pine beetle activity where preferred hosts have been depleted and increased moisture-levels that have helped to keep other agents at endemic levels.

Wildfires constitute a significant and necessary type of disturbance within many Oregon forest types. Forest lands affected by wildfires experience varying degrees of burn severity that may result in minor canopy loss to complete overstory mortality. While small areas (<100 acres) affected by wildfires are mapped during Statewide aerial surveys, more complete information on burned areas is collected independently by the Northwest Interagency Coordinating Center's Pacific Northwest Wildfire Coordinating Group (PNWCG) and the Wildland Fire Leadership Council's Monitoring Trends in Burn Severity (MTBS) project using remote-sensing. Annual estimates of the total area of Oregon forest lands affected by wildfires, the relative burn severity within those areas, and their spatial distributions have been documented since 1984 (Figures 6 and 7).

In 2008, remote sensing data from the MTBS project detected tree mortality from large wildfires on >70,000 acres in Oregon. A threshold (>1000 acres) for wildfires was used in all western States, and these represent >97 percent of the burned area in Oregon over the last decade. Tree mortality from wildfires during this time period, and historically, has occurred to a greater degree in the drier forest types in Southwest and Eastern Oregon.The occurrence of large wildfires shows a greater degree of annual variation than many disturbance agents due to the different factors that are involved in generating and sustaining these events.

Despite changing forest and climatic conditions in recent decades, wildfire-related tree mortality observed during this time period appears to have generally fallen within the historic range for Oregon. Overall, large areas burned by wildfires in 2008 were 26 percent lower than the 30-year average. For moderate-to-high burn severities that have the most substantial impact on overstory canopies, in 2008 these were 45 percent and 19 percent lower, respectively, than 30-year averages. Relatively low levels appear to be consistent with above-average moisture and below-average temperatures that have occurred recently.

Trend:

Mixed

Tree mortality trends on Oregon forestlands have historically and will continue to show significant annual fluctuations, making long-term trend assessments difficult. However, it appears that mountain pine beetle outbreaks in eastern Oregon will continue to decline and other major bark beetles should remain at endemic levels with continued normal to above-average moisture patterns. Similarly, tree mortality from large wildfires is expected to remain low if current environmental conditions persist.

While it is uncertain what the full extent of reduced management of forest lands, increased fire fuels, and climate change will be, overall tree mortality is expected to increase under some scenarios. And, although the incidence and impacts of many native and natural disturbance agents will continue to be uncertain, the overall risk may be reduced with forest and fuels management aimed at increasing stand vigor and resilience. Non-native species remain one of the most significant threats to forest lands.

Information:

Adequate

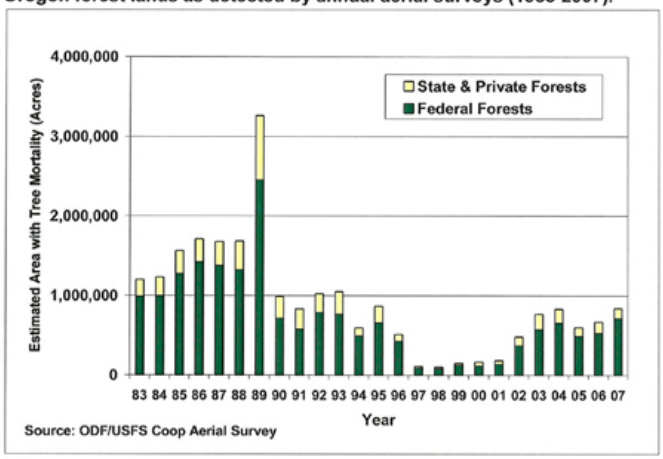
Statewide annual aerial surveys have been completed in a generally consistent manner since 1980 and are expected to continue to provide annual assessments of tree mortality despite recent federal and State funding losses. Remote-sensing information on tree mortality related to wildfires on forest lands in Oregon is available since 1984. Information is expected to continue to be available annually through the MTBS project.

As the data coverage, frequency, and reliability appear sufficient to draw conclusions with reasonable confidence, the information is rated as "adequate." However, if data quantity and quality are reduced, the information rating will be changed to "partial" or "inadequate" depending on the degree to which this occurs.

Report: Acres of Tree Mortality on Oregon's forests

Figure 1: Estimated annual area (acres) containing tree mortality and the long-term average for Oregon forest lands as assessed by aerial surveys (1980-2009). [1, 2]

Figure 1 – Estimated area (acres) over which tree mortality occurred on Oregon forest lands as detected by annual aerial surveys (1983-2007). [1, 2]



[1] Forest health surveys only assess burned areas of less than 100 acre, while larger fire boundaries are surveyed by the PNW Wildfire Coordinating Group.

[2] Does not include areas affected by insect defoliators or needle diseases as they experience wide annual variations and generally have less impact on forest cover.

[1] Aerial detection surveys occurred prior to 1980, but were not done in a consistent manner nor were they conducted on forest lands Statewide.

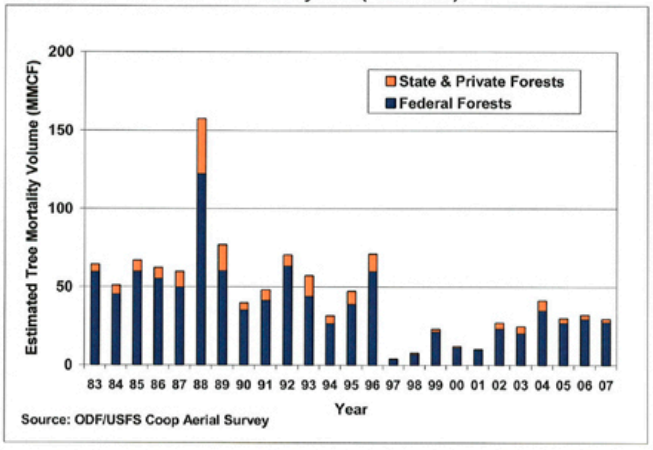
[2] Does not include areas affected by defoliating agents that do not normally cause tree mortality or the majority of root diseases and mistletoes, which are not usually detected by aerial surveys. Does include small areas (<100 acres) affected by wildfire as these are not tracked by other efforts; however, these represent <1% of the overall tree mortality detected.

Printable full-page-sized Figure 1 [PDF]

Report: Volume of Tree Mortality on Oregon's Forests

Figure 2: Estimated annual volume (MMCF) of tree mortality and the long-term average for Oregon forest lands as assessed by aerial surveys (1980-2009). [1, 2]

Figure 2 – Estimated volume (MMCF) of tree mortality on Oregon forest lands based on annual aerial survey data (1983-2007). [1, 2, 3]



[1] The number of recently dead and dying trees mapped during aerial surveys are converted to a volumetric measure for each agent/host combination by reporting area. The reporting area is an arbitrary geographic designation developed by the USFS that provides a seamless coverage over forested areas in Oregon.

[2] Forest health surveys only assess burned areas of less than 100 acre, while larger fire boundaries are surveyed by the PNW Wildfire Coordinating Group.

[3] Does not include areas affected by insect defoliators or needle diseases as they experience wide annual variations and generally have less impact on forest cover.

[1] Aerial detection surveys occurred prior to 1980, but were not done in a consistent manner nor were they conducted on forest lands Statewide.

[2] Does not include areas affected by defoliating agents that do not normally cause tree mortality or the majority of root diseases and mistletoes, which are not usually detected by aerial surveys. Does include small areas (<100 acres) affected by wildfire as these are not tracked by other efforts; however, these represent <1 percent of the overall tree mortality detected.

Printable full-page-sized Figure 2 [PDF]

Report: Major Insect and Disease Outbreaks on Oregon Forestlands (1980-2009)

Figure 3: Estimated peak extents of major insect and disease outbreaks on Oregon forest lands as assessed by aerial surveys (1980-2009). [1, 2]


This graphic is a map of the Estimated peak extents of major insect and disase outbreaks on Oregon forest lands as assessed by aerial surveys for 1980 through 2009.

[1] Large insect and disease outbreaks were recorded prior to these events, but aerial surveys were not done in a consistent manner nor were they conducted over forest lands Statewide.

[2] Overstory tree mortality is not generally observed from defoliating agents like Swiss needle cast or Western spruce budworm; however, these events can increase susceptibility to other agents.

Printable full-page-sized Figure 3 [PDF]

Report: Aerial Survey Damage Detection - 2009 and Historic Extent of Damage

Figure 4: Estimated extents for all damaging agents detected in 2009 and the historic extent on Oregon forest lands as assessed by annual aerial surveys (1980-2009).[1]


This is a map of the estimated extents for all damaging agents detected in 2009 and the historic extent on Oregon forestlands as assessed by annual aerial surveys from 1980 through 2009).

[1] Aerial detection surveys occurred prior to 1980, but were not done in a consistent manner nor were they conducted on forest lands Statewide.

Printable full-page-sized Figure 4 [PDF]

Report: Acres of Tree Mortality by Region (1980-2009)

Figure 5: Estimated annual area (acres) containing tree mortality by region for Oregon forest lands as assessed by aerial surveys (1980-2009). [1, 2, 3]


This is a graphic of a chart showing the estimated annual area, in acres, containing tree mortality by region for Oregon forestlands as assessed by aerial surveys for 1980 through 2009.

[1] Regions were separated by Oregon Department of Forestry fire protection district boundaries.

[2] Aerial detection surveys occurred prior to 1980, but were not done in a consistent manner nor were they conducted on forest lands Statewide.

[3] Does not include areas affected by defoliating agents that do not normally cause tree mortality or the majority of root diseases and mistletoes, which are not usually detected by aerial surveys. Does include small areas (<100 acres) affected by wildfire as these are not tracked by other efforts; however, these represent <1% of the overall tree mortality detected.

Printable full-page-sized Figure 5 [PDF]

Report: Estimated Annual Acres Burned by Large Wildfires (1984-2008)

Figure 6: Estimated annual area (acres) burned by large wildfires and the long-term average on Oregon forest lands as assessed by remote-sensing (1984-2008). [1, 2, 3]


This is a graphic of a chart showing the estimated annual area in acres burned by large wildfires and the long-term average on Oregon forestlands as assessed by remote sensing for 1984 through 2008.

[1] Data provided by the Northwest Interagency Coordinating Center's Pacific Northwest Wildfire Coordinating Group (PNWCG) and the Wildland Fire Leadership Council's Monitoring Trends in Burn Severity (MTBS) project. Large wildfires (>1000 acres) accounted for >97% of burned areas over the last decade in the Pacific Northwest.

[2] The remote sensing index used to determine burn severity categories is the differenced Normalized Burn Ratio (dNBR). Classifications were determined from dNBR image patterns, relying on the combined experience and observed performance from previous studies.

[3] The burn severity category descriptions are complex and have many components, but may be described generally in terms of the degree of estimated overstory canopy loss: Unburned to Low (≤25%), Low (>25%), Moderate (>50%), and High (>75%).

Printable full-page-sized Figure 6 [PDF]

Report: Fire Severity on Oregon's Forestlands (1984-2008)

Figure 7: Estimated extents of large wildfires on Oregon forest lands as assessed by remote sensing (1984-2008). [1, 2]


This graphic is a map showing Fire Severity for fires larger than 1000 acres from 1984 through 2008.

[1] Data provided by the Northwest Interagency Coordinating Center's Pacific Northwest Wildfire Coordinating Group (PNWCG) and the Wildland Fire Leadership Council's Monitoring Trends in Burn Severity (MTBS) project. Large wildfires (>1000 acres) accounted for >97% of burned areas over the last decade in the Pacific Northwest.

[2] The remote sensing index used to determine burn severity categories is the differenced Normalized Burn Ratio (dNBR). Classifications were determined from dNBR image patterns, relying on the combined experience and observed performance from previous studies.

[3] The burn severity category descriptions are complex and have many components, but may be described generally in terms of the degree of estimated overstory canopy loss: Unburned to Low (≤25%), Low (>25%), Moderate (>50%), and High (>75%).

Printable full-page-sized Figure 7 [PDF]

Evaluation by the Oregon Roundtable on Sustainable Forests on this indicator

- Initial Roundtable Evaluation of Indicator F.a.: Tree mortality and damage from insects, diseases, and other agents [PDF; 5 pages; 189 KB]
- Staff Response to F.a. [PDF; 7 pages; 196 KB]

Metrics and Data Sources

Metric	Data Source	Location/Links
Estimated tree mortality (acres affected and volume) based on annual aerial surveys	Oregon Department of Forestry	http://oregon.gov/odf/privateforests/fhMaps.html
	U.S. Forest Service Forest Health Protection and Forest Health Monitoring	http://www.fs.fed.us/r6/nr/fid/data.shtml
Estimated tree mortality (acres affected by wildfire and burn severity) based on remote sensing	Wildland Fire Leadership Council - Monitoring Trends in Burn Severity Project (MTBS)	http://mtbs.gov/index.html
	Northwest Interagency Coordination Center - Pacific Northwest Wildfire Coordinating Group (PNWCG)	http://www.nwccweb.us/index.asp

Related State, National, or International Indicators

- ***Montreal Process*:** Criterion 3 – Maintenance of forest ecosystem health and vitality: 3.3a Area and percent of forest affected by processes or agents beyond the range of historic variation.
- ***Heinz Center*:** Forest Disturbance: How many acres are affected each year by fire, insects, and tree disease?
- ***Northeastern Area*:** 3.7 – Area and percent of forestland affected by potential damaging agents
- ***Oregon State of the Environment Report:*** Number of nuisance invasive species