# Flathead National Forest Plan

# Terrestrial Ecosystems and Focal Species (Western White Pine) Monitoring Guide and Evaluation of Results (MON-TE&V)

## *Point of Contact*

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## *Introduction*

Forest Plan monitoring items have been grouped into separate documents based on the main resource area and primary contact person. The monitoring questions and indicators included in this document are designed to address the status of terrestrial ecosystems and vegetation, including the focal species of western white pine and one of the plant species at risk, whitebark pine. The monitoring items included in this document are listed below:

| **Monitoring Item and Question (Chapter 5 of Flathead Forest Plan)** |
|---|
| **MON-TE&V-01**: What is the change in key ecosystem characteristics for forest and non-forest vegetation? |
| **MON-TE&V-02**: What is the change in amount and severity of wildfire and the status of fire regimes? |
| **MON-TE&V-03:** What is the change in insect hazard and root disease severity? |
| **MON-TE&V-04**: How many acres of vegetation treatments are occurring that contribute to maintaining or moving towards achieving desired conditions in the plan? |
| **MON-TE&V-05**: To what extent have management actions maintained required levels of snags or snag replacement trees within harvest units? |
| **MON-TE&V Focal-01**: What is the change in ecological conditions within the warm-moist and cool-moist PVTs, as indicated by conditions suitable for western white pine? |
| **MON-TE&V Focal-02**: What management actions are contributing to the restoration of western white pine? |

## *Purpose and Outline of this Document*

Each individual monitoring item in the Forest Plan monitoring program (Chapter 5 of the Plan) has been addressed in a document such as this one, which is intended to serve as the primary location for information needed to conduct the monitoring and to record the results. It is designed to aid in the tracking and preservation of monitoring methods, data and results over the life of the plan. It is anticipated that these documents would be revisited and used as a guide to conduct the monitoring for each biennial reporting; to see past results and record new results; and updated where needed based on recommendations for change in the previous biennial report.

This document is NOT the final Biennial Monitoring Evaluation Report (BMER), but it should contain most if not all the information needed to prepare that report, and functions as project record material for the BMER.

Each monitoring item in this document is organized into five main sections:

- **Introduction:** Key information from the monitoring plan (i.e. indicators, plan component being monitored, data source/collection)
- **Methods**: Detailed information on how the monitoring will be accomplished, the intent of the selected indicators, data sources and confidence levels, etc.
- **Results:** Summary of the monitoring data used and the results for the current biennial monitoring report.
- **Discussion of Results**: A fact-based discussion of results. A list of general questions (see below) and in some cases more specific resource-based questions are provided to help guide this discussion
- **Evaluation of Results for Adaptive Management Finding:** evaluation of what the results mean in terms of management decisions. This information is incorporated into the Biennial Monitoring Evaluation Report.

## Information on data sources/methods common to all monitoring items in this section of the guide

The Region 1 Forest Inventory and Analysis Summary Database (R1 FIA SDB) is the source of the data used to derive the estimates for the monitoring indicators in this document. This database contains the most recent FIA plot data available. Estimated values for vegetation conditions (such as tree densities, species presence, dominance types, etc.) are obtained directly from the R1 FIA SDB. Many of the estimates for the forest-level monitoring report are provided at the regional level in reports prepared under the Broad Scale Monitoring Strategy (BSMS reports). Or the estimates may be obtained directly from the R1 FIA SDB using the Estimator Form. Detailed information on the R1 summary database and Information on downloading, accessing, and deriving estimates from this data base is found at: Northern Region Inventory and Analysis - R1 FIA and Intensified Grid Summary Database and Analysis Tools (sharepoint.com). Established regional protocols and methods for deriving estimates from the FIA data base are be used to determine the values (acres, trees per acre, etc.) for each vegetation indicator, as outlined in the document "R1 SDB reports and utilities user's guide" on this website.

The BSMS reports are provided periodically by the region when the R1 FIA SDB is updated with new FIA plot data (about every 5 years). Estimates associated with dead tree density and presence (snag density reports) are also provided periodically at the regional level. The BSMS and snag density reports provide estimates for a set of established vegetation indicators. These indicators are also used for some of the monitoring indicators for wildlife habitat. But other monitoring indicators may be specific to the Flathead monitoring program and are not currently provided in the regional reports. If these estimates are considered necessary, FNF personnel will need to derive them estimates directly from the R1 FIA SDB using the Estimator Form.

## Information on the revised Flathead Forest Plan data sets common to all Terrestrial Ecosystem Monitoring indicators

Below is a table with information on the primary vegetation data sources and the date of the data collection used in the development of the Flathead Forest Plan. When evaluating monitoring results, it is important to know the data sources and dates of data collection that were used in the previous monitoring report so that results and trends can be correctly interpreted.

**Table 1. Vegetation data set types and dates used for the 2018 Flathead Forest Plan**

| Data Set | Data type | Date compiled/collected |
|---|---|---|
| Region 1 Vegetation Map (VMap) – version 12 for the Flathead NF | Spatially mapped existing vegetation derived using remote sensing techniques refined through sampling and verification | Uses satellite imagery data from 2009. Updated to the year 2012 by the Forest Plan revision team, primarily to identify recent stand disturbance activities since 2009 (i.e. fires) and differentiate early successional forest types from true non-forest areas.<br>If a new VMap layer is available in the future, it will be used for monitoring items that use VMap as their data source (such as connectivity of habitat). However, it should not be compared directly to previous monitoring results due to the nature of the data set. See discussion below this table. |
| Region 1 Forest Inventory and Analysis Hybrid 2011 database (R1 FIA Hybrid 2011) | Spatially balanced sample of forest conditions gathered from field inventory plots across all lands. Data collection standards strictly controlled, scientifically designed and repeatable. | 398 total plots, with most data (357 plots) collected from the years 2003 to 2011.<br>FIA inventory plots are re-measured every 10 years. |
| Forest Activity Tracking System (FACTS) | Spatially mapped database recording all management activities and natural events that alter vegetation | Management activities from the 1940s through the year 2012. |

When a new VMap version is available, monitoring items that use VMap as a data source would be updated. However, any new analysis conducted for the monitoring report that uses a new version of VMap should be evaluated independently of the previous analysis. It would be an inappropriate use of VMap data to compare the results of the new analysis directly with the previous analysis, and trends cannot be reliably determined. This is because each new VMap layer is developed independent of the previous version and would potentially incorporate new methodology and technology, new accuracy assessments, and thus a new and different basis for the classification and mapping of the vegetation conditions. It is not possible to be confident that changes in vegetation conditions from an older to newer version of VMap are due to actual changes in forest conditions over that time period, or to different methodology or classification techniques.

PVT mapping for programmatic analysis purposes is also likely to change over time, with the expectation that our existing spatial PVT data source (i.e., Jones, Jeff. 2004. US Forest Service Region One potential vegetation type (PVT) classification of western Montana and northern Idaho. Kalispell, MT.) will be updated using new methods and protocol for mapping PVTs. If this occurs, then the subsequent monitoring report should use this new PVT map to evaluate this monitoring item. Similarly to the VMap situation, trends compared to the previous monitoring report results will not be able be detected at the switch to a new PVT layer, because of the different mapping protocols.

# TERRESTRIAL ECOSYSTEMS MONITORING (MON-TE&V)

## MON-TE&V-01. What is the change in key ecosystem characteristics for forest and non-forest vegetation?

### *Introduction*

This monitoring question is central to the evaluation of the biodiversity and ecological sustainability of the Forest landscape and forest conditions. Conditions of these vegetation indicators as a whole provide insight into the extent that natural processes and management activities are maintaining or trending the vegetation towards desired conditions. Vegetation that meets desired conditions reflects, to the best of our knowledge, a forest and landscape that is resilient and resistant to disturbances and able to adapt in the face of future disturbances and uncertainties. Desired vegetation conditions reflect the diversity of composition and structure that supports and sustains populations of native wildlife species.

The general desired condition in the plan which these indicators are designed to monitor is **FW-DC-TE&V-03: which states:**

"Across the landscape, diverse vegetation conditions occur in a complex pattern of species, tree sizes, tree ages, forest densities, patch sizes, canopy layers, and other forest structural characteristics such as downed wood and snags. The vegetation mosaic across the plan area varies greatly over time as vegetation is influenced by site conditions and responds to climate changes, ecological processes (such as natural succession, fire, insects, and disease), and human influences (such as vegetation management). Vegetation conditions and patterns contribute to resistant (the capacity to remain relatively unchanged following disturbances) and/or resilient (the capacity to regain normal functioning following disturbances) forest conditions at both the stand and landscape level."

Forest plan components **FW-DC-TE&V-07, 08, 09, 10, 11, 12, 13, 14, and 15** describe the specific, measurable vegetation conditions which will maintain desired ecosystem integrity while contributing to social and economic sustainability. These include vegetation composition (forest dominance types and tree species presence), forest size classes, tree canopy cover, old growth forest, very large tree presence and density, and snag conditions. The TEXT portions of these forest plan components are included below; the TABLES that display the forest plan desired percentages for each of these forest plan components can be found in Appendix A of this monitoring guide ("***Monitoring_Guide_TERRESTRIAL VEG_APPENDIX A-Results Tables").*** Refer to the Terrestrial Ecosystems and Vegetation section of the Flathead Forest Plan for the full documentation of each of these desired conditions.

> **FW-DC-TE&V-07** (Forest Dominance type) "The Forest has a diversity of native tree species, with most stands composed of more than one tree species. Desired conditions for forest dominance types forestwide are described in table 2. Desired conditions for the forestwide presence (distribution) of individual tree species are described in table 3. Refer also to table 4 for desired conditions for the presence of individual tree species by each potential vegetation type."
>
> **FW-DC-TE&V-08** (Tree species presence) "Presence of tree species within each potential vegetation type meets or trends towards desired conditions, as described in table 4. The distribution of tree species provide desired habitat conditions for associated wildlife species and contribute to diverse and resilient forest conditions, as described in table 4. See appendix D for a description of potential vegetation types."

**FW-DC-TE&V-09** (non-coniferous vegetation types) **"**Non-coniferous vegetation types are present across the Forest and meet the characteristics described in table 5. These communities provide habitat for associated wildlife species."

**FW-DC-TE&V-10** (forest and tree size classes) "A diversity of forest size classes occurs across the Forest. Desired conditions forestwide for forest size class proportions are described in table 6. Forest size class amount and distribution fluctuate over time and space as forests develop through natural succession and/or change in response to disturbances and may be limited by site productivity, species composition, and forest density."

**FW-DC-TE&V-11** (forest and tree size classes by PVT) "A diversity of forest size classes occurs within each potential vegetation type. The desired range forestwide is described in table 7. Forest size classes fluctuate over time and space as forests develop through natural succession and change in response to disturbances. These desired conditions, in combination with those described for composition, pattern, and other vegetation components in this plan, create habitat that supports a wide variety of wildlife associated with forests in the potential vegetation type."

**FW-DC-TE&V-12** (very large trees) "Very large live trees (greater than 20 inches d.b.h.) are present not only in the very large forest size class (see FW-DC-TE&V-10 and 11) but are also distributed throughout other forest size classes across the matrix of Forest lands, including areas where timber harvest activities occur. Forest vegetation conditions support maintaining or increasing the density and distribution of very large live trees across the landscape. Desired species are listed in table 8. Very large live trees contribute to forest structural diversity, to long-term forest resilience, and to recovery after disturbances (such as fire). Very large trees contribute to future snag habitat in the late successional and old-growth forest, providing for long-term recruitment of large rotten trees, broken-top trees, and snags that are important habitat for species such as pileated woodpeckers, flammulated owls, lynx, fisher, and others. Very large trees contribute to scenic quality and to the economic value of forest products in areas suitable for timber production."

**FW-DC-TE&V-13** (forest density) "Forest densities range from very low to very high and occur in a diverse pattern across the landscape. Moderate and high tree densities (i.e., greater than or equal to 40 percent canopy cover) occur on 50 to 75 percent of the forested area and most commonly located in the cool-moist and warm-moist potential vegetation types. Forests at lower densities (i.e., less than 40 percent canopy cover) occur on up to 50 percent of the forested area and are most commonly located in the warm-dry potential vegetation type; on the drier and colder sites within the cool-moist and cold potential vegetation types; and in the wildland-urban interface. Forests at lowest densities also occur in seedling/sapling forest size classes.

Forest densities contribute to ecological, social, and economic desired conditions at the stand and landscape scales, including:

- Wildlife habitat, e.g., providing cover and foraging conditions for many species including Canada lynx and flammulated owl, and facilitating tree growth for development of very large trees and future old-growth forest.
- Forest resilience, e.g., reducing competition, improving tree vigor and growth, and reducing forest fuels in areas of the wildland-urban interface.
- Timber productivity on lands suitable for timber production, e.g., maintaining adequate tree growth rates and stocking levels"

**FW-DC-TE&V-14** (old growth) "Forest conditions support the maintenance of existing amounts of old-growth forest and foster an increasing trend in the amount, patch size, and connectivity of old-growth forest into the future, especially in the warm-dry and warm-moist potential vegetation types. Old-growth forest provides conditions that create habitat for old-growth-associated wildlife species. Old-growth forest is distributed widely across the Forest. Forestwide and within individual watersheds, the distribution, patch size, and amount of old-growth forest varies over time, depending upon forest development stage and the influence of climate and natural disturbances. Desired ecological conditions for old-growth forest are displayed in table 9. Refer to glossary for definition of old-growth forest."

**FW-DC-TE&V-14** (old growth) "Desired conditions for snag densities across the Forest are displayed in table 10. At the landscape scale, snag presence, distribution, density, size, and species are highly variable both spatially and over time. Individual stands or sites may have no snags in these size categories or a much higher number of snags per acre, depending upon the unique conditions and disturbance history. The highest densities of snags are generally found in the areas with lower direct human influence, such as wilderness or unroaded areas, in riparian management zones, and in areas that have burned in the recent past or have had recent insect and disease infestations. The lowest densities of snags are found in areas where concern for fire hazard is elevated (such as in portions of the wildland-urban interface); in fuel breaks; in areas with concern for human safety (such as developed recreation sites); and in areas within 200 feet of open roads accessible to firewood cutting (especially those close to human communities). Snags suitable for nesting and denning, particularly in very large sizes (i.e., greater than 20 inches d.b.h.), are present not only in old-growth forests but across the matrix of forest lands, contributing to the diversity of forest structure and to the sustainability of wildlife and pollinator species associated with snags (such as flammulated owls and fisher)."

**Table 2. MON-TE&V-01 plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicators | Data Source / Partner | Data collection interval | Point of Contact |
|---|---|---|---|---|
| FW-DC-TE&V-03<br>FW-DC-TE&V-07, 08, 09, 10 through 15 | IND-TE&V-<br>Proportion (percentage of total acres) for each of these indicators:<br>01. Dominance type (i.e., cover type) – forestwide (FW) only<br>02. Species presence (FW and PVT)<br>03. Forest size class (FW and PVT)<br>04. Tree canopy cover (FW and PVT)<br>05. Old-growth forest—proportion of area (FW and PVT)<br>06. Very large tree presence—proportion of area (FW and PVT)<br>07. Very large tree density, trees per acre. All species combined as well as for this group of species: cedar, Douglas-fir, larch, ponderosa pine, western white pine, cottonwood<br>08. Snag density: Snags per acre ≥ 10 inches d.b.h.; ≥ 15 inches d.b.h.; ≥ 20 inches d.b.h. (FW and PVT) | R1 FIA SUMMARY DATA BASE (R1 FIA SDB)<br><br>R1 Broad Scale Monitoring Strategy (BSMS) Reports (derived from R1 FIA SDB) | FIA plots across the Forest are remeasured on a scheduled basis, with individual plots remeasured every 10 years.<br><br>The R1 summary database is updated periodically, usually every 5 years. | Forest Silviculturist |

### *Methods*

**The source of data for all these indicators is the Region 1 Forest Inventory and Analysis Summary Database (R1 FIA SDB), as described in the introduction to this document.** The Region produces periodic summary reports of this data as part of a Broad Scale Monitoring Strategy (BSMS), and these reports will provide the estimates for use in this FNF forest plan monitoring report. At each monitoring cycle (if there is an updated version of the R1 FIA SDB), the estimated proportions (percentage of total acres) for each of the indicators in Table 2 above are pulled from these BSMS reports to provide the data needed to address the monitoring question. The estimated percentages are entered into the RESULTS tables for each indicator, found in APPENDIX A of this monitoring guide (“***Monitoring_Guide_TERRESTRIAL VEG_APPENDIX A-Results Tables”).***

Because data in the BSMS reports are mostly in acres, and not all the vegetation classifications in the BSMS reports match up exactly with our FNF forest plan vegetation classifications, a SPREADSHEET has been developed to more easily translate the data in the BSMS reports into percentages and into the classes that can be directly compared to the Forest Plan components. This spreadsheet is located in the project record for the Biennial Monitoring Evaluation Report and is titled: ***Monitoring_Guide_TERRESTRIAL_VEG_FIA_Calculations spreadsheet***.

The more specific guidance on methods for each indicator is provided below.

**IND-TE&V-01: Dominance Type (FW-DC-TE&V-07).**

FNF Dominance type development is consistent with the R1 cover type attribute in the R1 FIA summary data base (see table below). Dominance type (= R1 Cover type) is a grouping of the “dominance mid 40” attribute (same as dominance group 6040), as described in the FNF VMap. Refer to Milburn et al (2015)[1] for a detailed description of the Region 1 cover types and the crosswalk to the VMap dominance classes.

NOTE: In the regional BSMS reports, nearly all of the R1 Cover Type classes are consistent with the FNF Dominance types. However, the FNF Dominance Types of Douglas-fir and Grand fir/Cedar do not align with any of the R1 Cover Types. For this reason, the FNF Dominance types of Douglas-fir and Grand fir/Cedar are combined for efficiency in Forest Plan Monitoring, to allow use of the BSMS report data. This is acceptable because the Grand fir/Cedar dominance type comprises a very small portion (less than 2%) of the FNF, and these two species will still be evaluated separately over time under the species presence indicator (IND-TE&V-02). See table below for the overall correlation of FNF Dominance types to R1 Cover types. Use of the spreadsheet *Monitoring_Guide_TERRESTRIAL_VEG_FIA_Calculations* will automatically perform all the combining and calculations of final percentages for Dominance types.

[1] Milburn, Amanda, Barry Bollenbacher, Mary Manning, and Renate Bush. 2015. Region 1 existing and potential vegetation groupings used for broad-level analysis and monitoring. In *Report 15-4 v1.0*. Missoula, MT.

**Table 3. IND-TE&V-01. Correlation of FNF dominance types with the R1 Cover Types in the BSMS Report**

| Flathead Plan Dominance Type | VMap DomMid40 Classes | R1 Cover Type (BSMS report) | Flathead Plan Dominance Type Description | R1 Cover Type Description |
|---|---|---|---|---|
| Ponderosa pine | MX-PIPO | Ponderosa pine | Ponderosa pine dominates | Ponderosa pine dominates. |
| Douglas-fir | IMIX or MX-PSME<br>on Hot Dry and driest of the Warm Dry habitat type groups | Dry Douglas-fir | This R1 cover type is rare on the FNF and was not identified as a separate dominance type for forest planning purposes. Any areas fitting the definitions of this cover type are included in the FNF Douglas-fir dominance type. | These are the driest habitat types within the Warm-Dry Broad PVT where Douglas-fir dominates. Sites could potentially support ponderosa pine, limber pine and juniper. |
| | MX-PSME and IMIX | Mixed Mesic Conifer | Douglas-fir dominates. This dominance type may occur on the warm-dry, warm-moist and cool-moist PVT.<br>Depending on site conditions, WL, LP, ES, AF, WP, GF, C, and/or WH may be present in varying amounts. | Cedar, white pine, grand fir, western hemlock and Douglas-fir may dominate. This cover type could occur on any but the very driest or Cold PVTs. |
| Grand Fir/Cedar | MX-ABGR, MX-THPL, and MX-TSHE | Mixed Mesic Conifer | Grand fir and/or cedar dominate. This type largely occurs in the warm-moist PVT.<br>WL, DF, LP, ES, AF, WP, and/or WH may also be present. | Both the Douglas-fir and the Grand fir/cedar FNF dominance types are included within the R1 mixed mesic conifer cover type classification. |
| Western Larch | MX-LAOC | Western Larch mixed Conifer | Western larch dominates | Western larch dominates |
| Lodgepole pine | MX-PICO | Lodgepole pine | Lodgepole pine dominates | Lodgepole pine dominates |
| Subalpine fir/spruce | MX-ABLA, MX-PIEN, and TMIX. | Spruce/fir | Subalpine fir and/or spruce dominates. | Subalpine fir and/or spruce dominates |
| Whitebark pine | MX-PIAL or MX-LALY | Whitebark pine/Alpine larch | Whitebark pine dominates. | Whitebark pine dominates. |
| Hardwood | MX-BEPA, MX-POPUL, MX-POTR5, or HMIX. | Aspen/ Hardwood | Aspen, cottonwood, birch dominate. May be minor conifer components. | Aspen, cottonwood, birch dominate. May be minor conifer components. |

| Flathead Plan Dominance Type | VMap DomMid40 Classes | R1 Cover Type (BSMS report) | Flathead Plan Dominance Type Description | R1 Cover Type Description |
|---|---|---|---|---|
| Grass/Shrub/ Sparse Vegetation | MX-TABR2 and NONE | Several cover types are identified: Grass, Dry Shrub, Riparian Grass/shrub, Mesic Shrub, and Non-vegetated | Grass, shrub, forb dominated areas, and other non-forested/non-vegetated areas.<br>The Flathead is a heavily forested landscape with very little non-forest cover types. Grouping of all non-forest types was done for purposes of analysis and development of forest plan desired conditions. | A variety of grass, shrub or forb species dominate, depending on site. |

**IND-TE&V-02: Species Presence (FW-DC-TE&V-07 and 08).** Data comes directly from the BSMS reports (converted to percentages in the spreadsheet *Monitoring_Guide_TERRESTRIAL_VEG_FIA_Calculations).* Common abbreviations used for the species are as follows:

PP=ponderosa pine; DF=Douglas-fir; WL=western larch; AF or SAF= subalpine fir; ES=Engelmann spruce; LP=lodgepole pine; GF=grand fir; WRC or C=western redcedar; CW=cottonwood; ASP=quaking aspen; B=birch

**IND-TE&V-03: Forest Size Class (FW-DC-TE&V-10 and 11).** Data comes directly from the BSMS reports, (converted to percentages and FNF Plan size classes in the spreadsheet *Monitoring_Guide_TERRESTRIAL_VEG_FIA_Calculations)*

**Table 4. IND-TE&V-03. Correlation of FNF size classes with the R1 FIA SDB size classes in the BSMS report**

| Flathead Forest plan size classes | BSMS report Tree Size class NTG |
|---|---|
| Seedling/sapling | 0.1-4.9 and Seedling |
| Small tree | 5.0-9.9 |
| Medium tree | 10.0-14.9 |
| Large tree | 15.0-19.9 |
| Very Large tree | 20.0-24.9 and 25.0+ |

**IND-TE&V-04: Forest Density/Canopy Cover (FW-DC-TE&V-13).** Data comes directly from the BSMS reports (combined into forest plan canopy cover classes and converted to percentages in the spreadsheet *Monitoring_Guide_TERRESTRIAL_VEG_FIA_Calculations).* The table below show the correlation of Flathead plan components with the regional BSMS reports.

**Table 5. IND-TE&V-04. Correlation of FNF Forest density with the R1 FIA SDB canopy cover classes in the BSMS report**

| Flathead Forest Plan canopy cover classes | BSMS report canopy cover classes |
|---|---|
| <40% | <10% =Very Low and 10-39% =Low |
| >40% | 40-60% =Moderate and >60% =High |

**IND-TE&V-05: Old Growth (FW-DC-TE&V-14).** Data comes directly from the BSMS reports, already reported out as a percentage forestwide and by PVT.

**IND-TE&V-06: Very Large Tree Presence (FW-DC-TE&V-12).** This is a measure to help assess the distribution of very large live trees across the Forest, defined as the proportion (percent) of area with at least one 20"+ live tree.

Currently (2021) the regional BSMS reports do not provide estimates of very large live tree presence, and it is not anticipated that these estimates will be provided by the region in the future. The estimates for this indicator as currently designed would need to be obtained directly from the R1 FIA SDB by FNF personnel using the Estimator Form as follows: Select the attribute "**presence of live trees 20 in. DBH and larger".** To get estimates by PVT, select **"R1 broad habitat group**s" in the grouping field on the estimator form.

Alternative Estimate Recommended for IND-TE&V-06: Large Tree Structure Classes:

The attribute "Large Tree Structure" in the R1 FIA SDB is reported at the Regional level in the BSMS reports. For purposes of efficiency in Forest Plan monitoring (to minimize direct querying of FIA by FNF personnel, who may or may not be trained in this task), and to provide a meaningful assessment of large and very large tree conditions across the Flathead over time, it is recommended to modify IND-TE&V-06 to utilize this "Large Tree Structure" attribute in the R1 FIA database. This new indicator is described below.

> Large Tree Structure definitions were developed by regional resource specialists to describe minimum densities of larger trees that are ecologically meaningful and likely to contribute substantially to ecosystem function, such as those associated with wildlife habitat and post-disturbance forest conditions (Milburn et al, 2019[2]). The table below provides definitions of the large tree structure attribute.

**Table 6. Definition of "Large Tree Structure" attribute in the R1 FIA Summary Data Base**

| | Region 1 Broad PVT | Large[a] (TPA >=15" DBH) | Very Large[b] (TPA >=20" DBH) | Both[c] | None[d] |
|---|---|---|---|---|---|
| Western Montana | Warm Dry | 10 | 8 | Both the Large and Very Large TPA criteria are met | Neither the Large or Very Large TPA criteria are met |
| | Warm Moist or Cool Moist | 10 | 10 | | |
| | Cold | 10 | 10 | | |

**Notes:**

a. "Large" is assigned to stands/plots that contain the required TPA for live trees with DBH >=15" but do not contain the minimum TPA for live trees with DBH >=20" to qualify as Very Large

b. "Very Large" is assigned to stands/plots that contain the required TPA for live trees with DBH >=20" but do not contain the minimum TPA for live trees with DBH >=15" to qualify as Large. The total stands/plots that contain Very Large tree structure would include those classified as Very Large and Both.

[2] Milburn, Amanda. G. Carnwath, S. Fox, E. Henderson, R. Bush. 2019. Region 1 Large Tree Structure Classification Used for Broad Level Analysis and Monitoring. Region One Vegetation Classification, Mapping, Inventory and Analysis Report 19-03, v1.0. USDA Forest Service Region 1, Missoula, MT. October 16, 2019.

c. "Both" is assigned to stands/plots that contain the required TPA for live trees with DBH >=15" to qualify as Large, as well as the required TPA for live trees with DBH >=20" to qualify as Very Large.
d. "None" is assigned to stands/plots that do not have the required TPA in live trees meeting or exceeding thresholds to qualify as either Large or Very Large Tree class.

**IND-TE&V-07 Very Large Tree Density (FW-DC-TE&V-12):** This is a measure that helps assess the abundance of very large live trees where they exist, defined as the trees per acre of live trees 20"+ DBH across the area.

Currently the regional BSMS reports do not provide estimates of very large live tree density under the specific parameters of this indicator (forestwide, by PVT and by species). It is not anticipated these types of estimates will be provided in regional reports in the future. HOWEVER, the regional snag density reports (see below under IND-TE&V-08) DO provide an estimate of density of 20"+ DBH trees by PVT. These estimates are reported forestwide for areas "Inside Wilderness/Roadless" and areas "Outside Wilderness/Roadless", and there are no differentiation by species. For efficiency in Forest Plan monitoring, it is recommended that IND-TE&V-07 be reworded to be consistent with the estimates provided in these regional snag density reports, which are and will be produced periodically at the regional level. Reporting inside and outside Wilderness/roadless would be a minor change to the original indicator and provide similar and perhaps even more meaningful estimates of very large tree densities. These estimates would be for all species combined. Reporting densities of very large trees by species or groups of species is a substantially more complicated query of FIA data base that would have to be done by FNF personnel at each monitoring period. Expertise at the Forest level to perform this task is likely to be an issue. If this species data is determined to be a critical need for Forest plan monitoring, R1 Forest inventory and Analysis staff would need to be contacted to help in obtaining the estimate.

**IND-TE&V-08: Snag Densities (FW-DC-TE&V-15).**

Snag and live tree density reports are published periodically by the region as part of the Broad Scale Monitoring Strategy. Estimates for this indicator would come directly from a table in this report. In the most recent publication (Bush and Reyes 2020[3]), this data was located in Table 1 in Appendix B of the publication. This table displays estimates of snag densities for trees 10"+, 15"+ and 20"+ DBH by R1 Snag Analysis Groups. All plots/stands that have a Dominance Group 40% Plurality of MX-PICO (lodgepole pine dominance) are in the PICO group; all other FIA plots are analyzed by R1 Broad PVT Groups, Cold and Cool Moist are combined. There is no estimate of snag densities forestwide, so it is recommended that this forestwide estimate be dropped from the indicator language.

[3] Bush, Renate, and Brian Reyes. 2020. Estimates of Snag and Live-Tree Densities for Western Montana Forests in the Northern Region Based on FIA Hybrid 2011 Analysis Dataset. Region One Vegetation Classification, Mapping, Inventory and Analysis Report 20-02 v. 1.0. USDA Forest Service Region 1, Missoula, MT. October 16, 2020.

## Results

**Table 7. Monitoring Evaluation Report – summary of data sources for MON-TE&V-01 – Key Ecosystem and Vegetation characteristics**

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| 2021 | IND-TE&V-01, 02, 03, 04, 05, 06, 07 | Hybrid FIA 2015 Analysis Dataset – data collected on FIA plots 2006-2015.<br>Forestwide acres: 2,350,690 | High level of confidence in data. Using standardized USFS datasets and procedures used for monitoring vegetation characteristics |
| 2021 | IND-TE&V-08 | The regional snag estimate tables are based on the Hybrid FIA 2011Analysis Database (same as used in the analysis for the 2018 FNF Forest Plan). Updates to the snag estimate tables based on Hybrid FIA 2015 database are not available at this time. | Same as above |

## Discussion of Results

RESULTS TABLES containing the Baseline (2018) Forest Plan estimates and the 2021 monitoring report estimates for ALL the vegetation indicators are found in the document *Monitoring_Guide_TERRESTRIAL VEG_ResultsTables*, located in the project record.

### Factors to be aware of at each monitoring cycle when assessing results

1. The mean values are estimates – small changes in percent from one period to the next may not indicate a consistent or true trend. Evaluate the means relative to the confidence intervals. The 90% CI indicates a 90% certainty that the true mean is within that range. Related to this is the rate of change that naturally occurs in forested ecosystems, as described in #2 below.

2. It is likely to take many decades to reliably detect persistent, long-term trends for vegetation indicators. Incremental changes in the mean values for vegetation conditions may be detected over short periods of time (such as over the 15-20 year life of the plan), but uncertainty as to the direction, degree and consistency of this change over time exists (see #1 above). Natural succession and disturbances are by far the primary agents of vegetation change on the FNF. Tree harvest/thinning and the like is a minor agent of change (historically <2% of the Forest per decade), and overwhelmingly occurs on the lands designated suitable for timber production (about 17% of the FNF). Natural succession is relatively slow and gradual – change can take decades to detect. Natural disturbances such as fire may cause rapid change, but periods with severe fire over large areas occur infrequently, e.g., every 80 to 130 years under the natural fire regimes. The inter-action of these ecological processes and natural (and human) disturbances result in a landscape with highly variable and dynamic vegetation conditions when observed over a long time period. This is why a wide range of natural variation is the norm for most of the vegetation indicators, as reflected in the desired conditions. A long-term increasing trend in a vegetation condition may display short-term decreasing trends along the way.

### Desired status/trends to evaluate at each monitoring cycle

Certain vegetation conditions and trends have been identified as particularly important to the Forest's adaptation strategy for providing for biodiversity, wildlife habitat needs and maintaining/restoring resilient and resistant forest conditions (USDA Forest Service, 2017)[4]. These conditions are listed in the table below. Discussion and evaluation for MON-TE&V-01 will focus on these conditions, responding to the question "are the results of the monitoring consistent with the desired trend/status?".

For tables showing the Forest Plan desired conditions, and the 2021 monitoring results for all the vegetation indicators under MON-TE&V-01, see the spreadsheet in the project record: *Monitoring_Guide_TERRESTRIAL VEG_ResultsTables.*

**Table 8. MON-TE&V-01: Discussion of results for vegetation conditions important to FNF adaptation strategy.**

| Desired status/trends | Monitoring date 2021 | Monitoring data xxxx |
|---|---|---|
| | Results (compared to Forest Plan baseline conditions)★ | Results (compared to 2021 monitoring results) |
| **IND-TE&V-01, 02**: To improve forest resiliency and wildlife habitat values:<br>Increase ponderosa pine dominance type and the presence of ponderosa pine, particularly in the warm-dry PVT | Dom Type FW: No change;<br>Presence:<br>FW: -0.1%<br>WD: +0.3% | |
| **IND-TE&V-01, 02:** To improve forest resiliency and wildlife habitat values:<br>Increase western larch dominance type and the presence of western larch, forestwide and within the warm-dry, cool-moist and warm-moist PVT | Dom Type FW: 1% increase;<br>Presence:<br>FW: no increase<br>WD: +6%<br>WM: no change<br>CM: no change | |
| **IND-TE&V-01, 02:** To improve forest resiliency and wildlife habitat values:<br>Increase presence of whitebark pine forestwide and in the cold and cool-moist PVT | Presence:<br>FW: No change<br>CM: -0.4%<br>Cold: No change | |
| **IND-TE&V-01, 02:** To improve forest resiliency and wildlife habitat values:<br>Increase presence of western white pine in the cool-moist and warm-moist PVT | Presence:<br>WM and CM: -0.1% | |

[4] Final Environmental Impact Statement for the Forest Plan, Flathead National Forest. Volume 1, Section 3.3.9. December 2017. USDA Forest Service, Flathead National Forest, 650 Wolfpack Way, Kalispell, MT 59901

| Desired status/trends | Monitoring date 2021<br>Results (compared to Forest Plan baseline conditions)★ | Monitoring data xxxx<br>Results (compared to 2021 monitoring results) |
|---|---|---|
| **IND-TE&V-01, 02:** To improve resiliency of forests, limiting susceptibility to insects and disease:<br>Maintain Douglas-fir dominance type and species presence within the desired condition (DC) - forestwide and within the warm-moist and cool moist PVTs. (Forest Plan Tables 2, 3, and 4 for DCs)<br>Decrease presence of Douglas-fir in the warm-dry PVT. | Dom type FW: 19.3%, no change from baseline, w/in DC<br>Presence:<br>FW: 35%, no change, w/in DC<br>WD: 76.1%, no change, above DC<br>WM: 49%, decrease of 0.1% from baseline, w/in DC<br>CM: 35.6%, no change, w/in DC | |
| **IND-TE&V-01, 02**: To maintain Lynx habitat values,<br>Maintain subalpine fir/spruce dominance type and presence forestwide within desired ranges (30-45% for dominance type; 55-74% for presence).<br>Maintain presence of subalpine fir within the desired ranges in the cool moist PVT (69-85% desired) and cold PVT (50-90 desired. | Dom type FW: 41.5%, a decrease of 2%, w/in DC<br>Presence: Spruce<br>FW: 44.3%, no change, w/in DC<br>CM: 53.7%, no change, w/in DC<br>Cold: 33.2, decrease of ~7%, below DC<br>Presence: Subalpine fir<br>FW: 60.4%, decrease of ~1%, w/in DC<br>CM: 67.4%, decrease of ~2%, just below the DC<br>Cold: 76.4%, decrease of ~5%, w/in DC | |
| **IND-TE&V-01, 02**: To increase forest diversity and wildlife habitat values:<br>Maintain or increase the hardwood dominance type and the presence of aspen, cottonwood and/or birch, forestwide | Dom type FW: +0.1%<br>Presence:<br>FW: Aspen +0.7%; Birch +0.1%; Cottonwood -0.2% | |
| **IND-TE&V-03:** To provide for desired forest structural diversity across the landscape:<br>Maintain or decrease proportion of small and medium forest size classes forestwide and within all PVTs. | FW: increase of 1% in both small and med size class<br>WD: Small +2%, Med +8%<br>WM: Small -2%; Med +2%<br>CM: Small +5%, Med +3%<br>Cold: Small +8%; Med +3% | |
| **IND-TE&V-03:** To provide for desired forest structural diversity across the landscape:<br>Increase proportion of large and very large forest size classes forestwide and within all PVTs | FW: Lg no change; VLg -0.2%<br>WD: Lg +1%; VLg +0.3%<br>WM: Lg +0.7%; VLg +1%<br>CM: Lg +1%; VLg +0.2%<br>Cold: Lg +0.1%; VLg -0.5% | |

| Desired status/trends | Monitoring date 2021 | Monitoring data xxxx |
|---|---|---|
| | Results (compared to Forest Plan baseline conditions)★ | Results (compared to 2021 monitoring results) |
| **IND-TE&V-04:** To provide for desired forest structural diversity across the landscape:<br>Decrease higher-density forest conditions focusing on the warm-dry potential vegetation type and portions of the cold potential vegetation type with whitebark pine. | FW: no measurable change<br>By PVT, for the >=40% canopy cover class:<br>WD: -3%<br>Cold: -1% | |
| **IND-TE&V-05:** To provide for desired forest structural diversity and improve wildlife habitat conditions:<br>Maintain or increase amount of old growth forest | FW +0.1<br>WD -0.6<br>WM +0.7<br>CM +0.3<br>Cold -1.1% | |
| **IND-TE&V-06:** To provide for desired forest structural diversity and improve wildlife habitat conditions:<br>Maintain or increase the proportion of area (FW and by PVT) where Large and Very Large Tree Structure classes occur | FW: LgTree +0.1%, VLg -0.1%<br>WD: LgTree -1.6%, VLg -1.4%<br>WM: LgTree no change, VLg +1.2%<br>CM: LgTree **+**1.8%, VLg -0.9%<br>Cold: LgTree -0.2%, VLg -2.3% | |
| **IND-TE&V-07:** To provide for desired forest structural diversity and improve wildlife habitat conditions:<br>Maintain or increase density (tpa) of very large live trees in all PVTs, Inside and Outside Wilderness/Roadless areas | No trend data available at this monitoring cycle. (updates to snag/live tree estimate reports not completed in time for this monitoring report) | |
| **IND-TE&V-08:** To provide for desired forest structural diversity and improve wildlife habitat conditions:<br>Maintain snag conditions within the desired ranges (Forest Plan Table 10) | No trend data available at this monitoring cycle. (updates to snag/live tree estimate reports not completed in time for this monitoring report) | |

★ Abbreviations: FW-forestwide; WD=warm dry pvt; WM=warm moist pvt; CM=cool moist pvt; C=cold pvt

As a whole, most of these key vegetation conditions related to forest resilience, diversity, and wildlife habitat conditions have experienced little to no change from the baseline Forest Plan conditions. This is not too surprising as there is a less than 10-year time difference between the date of plot measurements for the FIA datasets used in the Forest Plan (baseline) and this monitoring report. Changes and trends indicated in the table above are discussed further below. More time will be necessary to confirm whether trends and changed conditions remain consistent over time.

One of the more notable desired changes is the increase in western larch in the warm-dry PVT. Ponderosa pine is also showing a desirable upward trend in the WD PVT, though much smaller amount of increase

compared to WL. Desired upward trends in presence/dominance type for western white pine and whitebark pine are not occurring. Douglas fir has not noticeably changed from baseline, and remains within the desired condition range, except for the warm-dry PVT, where it is still notably above the desired condition. Proportion of subalpine fir has shown an apparent decrease forestwide and within the CM and Cold PVTs, falling below the desired condition in the cool moist PVT. This is most likely due to the large-scale wildfires that occurred across the forest in the decade 2001-2010. Hardwood species have shown an overall increase, particularly in aspen and birch, which is consistent with desired trend.

Forest wide there has been an apparent small increase in the small and medium size classes, though conditions remain within the desired condition ranges. Within the PVTs, the proportion of small and medium forest size classes has mostly increased. In some cases, this means that the proportions of these size classes remain slightly above the desired range. The large and very large forest size classes have also shown mostly an increase over the baseline, though generally a smaller increase than that of the small and medium size classes. Proportions in all of the forest size classes will fluctuate over time in response to both natural succession/growth of forests and natural disturbances, such as fire. Desirable decreases in forest density have been occurring, though small in magnitude.

Old growth forest has changed only very slightly over the monitoring period, with nearly no change detectable at the forestwide level. There has been a slight increase apparent in the warm moist and cool moist PVTs; a slight decrease in the warm dry PVT; and the largest decrease (though still small) in the cold PVT. Several more monitoring periods are necessary before the consistency of these trends can be determined. Large wildfire events are the primary factor that would reduce amounts of old growth. A large amount of acres burned (over 400,000 acres) on the Flathead NF during this past 20 year period (particularly in the decade 2001 to 2010), which is the period over which the FIA plot data was measured.

Trends in Large/Very Large Tree Structure classes vary depending upon the PVT. The changes in these structure classes generally are consistent with the results of old growth monitoring., which would be expected as these structure classes are designed to provide another metric identifying identify forest structures with minimum larger tree densities that are ecologically meaningful and contribute to ecosystem functions, such as wildlife habitat (as described under the *Methods* section above). Forest wide there has been nearly no change in the amount of Very Large Tree Structure class. Within the PVTs, changes in Large/Very Large Tree Structure classes vary. The cold and warm dry PVTs have experienced drops in amount of both Structure classes, though relatively small (except perhaps for the Very Large Tree Structure class in the cold PVT). These changes indicate a loss of some of the largest trees (20 inches D.B.H. and above) across portions of the forest, very likely due to fires (large number of acres burned in past 20 years), pathogens such as root disease and bark beetles (very large trees tend to be more vulnerable), and maybe to harvesting in limited areas of the forest. However, there appears to be an increase in the Large Tree Structure class in the cool moist PVT, and the Very Large Tree Structure class in the warm moist PVT. Forest growth and succession continues to add to the larger tree structure classes over time. It will take several monitoring periods to determine if any of these increases or drops in Large/Very Large Tree Structure classes are consistent over time.

## Recommended changes in monitoring indicators and data sources

Based on the discussion in the *Methods* section above, the following changes in the Forest Plan monitoring program are recommended for indicators.

**Table 9. Recommended changes in monitoring indicators**

| Original Indicator | Recommended Change | Data source |
|---|---|---|
| **IND-TE&V-06.** Very large tree presence—proportion of area (FW and PVT) | **IND-TE&V-06.** Proportion of area (FW and by PVT) where large and very large tree structural components occur at densities that contribute to ecosystem functions. | Estimates come directly from the "**Large Tree Component"** attribute in the R1 FIA Summary Database, and are reported out FW and by R1 Broad PVT Groups in the regional BSMS reports. |
| **IND-TE&V-07.** Very large tree density, trees per acre. All species combined as well as for this group of species: cedar, Douglas-fir, larch, ponderosa pine, western white pine, cottonwood | **IND-TE&V-07.** Density (tpa) of very large live trees, by PVT (Snag Analysis Group), Inside and Outside Wilderness/Roadless areas. | Estimates come directly from a table in the "**Snag and Live tree density" report**, produced as part of the regional BSMS.<br>(Appendix B, Table 3 in the 2020 publication) |
| **IND-TE&V-08.** Snag density: Snags per acre ≥ 10 inches d.b.h.; ≥ 15 inches d.b.h.; ≥ 20 inches d.b.h. (FW and PVT) | **IND-TE&V-08.** Snag density: Snags per acre ≥ 10 inches d.b.h.; ≥ 15 inches d.b.h.; ≥ 20 inches d.b.h., by PVT (Snag Analysis Group) | Estimates come directly from a table in the **"Snag and Live tree density" report,** produced as part of the regional BSMS.<br>(Appendix B, Table 1 in the 2020 snag publication) |

## *Evaluation of Results for Adaptive Management Finding*

The following findings and recommendations resulted from the evaluation of monitoring results as documented above.

**Table 10. Summary of Findings for Monitoring Item MON-TE&V-01**

| |
|---|
| **1. Plan Monitoring Results**: Does the monitoring question and indicator(s) provide the information necessary to understand the status of the associated plan component listed above? |
| YES, with some changes to indicators. |
| Recommendations – Most of the indicators provided information necessary, with recommendation for minor modification of three indicators, due to availability and efficiency of data source. See table 9 above. |
| **2. Plan Implementation Status [1]:** Do monitoring results demonstrate progress of the associated plan components for with this monitoring item? |
| UNCERTAIN (B). Veg conditions at this monitoring show small change from the existing conditions in the plan, and will take more time in the next monitoring cycle to be certain of trends in vegetation conditions over the long term, and determine whether implementation of plan provides desired changes. |
| **Recommendation** - NA |
| **3. Type of change under consideration [2]:** If corrective action/change was indicated under either #1 or #2, where might that change might be needed? |
| Forest Plan Monitoring Program |

[1] **PLAN IMPLEMENTATION STATUS: (A) Uncertain –** Availability of data or Interval of data collection beyond this reporting cycle (*indicate date of next time this monitoring item will be evaluated*); **(B) Uncertain -** More time/data are needed to understand status or progress of the plan component(s)**; (C) Uncertain -** Methods inadequate to assess the status or progress toward achieving plan component(s); (**D**) **NO** - Implementation of plan component(s) ARE NOT trending, progressing, and/or conducted as desired**; (E) YES -** Implementation of plan component(s) ARE trending, progressing, and/or conducted as desired

[2] **CHOICES for where change may be needed include**: Monitoring program, plan component, management activity, plan assessment, program strategy or approaches documents, public engagement strategy.

## MON-TE&V-02. What is the change in amount and severity of wildfire and the status of fire regimes?

### *Introduction*

This monitoring question is central to the evaluation of the ecological sustainability of the fire-adapted ecosystems of the Forest. Trends in amount and severity of fire over time provide insight into how ecological processes and disturbances, and associated forest conditions, may be responding to environmental changes, such as a changing climate. This indicator also provides information that will inform the evaluation of trends in wildlife habitat conditions for species associated with recently burned forests.

The desired condition FW-DC-FIRE-04 is monitored under this indicator and states: "Wildland fires burn with a range of intensity, severity, and frequency that allows ecosystems to function in a healthy and sustainable manner and meets desired conditions for other resources, including wilderness. Wildland fire is accepted as a necessary process integral to the sustainability of the Forest's fire-adapted ecosystems."

FW-DC-TE&V-25 states the following: "Planned and unplanned ignitions occur periodically and create recently burned forest conditions (a fire event within the preceding 10 years) that trend towards desired conditions for plant and wildlife species associated with burned forest (such as the black-backed woodpecker and northern hawk owl). Recently burned forests are consistent with the natural range of variation at the landscape scale. Salvage within burned forests to meet desired conditions may occur in certain circumstances, as described in other sections of this forest plan (see Forest Vegetation Products: Timber section and suitability determinations under each management area). Desired characteristics for recently burned forests are described in table 13."

An abbreviated summary of the Forest Plan's table 13 describing the desired conditions is provided in the table below.

**Table 11. Desired condition FW-DC-TE&V-25 table 13 in the Flathead Forest Plan for amount and severity of wildlfire**

| Severity | Natural range of variation | Description |
|---|---|---|
| Moderate- (greater than 40% mortality of trees in small to large size classes) to high-severity recently burned forest (greater than 70% mortality of trees) | 1-18% of NFS lands in a decade<br>*Up to ~420,000 acres* | Burn areas widely distributed; most are within wilderness and larger unroaded lands; burned patches all sizes, with weighted average patch size up to 37,000 acres; diverse sizes and densities of snags. |
| Low-severity recently burned forest (less than 30% mortality of trees in medium and larger size classes) | 0-2% of NFS lands in a decade<br>*Up to ~48,000 acres* | Uncommon, mostly in warm-dry PVT and in more sparsely vegetated areas in cold PVT. Fire-scorched conifers over 20 inches d.b.h. are present for cavity nesting or denning species. Smaller snags are abundant in some areas, depending on pre-fire conditions. |

**Table 12. MON-TE&V-02 plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicators | Data Source / Partner | Data collection interval | Point of Contact |
|---|---|---|---|---|
| FW-DC-TE&V- | IND-TE&V- | R1 Fuels Report | Data compiled annually at | Primary-Forest fire |

| Plan Component(s) | Indicators | Data Source / Partner | Data collection interval | Point of Contact |
|---|---|---|---|---|
| 03, 25<br>FW-DC-FIRE-04 | 09. Forestwide acres burned by wildfire by severity class (low, medium, high) and acres not burned | Monitoring trends in burn severity (MTBS) interagency program. | forestwide scale. | management officer;<br>Secondary-Forest Silviculturist |

## *Methods*

The US Forest Service's Remote Sensing Application Center (RSAC) conducts an analysis of burn severity in large wildfires at the regional level. If the fire is large enough and data is available in a timely manner, the interagency program "monitoring trends in burn severity" (MTBS) would be the source of the burn severity information. The primary objective of MTBS is to provide consistent burn severity data and fire perimeters for all large fires within the United States. MTBS maps all fires 1000 acres or greater for the western U.S. and across all land ownerships for the period 1984 and beyond. Geospatial and tabular data are provided, including a thematic raster image of burn severity classes for the inventoried fires. Maps and other information on MTBS is available at their website https://www.mtbs.gov/. The MTBS data would be accessed and summarized for the Forest for acres burned in large fires annually at low, medium and high severity.

At the regional level, the BSMS reports may provide a summary of the wildfires and their burn severities using the data provided by RSAC. If this data is available by forest, it would serve as the data source for IND-TE&V-09. For this indicator, data would be summarized for each year of the monitoring cycle, starting with the year 2018, when the revised Forest Plan was adopted.

Wildfire boundaries are also mapped and entered into the Forest GIS data library, for fires of all sizes. This is also a data source for location and area burned by wildfire. However, burn severity is not mapped in the Forest GIS layers.

## *Results*

**Table 13. Monitoring Evaluation Report – summary of data sources for MON-TE&V-02 – Amount and severity of wildfire and status of fire regimes**

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| 2021 | IND-TE&V-09 | Monitoring trends in burn severity (MTBS) interagency program, reported in regional BSMS report for fires on an annual basis. MTBS reports are delayed by 2 or more years after the fire season. | High |

The tables and figures below display the fire severity data from the MTBS database for the Flathead National Forest, as summarized by forest under the Regional Broad Scale Monitoring Strategy (BSMS reports). No summary data by forest prior to the year 2015 is available.

**Table 14. Acres burned annually and percent of fire area that burned at low, moderate and high severity for the FNF of wildfires greater than >1000 acres in size, as reported in the MTBS database**

| FIRE YEAR | Total ACRES BURNED (fires>1000 acs) | Low severity Acs/% | Moderate severity Acs/% | High severity Acs/% | Other (unburned to underburned, or uncertain) Acs/% |
|---|---|---|---|---|---|
| 2015 | 88,470 | 20,079/23% | 20,377/23% | 29,388/33% | 18,626/21% |
| 2016 | 0 | 0 | 0 | 0 | 0 |
| 2017 | 88,196 | 30,748/35% | 18,134/20% | 25,489/29% | 13,825/16% |
| 2018 | 8421 | (no data) | (no data) | (no data) | (no data) |
| **TOTAL ACRES** | **185,087** | **--** | **--** | **--** | **--** |

**Table 15. Percent of the national forest lands on the FNF that burned by wildfire, by year and by fire severity as reported in the MTBS database.**

| FIRE YEAR | Total acres burned | Low Severity | Moderate Severity | High Severity | Other |
|---|---|---|---|---|---|
| 2015 | 3.8% | 0.8% | 0.8% | 1.2% | 0.8% |
| 2016 | 0 | 0 | 0 | 0 | 0 |
| 2017 | 3.8% | 1.3% | 0.8% | 1.4% | 0.6% |
| 2018 | 0.4% | unknown | unknown | unknown | unknown |
| **TOTAL %** | **8.0%** | **--** | **--** | **--** | **--** |

*Total acres for the FNF = 2,350,700 acres

Figure 1 and Figure 2 below display the acres burned in 2015 and 2017 by burn severity. Fire severity data for the year 2018 was not available at the time this monitoring report was being prepared.

| FORESTNAME | Flathead National Forest | Monitoring Trends In Burn Severity | | | 2015 |
|---|---|---|---|---|---|
| **Sum of ACRES** | **Column Labels** | | | | |
| **Row Labels** | **Unburned/Underburned to Low Burn Severity** | **Low Burn Severity** | **Moderate Burn Severity** | **High Burn Severity** | **Grand Total** |
| warmdry | 20.64% | 29.53% | 25.23% | 24.60% | 100.00% |
| warmmoist | 2.87% | 12.75% | 21.27% | 63.11% | 100.00% |
| coolmoist | 16.84% | 22.16% | 25.44% | 35.56% | 100.00% |
| cold | 24.60% | 20.91% | 19.68% | 34.82% | 100.00% |
| riparianwetland | 16.67% | 33.33% | 50.00% | 0.00% | 100.00% |
| grassland | 65.46% | 22.87% | 9.37% | 2.30% | 100.00% |
| mesicshrub | 41.74% | 36.36% | 20.25% | 1.65% | 100.00% |
| sparse | 62.83% | 26.74% | 7.07% | 3.36% | 100.00% |
| **Grand Total** | **20.77%** | **22.78%** | **23.12%** | **33.34%** | **100.00%** |

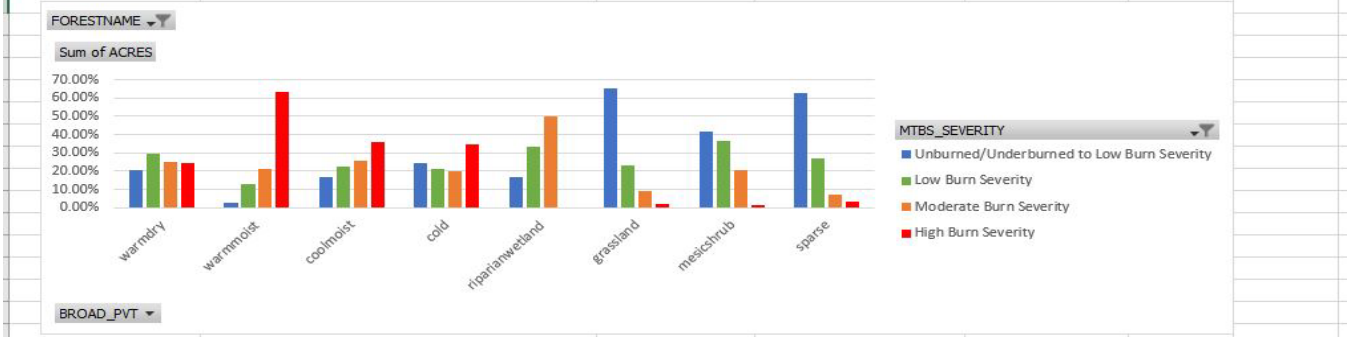


**Figure 1. YEAR 2015: Fire severity data (from MTBS) by Broad PVT for fires >1000 acres on the FNF**

| FORESTNAME | Flathead National Forest | Monitoring Trends In Burn Severity | | | 2017 |
|---|---|---|---|---|---|
| **Sum of Acres** | **Column Labels** | | | | |
| **Row Labels** | **Unburned/Underburned to Low Burn Severity** | **Low Burn Severity** | **Moderate Burn Severity** | **High Burn Severity** | **Grand Total** |
| warmdry | 16.08% | 44.88% | 21.64% | 17.40% | 100.00% |
| warmmoist | 53.45% | 35.78% | 3.88% | 6.90% | 100.00% |
| coolmoist | 13.45% | 31.09% | 22.23% | 33.23% | 100.00% |
| cold | 15.23% | 33.93% | 20.24% | 30.60% | 100.00% |
| riparianwetland | 4.76% | 33.33% | 33.33% | 28.57% | 100.00% |
| grassland | 22.79% | 67.04% | 7.64% | 2.53% | 100.00% |
| mesicshrub | 14.29% | 65.08% | 9.52% | 11.11% | 100.00% |
| sparse | 24.61% | 48.38% | 15.40% | 11.61% | 100.00% |
| **Grand Total** | **15.08%** | **35.11%** | **20.71%** | **29.11%** | **100.00%** |

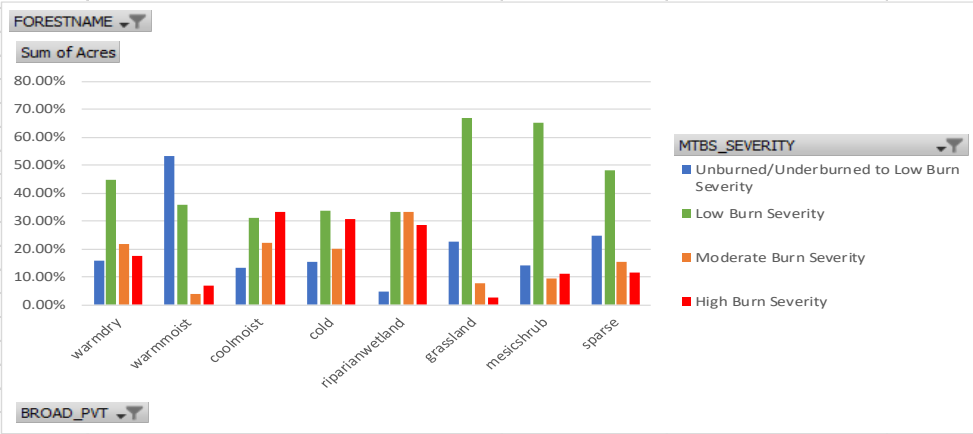


**Figure 2. YEAR 2017 Fire severity data (from MTBS) by Broad PVT for fires >1000 acres on the FNF.**

## *Discussion of Results*

For each monitoring cycle, the acres burned and severities over the previous 10 years on FNF lands should be compared to desired condition (NRV), and trends over time should be evaluated.

- *Is the amount and severity of fire remaining within the natural range of variation at the landscape scale?*

There is not yet a full decade worth of fire data available in order to compare the total acres recently burned by severity class on a decadal basis, as would be required to compare to the desired condition. However, the total amount of acres burned in the years 2015 to 2018, for which data is available, is 185,087 acres, or about 8% of the FNF. At this point, this is at the low end of the decadal NRV for the total amount of fire on the FNF.

- *Is there a notable trend in fire severities or amount over time?*

There is only 4 years of fire data for this monitoring cycle, and this is insufficient time to determine trends for fire severity or amount. Several more monitoring periods are required.

### *Evaluation of Results for Adaptive Management Finding*

The following findings and recommendations resulted from the evaluation of monitoring results as documented above.

**Table 16. Summary of Findings for Monitoring Item MON-TE&V-02**

| |
|---|
| **1. Plan Monitoring Results**: Does the monitoring question and indicator(s) provide the information necessary to understand the status of the associated plan component listed above? |
| YES with edit to monitoring program |
| Recommendations – slight edit to forest plan monitoring program, see below |
| **2. Plan Implementation Status [1]:** Do monitoring results demonstrate progress of the associated plan components for with this monitoring item? |
| UNCERTAIN. (**B)** More time/data (at least until the next monitoring cycle or perhaps even longer) are needed to understand status or progress of the Plan Component(s)**;** |
| **Recommendation** – |
| **3. Type of change under consideration [2]:** If corrective action/change was indicated under either #1 or #2, where might that change might be needed? |
| Forest plan monitoring program: Drop FW-DC-TE&V-03 from the list of forest plan components monitored for MON-TE&V-02. Monitoring question does not relate specifically enough to this DC. |

[1] **PLAN IMPLEMENTATION STATUS: (A) Uncertain –** Availability of data or Interval of data collection beyond this reporting cycle (*indicate date of next time this monitoring item will be evaluated*); **(B) Uncertain -** More time/data are needed to understand status or progress of the plan component(s)**; (C) Uncertain -** Methods inadequate to assess the status or progress toward achieving plan component(s); (**D**) **NO** - Implementation of plan component(s) ARE NOT trending, progressing, and/or conducted as desired**; (E) YES -** Implementation of plan component(s) ARE trending, progressing, and/or conducted as desired

[2] **CHOICES for where change may be needed include**: Monitoring program, plan component, management activity, plan assessment, program strategy or approaches documents, public engagement strategy.

## MON-TE&V-03. What is the change in the insect hazard and root disease severity?

### *Introduction*

Trends in amount of area at various insect or disease hazard levels or severity of impact provides insight into how ecological processes and disturbances, and associated forest conditions, may be responding to environmental changes, such as a changing climate. Forest plan desired condition FW-DC-TE&V-20 states: "Native insect infestations and disease activity occur periodically within the range of natural variability, influencing forest successional processes and providing structural features such as snags and downed wood that contribute to fish and wildlife habitat."

**Table 17. MON-TE&V-03 plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicators | Data Source / Partner | Data collection interval | Point of Contact |
|---|---|---|---|---|
| FW-DC-TE&V-03 and 20 | IND-TE&V-<br>10. Acres or percent of Douglas-fir beetle hazard, mountain pine beetle hazard, western spruce budworm hazard, and root disease severity | R1 FIA Summary Database<br>Detailed information about the FIA program can be found at: http://fsweb.r1.fs.fed.us/forest/inv/fia_data/index.shtml | FIA plots across the Forest are remeasured on a scheduled basis, with individual plots remeasured every 10 years.<br>The R1 summary database is updated periodically, usually every 5 years. | Forest Silviculturist |

### *Methods*

Reports containing the estimated values from FIA data for indicator IND-TE&V-10 are obtained from the FIA data, with summaries of this data provided in the Forest Health Protection portion of the Regional BSMS reports. The following estimates from the reports would be used for the FNF monitoring:

**Table 18. Forest plan monitoring indicator for insect hazard and root disease severity and the estimate in the BSMS report to use**

| Monitoring Indicator | BSMS Report estimate name |
|---|---|
| Douglas-fir (DF) beetle hazard | Douglas-fir beetle hazard |
| Mountain pine beetle (MPB) hazard | Combined Beetle hazard (all pine species that are affected are included) |
| Western spruce budworm hazard | According to regional insect and disease specialists, estimates from the FIA database on defoliator hazard rating have not been sufficiently reviewed and they recommend not using this data. |
| Root disease severity | Root disease severity |

### *Results*

**Table 19. Monitoring Evaluation Report – summary of data sources for MON-TE&V-03 – Insect and Disease hazard/severity**

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| 2021 | IND-TE&V-10 | R1 Hybrid FIA 2015 Analysis Dataset – | High level of confidence in data. |

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| | | data collected on FIA plots 2006-2015. | Using standardized USFS datasets and procedures used for monitoring vegetation characteristics |

**Table 20. Monitoring report results for MON-TE&V-03, Insect and Disease hazard/severity.**

| Indicator | Forest Plan – Baseline conditions* | | | | Monitoring date: | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2021 | | | | | | | |
| **Percent area Forestwide** | **0** | **L** | **M** | **H** | **0** | **L** | **M** | **H** | **0** | **L** | **M** | **H** |
| **DF Beetle hazard** | 73 | 14 | 10 | 3 | 68 | 18 | 11 | 3 | | | | |
| **MPB hazard-LPP** | 80 | 6 | 10 | 4 | 71 | 15 | 12 | 2 | | | | |
| **Root disease severity** | 53 | 22 | 22 | 3 | 39 | 49 | 12 (M&H combined) | | | | | |

* Hybrid FIA 2011

## *Discussion of Results*

- *Are the levels of insect hazard and root disease severity trending upwards? If so, what might be influencing this trend, and is there reason for concern? Factors to consider include: rate of change; changes in vegetation conditions (such as dominance types, size classes) that may be influencing insect and disease trends*

DFB hazard appears to have changed little, though the slight rise in low hazard may reflect the result of forest growth and succession, with the DF dominance types increasing in density and size. Similarly, the increase of root disease severity into the low to moderate severity classes may also be associated with successional progression in the DF-dominated forests (where root disease is most prevalent).

A similar small trend upwards in MPB hazard may also be occurring in the lodgepole pine forests, also likely associated with natural forest succession to larger diameter trees and increased densities.

It will require more time to confirm that these trends are consistent over time, and to confirm that changing vegetation conditions is the primary cause for these changes in insect and disease conditions.

## *Evaluation of Results for Adaptive Management Finding*

The following findings and recommendations resulted from the evaluation of monitoring results as documented above.

**Table 21. Summary of Findings for Monitoring Item MON-TE&V-03**

| |
|---|
| **1. Plan Monitoring Results**: Does the monitoring question and indicator(s) provide the information necessary to understand the status of the associated plan component listed above? |
| YES, with small modification to the indicator. |
| Recommendations – |
| **2. Plan Implementation Status [1]:** Do monitoring results demonstrate progress of the associated plan components for with this monitoring item? |
| UNCERTAIN. (B) More time needed to confirm long-term trends – that is at least until the next monitoring cycle or perhaps even beyond that. |
| **Recommendation** – na |
| **3. Type of change under consideration [2]:** If corrective action/change was indicated under either #1 or #2, where might that change might be needed? |
| Plan Monitoring Program.<br>• Drop FW-DC-TE&V-03 from the list of forest plan components monitored. Monitoring question does not relate specifically enough to this DC.<br>• Western spruce budworm hazard will be removed from the indicator. According to regional insect and disease specialists, estimates from the FIA database on defoliator hazard rating have not been sufficiently reviewed and they recommend not using this data. There is no other dataset suitable for determining western spruce budworm hazard at the broad forest-wide scale for purposes of forest plan monitoring. Therefore it is recommended to drop WSB hazard monitoring from IND-TE&V-03. |

[1] **PLAN IMPLEMENTATION STATUS: (A) Uncertain –** Availability of data or Interval of data collection beyond this reporting cycle (*indicate date of next time this monitoring item will be evaluated*); **(B) Uncertain -** More time/data are needed to understand status or progress of the plan component(s)**; (C) Uncertain -** Methods inadequate to assess the status or progress toward achieving plan component(s); (**D**) **NO** - Implementation of plan component(s) ARE NOT trending, progressing, and/or conducted as desired**; (E) YES -** Implementation of plan component(s) ARE trending, progressing, and/or conducted as desired

[2] **CHOICES for where change may be needed include**: Monitoring program, plan component, management activity, plan assessment, program strategy or approaches documents, public engagement strategy.

## MON-TE&V-04. How many acres of vegetation treatments are occurring that contribute to maintaining or moving towards achieving desired conditions in the plan?

### *Introduction*

All vegetation treatments are designed to maintain or move towards achieving one or more desired conditions in the plan. Objectives were developed for acres of vegetation treatments over the life of the plan (15 years), based on reasonably foreseeable budgets. This monitoring item is designed to track these treatment acre objectives over time. It is acceptable and quite possible that objectives could either exceed or not meet a target based upon a number of factors, including budget and staffing increases or decreases, increased or decreased planning efficiencies, and unanticipated resource constraints.

The primary objective monitored under this item is **FW-OBJ-01 which states**: "Vegetation management treatments (e.g., timber harvest, planned ignitions, thinning, planting) occur on 62,000 to 174,000 acres of the Forest to maintain or move towards achieving desired conditions for coniferous forest types and associated wildlife species, and for other resources."

Included within this total acre figure are treatments that could also be meeting the following objectives:

FW-OBJ-02: Vegetation management treatments (e.g., timber harvest, planned ignitions, thinning, planting) occur on 16,000 to 21,000 acres of the Forest to contribute to restoration of blister rust-resistant western white pine and achieve desired conditions for this species' presence across the landscape.

FW-OBJ-03: Vegetation management treatments (e.g., timber harvest, planned ignitions, thinning, planting) occur on 500 to 5,000 acres of the Forest to contribute to restoration of diverse native hardwoods and associated wildlife species.

FW-OBJ-04: Vegetation management treatments (e.g., planned ignitions, slashing, control of non-native, invasive plants) occur on 1,500 to 5,000 acres of the Forest to promote persistence of grass/forb/shrub plant communities, focusing on key habitats for big game species and pollinators, to improve conditions for native plant establishment and growth and reduce non-native plants.

**Table 22. MON-TE&V-04 plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicators | Data Source / Partner | Data collection interval | Point of Contact |
|---|---|---|---|---|
| FW-OBJ-TE&V-01, 02, 03, 04 | IND-TE&V-<br>11. Acres treated by vegetation management actions (e.g. harvest, prescribed fire, precommercial thinning, tree/shrub planting, fuel treatments, control of invasive plants).<br>12. Acres treated by vegetation management actions that specifically address the Region 1 indicators associated with restoration and resilience of forests | Forest Service Activity Tracking System (FACTS)<br><br>R1 Restoration and Resilience Report | Annually | Forest Silviculturist |

### *Methods*

IND-TE&V-11: The Forest annual accomplishment reports, as extracted from the Forest Service activity tracking system (FACTS), provides the data summary results for this indicator. All vegetation management is guided by forest plan direction and is designed to meet one or more desired conditions in the plan. To obtain the acres for this indicator, the FACTS database would be queried for any vegetation management activities that have occurred since the last plan monitoring report (the previous 2 years) to obtain the total acres treated. The table below lists the treatment activities included in the first monitoring report (2019-2020 date of completion). Though this list covers most of the activity types likely to occur on the FNF, there may be additional activities included in future monitoring reports, depending on what activities occurred during the monitoring period.

**Table 23. Vegetation management activities included in the acres reported for IND-TE&V-11 (for years 2019-2020)**

| Activities listed in alphabetical order, from the "ACTIVITY" field in FACTS |
|---|
| Broadcast Burning - Covers a majority of the unit |
| Burning of Piled Material |
| Chipping of Fuels |
| Commercial Thin |
| Compacting/Crushing of Fuels |
| Disease Control |
| Fill-in or Replant Trees |
| Genetic Evaluation Plantation Establishment |
| Improvement Cut |
| Initiate Natural Regeneration |
| Insect Control |
| Invasives - Biocontrol, Classic |
| Invasives - Mechanical /Physical |
| Invasives - Pesticide Application |
| Piling of Fuels, Hand or Machine |
| Plant Trees |
| Precommercial Thin |
| Prune |
| Seed-tree Seed Cut (with and without leave trees) (EA/RH/NFH) |
| Shelterwood Establishment Cut (with or without leave trees) (EA/RH/NFH) |
| Site Preparation for Natural Regeneration - Burning |
| Site Preparation for Natural Regeneration - Mechanical |
| Site Preparation for Planting - Mechanical |
| Stand Clearcut (w/ leave trees) (EA/RH/FH) |
| Thinning for Hazardous Fuels Reduction |
| Tree Release and Weed |
| Two-aged Seed-tree Seed and Removal Cut (w/res) (2A/RH/FH) |
| Underburn - Low Intensity (Majority of Unit) |

| |
|---|
| Wildlife Habitat Mechanical treatment |
| Wildlife Habitat Prescribed fire |
| Yarding - Removal of Fuels by Carrying or Dragging |

NOTE: Many of the treatment acres reported in the Fire and Fuels section of the monitoring program (indicator IND-FIRE-01 under the monitoring item MON-FIRE-01) overlap those reported for IND-TE&V-01 in this Terrestrial Vegetation section of the monitoring program. This is because vegetation treatments typically provide multiple benefits and contribute to multiple forest plan objectives, including fuel reduction.

**IND-TE&V-12:** The *Northern Region Restoration and Resilience Report*, which is produced annually at the regional level, is the source of information for this indicator. The data source for the report is FACTS. The report summarizes vegetation treatments in nine main categories that have been identified by the region as key to the overall goal to restore and develop resilient vegetation at the regional level. Data is reported out for the whole region and by each national forest. This report is located at: https://www.fs.usda.gov/detail/r1/landmanagement/resourcemanagement/?cid=stelprdb5428177. More detailed information about this report is located on the website as well.

There are nine categories reported out in the *Northern Region Restoration and Resilience Report*, which are listed below. All of these outcomes are anticipated to improve resilience of the forest under current climate conditions and are hypothesized to do so in the future as well, considering projected mid to late century future climate.

1. Restoration of desired species composition through reforestation after harvest (regeneration harvest followed by natural regeneration or planting of desired shade-intolerant species).
2. Restoration of desired species composition and density after intermediate harvest (increasing or maintaining proportion of desired shade-intolerant species through treatments such as commercial thinning)
3. Restoration of density through non-commercial stand improvement (such as pre-commercial thinning, and other tending of non-commercial stands).
4. Restoration of desired composition and density as a result of fuels treatments not related to timber sales
5. Restoration of desired composition and structure due to prescribed burns (low, moderate or high severity prescribed fire use that increases or maintains proportion of desired shade-intolerant species)
6. Restoration of desired species composition due to wildfire (wildfires that result in increasing or maintaining the proportion of desired shade-intolerant species through post-fire planting or natural regeneration).
7. Grassland/shrub land restored through prescribed burning or noxious weed treatment (treatments either decrease conifer encroachment or improve native grassland/shrubland communities on non-forest lands)
8. Restoration of desired patch size and pattern (harvest and prescribed burn treatments larger than 40 acres will qualify as restoring patch sizes. Natural ignition (wildfire) that meets management objectives is also considered as restoring patch size. Group selection harvests will qualify where small patches are considered restoration of pattern)

9. Summary of resilience (total of all acres 1 through 8. May be duplicate acres due to the same activity meeting multiple objectives)

## *Results*

**Table 24. Monitoring Evaluation Report – summary of data sources for MON-TE&V-04, Acres of vegetation treatments contributing to maintaining or trending towards desired conditions**

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| 2021 | IND-TE&V-11 | Fiscal Year 2019 and 2020 acres accomplished in FACTS | High |
| 2021 | IND-TE&V-12 | R1 Restoration and Resiliency Report – data source from FACTS. Years 2019 and 2020 acres reported | High |

**Table 25. Monitoring Report Results for IND-TE&V-11, Acres treated by vegetation management actions that contribute to maintaining or trending towards desired conditions in the Forest Plan**

| ACTIVITY TYPE (FACTS) | MONITORING DATE and Results | | |
|---|---|---|---|
| | 2021 ACRES accomplished (2019-2020 combined) | 20XX | |
| Broadcast Burning | 272 | | |
| Burning of Piled Material | 6748.8 | | |
| Chipping of Fuels | 13 | | |
| Commercial Thin | 1433.6 | | |
| Compacting/Crushing of Fuels | 18.4 | | |
| Disease Control | 64 | | |
| Fill-in or Replant Trees | 158.4 | | |
| Genetic Evaluation Plantation Establishment | 12 | | |
| Improvement Cut | 98.2 | | |
| Initiate Natural Regeneration | 94.1 | | |
| Insect Control | 576.1 | | |
| Invasives - Biocontrol, Classic | 344.4 | | |
| Invasives - Mechanical /Physical | 10.3 | | |
| Invasives - Pesticide Application | 10258.5 | | |
| Piling of Fuels, Hand or Machine | 2629.6 | | |
| Plant Trees | 2522.6 | | |
| Precommercial Thin | 781.2 | | |
| Prune | 204.6 | | |
| Seed-tree Seed Cut (with and without leave trees) (EA/RH/NFH) | 1042.3 | | |
| Shelterwood Establishment Cut (with | 151.4 | | |

| ACTIVITY TYPE (FACTS) | MONITORING DATE and Results | | |
|---|---|---|---|
| | 2021 ACRES accomplished (2019-2020 combined) | 20XX | |
| or without leave trees) (EA/RH/NFH) | | | |
| Site Preparation for Natural Regeneration - Burning | 27 | | |
| Site Preparation for Natural Regeneration - Mechanical | 131 | | |
| Site Preparation for Planting - Mechanical | 8.4 | | |
| Stand Clearcut (w/ leave trees) (EA/RH/FH) | 172.9 | | |
| Thinning for Hazardous Fuels Reduction | 901.4 | | |
| Tree Release and Weed | 51 | | |
| Two-aged Seed-tree Seed and Removal Cut (w/res) (2A/RH/FH) | 3.2 | | |
| Underburn - Low Intensity (Majority of Unit) | 136.5 | | |
| Wildlife Habitat Mechanical treatment | 274.6 | | |
| Wildlife Habitat Prescribed fire | 313 | | |
| Yarding - Removal of Fuels by Carrying or Dragging | 1523.4 | | |
| **Grand Total** | **30,975.9** | | |

**Table 26. Monitoring Report Results for IND-TE&V-11, Acres from Table above, grouped by treatment types**

| ACTIVITY TYPE (FACTS) | MONITORING DATE and Results | | |
|---|---|---|---|
| | 2021 ACRES accomplished (2019-2020 combined) | 20XX | |
| Harvest activities (CC, ST, SW, CT) | 2901 | | |
| Thinning (PCT, Release/Weed, hazard fuel reduction) | 1733 | | |
| Mechanical fuel treatments (chipping, piling, yarding, | 4323 | | |
| Rx Burn – site prep, fuel reduction, pile burn | 7184 | | |
| Planting or Nat Regen | 2775 | | |
| Invasive weed controls | 10,612 | | |
| Wildlife habitat | 588 | | |
| All other activities | 856 | | |

| ACTIVITY TYPE (FACTS) | MONITORING DATE and Results | | |
|---|---|---|---|
| | 2021<br>ACRES accomplished<br>(2019-2020 combined) | 20XX | |
| **Grand Total** | **30,972** | | |

**Table 27. Monitoring Report Results for IND-TE&V-12, Acres treated by vegetation management actions that specifically address the Region 1 indicators associated with restoration and resilience of forests**

| The 9 categories reported out in the *Northern Region Restoration and Resilience Report* | 2021<br>Acres treated in 2019 (2020 data not available yet) | Monitoring date and results | | |
|---|---|---|---|---|
| | | 202x<br>Acres treated in 2020- | | |
| 1. Restoration of desired species composition through reforestation after harvest. | Annual treatments<br>2019 =1121 | | | |
| 2. Restoration of desired species composition and density after intermediate harvest | Annual treatments<br>2019 =2875 | | | |
| 3. Restoration of desired density through non-commercial stand improvement treatments not related to timber sales | Annual treatments<br>2019 =830 | | | |
| 4. Restoration of desired composition and density as a result of fuels | Annual treatments<br>2019 =108 | | | |
| 5. Restoration of desired composition and structure due to prescribed burning | Annual treatments<br>2019 =84 | | | |
| 6. Restoration of desired species composition due to wildfire | Annual treatments<br>2019 =943 | | | |
| 7. Grassland/shrub land restored through prescribed burning or noxious weed treatment | Annual treatments<br>2019 =2703 | | | |
| 8. Restoration of desired patch size and pattern through treatments | Annual treatments<br>2019 =1555 | | | |
| 9. **Summary of resilience** (potential duplicate acres due to same activity meeting multiple criteria) | Annual treatments<br>2019 =10,220 | | | |

[a]Northern Region Restoration and Resilience Report, located at: https://www.fs.usda.gov/detail/r1/landmanagement/resourcemanagement/?cid=stelprdb5428177.

## *Discussion of Results*

The forest plan objective is to treat 62,000 – 174,000 acres over life of the plan (15 years). This equates to an annual average of 4130 – 11,600 acres

Accomplishment reports for the monitoring period (FY 2019 and 2020) indicate that the forest is conducting numerous activities and accomplishing many acres annually that contribute towards meeting the objectives in the plan for terrestrial vegetation conditions.

Of these total acres of treatments completed, 10,220 acres contributed to one or more of the regional objectives outlined in the Restoration and Resilience Report, for the purpose of creating more resilient and desirable forest conditions. These regional criteria are in sync with the FNF desired conditions in terms of desired species compositions, forest size classes and structures (densities), and patterns.

### *Evaluation of Results for Adaptive Management Finding*

The following findings and recommendations resulted from the evaluation of monitoring results as documented above.

**Table 28. Summary of Findings for Monitoring Item MON-TE&V-04**

| |
|---|
| **1. Plan Monitoring Results**: Does the monitoring question and indicator(s) provide the information necessary to understand the status of the associated plan component listed above? |
| YES |
| Recommendations NA |
| **2. Plan Implementation Status [1]:** Do monitoring results demonstrate progress of the associated plan components for with this monitoring item? |
| YES (E) - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired based on the 10,220 acres completed. |
| **Recommendation** – *NA* |
| **3. Type of change under consideration [2]:** If corrective action/change was indicated under either #1 or #2, where might that change might be needed? |
| NA |

[1] **PLAN IMPLEMENTATION STATUS: (A) Uncertain –** Availability of data or Interval of data collection beyond this reporting cycle (*indicate date of next time this monitoring item will be evaluated*); **(B) Uncertain -** More time/data are needed to understand status or progress of the plan component(s)**; (C) Uncertain -** Methods inadequate to assess the status or progress toward achieving plan component(s); (**D**) **NO** - Implementation of plan component(s) ARE NOT trending, progressing, and/or conducted as desired**; (E) YES -** Implementation of plan component(s) ARE trending, progressing, and/or conducted as desired

[2] **CHOICES for where change may be needed include**: Monitoring program, plan component, management activity, plan assessment, program strategy or approaches documents, public engagement strategy.

## MON-TE&V-05. To what extent have management actions maintained required levels of snags or snag replacement trees within harvest units?

### *Introduction*

Maintaining desired level of snags and snag replacement trees is important mainly for the key wildlife habitat values provided by these forest structural components. This monitoring question assesses the compliance with forest plan standards associated with snag retention within harvest units.

**FW-STD-TE&V-03:** "Within timber harvest areas, snags and/or live snag replacement trees shall be retained at minimum levels that vary depending upon the geographic area and whether the harvest is within a riparian management zone. Refer to snag retention standards located under each geographic area in chapter 4 of the plan. Refer to FW-GDL-RMZ-10 for additional snag management direction for harvest areas within riparian management zones."

In chapter 4 of the Forest Plan, there are snag management standards within each of the five Geographic Areas **(GA-STD-HH-01, GA-STD-SF-01, GA-STD-SV-01, GA-STD-NF-01, GA-STD-MF-02, GA-STD-SM-02).** Each standard contains the following language:

> "Within timber harvest areas, snags or live replacement trees shall be retained at or above the minimum levels displayed in table (*XX – table number varies by geographic area)*. All snags of western larch, ponderosa pine, and black cottonwood trees greater than 20 inches d.b.h. shall be retained. If sufficient snags to meet the minimum levels in each column of table *(XX – table number varies by geographic area)* are not present, live replacement trees shall be substituted for each snag. Live replacement trees shall be of the largest size present above 10 inches d.b.h., decayed or decadent trees if present, and the following species if present: western larch, ponderosa pine, Douglas-fir, cottonwood, aspen, birch, or western redcedar. In regeneration harvest units, suitable replacement trees include those that would not cause unacceptable impacts to the conifer tree regeneration (e.g., dwarf mistletoe infection or potential dysgenic seed source)."
>
> "Exceptions to the snag retention standard may occur in areas where there are issues of human health and safety (e.g., developed recreation sites, adjacent to landings). To contribute to forest structural diversity and wildlife habitat (such as for fisher or marten), snags or live replacement trees within harvest units that are designated for retention but fall down due to natural causes (e.g., wind) or are deliberately felled for reasons of human safety shall not be removed."

Also provided in each standard is a table identifying minimum average number of snags or live replacement trees per acre greater than 10 feet tall to retain within timber harvest areas, with densities that are specific to the Geographic Area. Refer to the forest plan for these tables.

**Table 29. MON-TE&V-05 plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicators | Data Source / Partner | Data collection interval | Point of Contact |
|---|---|---|---|---|
| FW-STD-TE&V-03<br>GA-STD-HH, SF, SV, NF-01<br>GA-STD-MF, SM-02 | IND-TE&V-<br>13. Snag and snag replacement tree densities retained within a sample of timber harvest areas | USFS Post-harvest survey records | Annually | Primary-Forest Silviculturist;<br>Secondary-Forest Wildlife |

| | | | | |
|---|---|---|---|---|
| | | | | Biologist |

## Methods

Post-harvest field surveys are routinely conducted to assess stand conditions, verify that treatment objectives were met, and to confirm and fine-tune the prescription for potential post-harvest activities, such as regeneration. As part of this standard survey, snag and snag replacements (live tree reserves) are assessed within sampled units.

The source of data for this monitoring item would be project level NEPA decision documents and field surveys from harvest treatments resulting from these decisions. Only project level NEPA decisions that occurred after the forest plan was adopted (December 2018) would be considered. Only harvest activities from these NEPA decisions that have occurred since the previous monitoring report (the previous 2 years) would be considered. A sample of the projects and units that meet these criteria would be selected for review. At least one project and one randomly selected harvest unit (or more than one, depending on basis of snag prescription) should be sampled, if available, during each monitoring period. Since flexibility in application of the snag standards is provided in the plan, the evaluation and summary may be on an individual harvest unit basis, or by groups of units, or across a larger landscape area, depending upon individual projects and how the snag standards were applied. The review would involve looking at both the NEPA decision and silvicultural prescription to ensure consistency with snag standards, and reviewing whether results after harvest were consistent with the prescription, based on field survey data.

## Results

**Table 30. Monitoring Evaluation Report – summary of data sources for MON-TE&V-05, Snag Density Standards for Harvest Units**

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| 2021 | IND-TE&V-13 | Fiscal Year 2019 and 2020 project level decisions and any harvest activities that occurred in this time period based on these decisions | High |

**Table 31. Monitoring Report Results for MON-TE&V-05, Snag Density Standards for Harvest Units**

| Sampled harvest units/areas | Snag retention Rx | Monitoring date | | |
|---|---|---|---|---|
| | | 2021 | | |
| No samples yet | No data yet | *No data available.* | | |

The vegetation mgmt. projects that have had decisions since adoption of the plan (decisions in 2019 or 2020) are the following: GNA Taylor Hellroaring; Crystal Cedar; Salish Good, and Hellroaring Basin Improvements Project (Whitefish Mountain ski area improvements).

## Discussion of Results

Taylor Hellroaring, Crystal Cedar, and Salish Good include harvest treatments in which the prescription for these treatments was designed to comply with the snag retention standards in the plan. None of these projects has been completed yet, though there has been some harvesting accomplished. For this

monitoring cycle, there has been insufficient time to select and review harvest units on the ground, if needed, to check if snag retention prescriptions were implemented as planned.

At next monitoring cycle, harvest activities will be available for monitoring. To guide the discussion of results, consider addressing the following question:

- Were snag prescriptions designed, applied and implemented consistent with the standards in the plan? Were the post-implementation results as expected?

If data indicates there is a substantial difference in the snag conditions within units between what was planned during the project analysis and prescription development, then there should be some evaluation as to why this may have occurred. This knowledge may help to assess whether there may be opportunity for improvement in either design or implementation of snag retention prescriptions to better ensure that harvest areas contribute desired amounts of snags.

### *Evaluation of Results for Adaptive Management Finding*

The following findings and recommendations resulted from the evaluation of monitoring results as documented above.

**Table 32. Summary of Findings for Monitoring Item MON-TE&V-05**

| |
|---|
| **1. Plan Monitoring Results**: Does the monitoring question and indicator(s) provide the information necessary to understand the status of the associated plan component listed above? |
| YES |
| Recommendations – NA |
| **2. Plan Implementation Status [1]:** Do monitoring results demonstrate progress of the associated plan components for with this monitoring item? |
| UNCERTAIN. A. Data not available yet – harvest activities incomplete |
| **Recommendation** – |
| **3. Type of change under consideration [2]:** If corrective action/change was indicated under either #1 or #2, where might that change might be needed? |
| NA |

[1] **PLAN IMPLEMENTATION STATUS: (A) Uncertain –** Availability of data or Interval of data collection beyond this reporting cycle (*indicate date of next time this monitoring item will be evaluated*); **(B) Uncertain -** More time/data are needed to understand status or progress of the plan component(s)**; (C) Uncertain -** Methods inadequate to assess the status or progress toward achieving plan component(s); (**D**) **NO** - Implementation of plan component(s) ARE NOT trending, progressing, and/or conducted as desired**; (E) YES -** Implementation of plan component(s) ARE trending, progressing, and/or conducted as desired

[2] **CHOICES for where change may be needed include**: Monitoring program, plan component, management activity, plan assessment, program strategy or approaches documents, public engagement strategy.

# FOCAL SPECIES MONITORING—Western White Pine (MON-TE&V Focal)

## MON-TE&V Focal 01. What is the change in ecological conditions as indicated by conditions suitable for western white pine?

## MON-TE&V Focal 02. What management actions are contributing to the restoration of western white pine?

### *Introduction*

Focal species are defined as species whose status provides meaningful information regarding the effectiveness of the plan components in maintaining or restoring the desired ecological conditions and species diversity within the plan area. They are selected on the basis of their functional role in ecosystems.

Western white pine is a focal species identified in the forest plan. Monitoring of the status and condition of this species would provide insight into the integrity and diversity of our forested ecosystems, especially the lower elevation forests on the warm moist potential vegetation types, which are uncommon but highly productive sites on the Forest. Monitoring will help in assessing effectiveness of plan components to maintain or restore desired ecological conditions on these sites, and the potential effects of future disturbances and climate change on forests and ecosystems within the planning area.

Analysis conducted for development of the Flathead Forest plan estimated that 8 to 10 percent of the FNF (or up to about 200,000 acres) could currently support the establishment and growth of western white pine. The FNF is at the far eastern edge of the species range, in the ecotone between the moist, productive forest types to the west and the drier, less maritime influenced types to the east and south. This unique position may be especially important in light of future climate change and associated uncertainties of effects to ecosystems, including changes in species distribution and forest conditions.

Western white pine has characteristics that contribute to resilient forest conditions as well as social and economic values. These characteristics include superior growth rates; ability to achieve very large diameter, height and age; values as wildlife habitat and for forest structural and species diversity; comparative level of resistance to fire, wind, some diseases, and drier conditions; prolific seeding/regeneration capability and adaptability to very wide range of seedbed and light conditions; wide genetic variability; and high timber values.

The forest plan components monitored by this item include:

**FW-DC-TE&V-04: "**Desired habitat conditions across the Forest and within each potential vegetation type contribute to long-term persistence and diversity of native plant and animal species. Ecosystem conditions and ecological processes contribute to the survival, reproduction, and dispersal of terrestrial and aquatic animal (vertebrate and invertebrate) species native to the Forest and provide for nesting or denning, habitat security, shelter, and forage (see also the plan components in the wildlife section).

**FW-DC-TE&V-07:** "The Forest has a diversity of native tree species, with most stands composed of more than one tree species. Desired conditions for forest dominance types forestwide are described

in table 2. Desired conditions for the forestwide presence (distribution) of individual tree species are described in table 3." *(see forest plan for the table information)*

**FW-OBJ-TE&V-02**: "Vegetation management treatments (e.g., timber harvest, planned ignitions, thinning, planting) occur on 16,000 to 21,000 acres of the Forest to contribute to restoration of blister rust-resistant western white pine and achieve desired conditions for this species' presence across the landscape. "

**Table 33. MON-TE&V Focal-01 plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicator(s) | Data Source / Partner | Data collection interval | Point of contact |
|---|---|---|---|---|
| FW-DC-TE&V-04, 07 | IND-TE&V Focal-<br>01. Proportion (percentage of total acres) forestwide and by the warm-moist and cool-moist PVTs for western white pine species presence<br>02. Proportion (percentage of total acres) forestwide of forest size classes in the areas where western white pine is present | R1 FIA Summary Database<br><br>Detailed information about the FIA program can be found at: http://fsweb.r1.fs.fed.us/forest/inv/fia_data/index.shtml | FIA plots across the Forest are remeasured on a scheduled basis, with individual plots remeasured every 10 years.<br><br>The R1 Summary database is updated periodically, usually every 5 years. | Forest Silviculturist |

**Table 34. MON-TE&V Focal-02, plan components, indicators, data source, data collection interval and point of contact**

| Plan Component(s) | Indicator(s) | Data Source / Partners | Data collection interval | Point of contact |
|---|---|---|---|---|
| FW-OBJ-TE&V-02 | IND-TE&V Focal-<br>03. Acres treated for the purpose of sustaining or restoring western white pine<br>04. Survival of planted western white pine seedlings | Forest Service Activity Tracking System (FACTS) – Regional Restoration and Resilience Report | Annually or periodically | Forest Silviculturist |

### *Methods*

**IND-TE&V Focal-01**: This data can be directly copied from the results under monitoring question MON-TE&V-01, indicator IND-TE&V-02 (western white pine species presence forestwide and within the warm-moist and cool-moist PVTs).

**IND-TE&V Focal-02:** This data is not provided in the regionally produced BSMS reports, and it is not anticipated to be provided in the future. The FNF would have to query the FIA database directly to access this information, which requires a skill set that may not always be present on the FNF. It is recommended that this indicator be dropped, to improve efficiency of the biennial Forest Plan monitoring task, and

because this indicator does not really add substantially to the interpretation of western white pine conditions over time. The other indicators are sufficient to monitor changes in western white pine conditions over time.

**IND-TE&V Focal-03:** The *Northern Region Restoration and Resilience Report*, which is produced annually at the regional level, is the source of information for this indicator. The data source for this report is FACTS. The report summarizes vegetation treatments in nine main categories that have been identified by the region as key to the overall goal to restore and develop resilient vegetation at the regional level. Treatments that restore or benefit western white pine are directly identified by forest in this report. More details about this report and output data is located at: https://www.fs.usda.gov/detail/r1/landmanagement/resourcemanagement/?cid=stelprdb5428177.

**IND-TE&V Focal-04:** Reforestation surveys to monitor survival of seedlings after regeneration harvest activity is a requirement of NFMA and conducted in the first, third and fifth year after harvest. Stake rows that provide percent survival statistics are also established within a subset of planted units. Results are stored in FACTS. Access to this data would occur by querying the FACTS data base for stake row surveys in plantations where WWP was planted. Only areas that were planted since the FNF forest plan was adopted (November 2018) would be included within the monitoring dataset. Only stake rows surveys that occur in the two-year period since the previous monitoring report would be included.

## *Results*

**Table 35: Monitoring Evaluation Report – summary of data sources for MON-TE&V-Focal 01 and 02 – Western White Pine conditions and treatments**

| Year of Report | Indicator | Date of Data Collection/Compilation | Data confidence |
|---|---|---|---|
| 2021 | IND-TE&V-Focal 01 | Hybrid FIA 2015 Analysis Dataset<br>– data collected on FIA plots 2006-2015. | High level of confidence in data. Using standardized USFS datasets and procedures used for monitoring vegetation characteristics |
| 2021 | IND-TE&V-Focal 03 and 04 | Fiscal Year 2019 and 2020 acres accomplished in FACTS | High |
| 2021 | IND-TE&V-Focal 03 and 04 | R1 Restoration and Resiliency Report – data source from FACTS. Years 2019 and 2020 acres reported | High |

**Table 36. Monitoring Report Results for MON-TE&V-Focal 01, Western white pine conditions**

| Indicator | Forest Plan 2018* | | Monitoring date | | |
|---|---|---|---|---|---|
| | Desired range (% area) | Existing Condition (Baseline) (% area) | 2021 | | |
| **IND-TE&V Focal-01: Western white pine species presence** | | | **% area (CI 90%)** | | |
| Forestwide | 3-10 | 1.6% | 1.73 (0.9 – 2.64) | | |
| Warm-moist PVT | 10-25 | 11.4% | 10.42 (2.68-19.57) | | |
| Cool-moist PVT | 5-10 | 1.6% | 1.73 0.74-2.87) | | |

* Hybrid FIA 2011

**Table 37. Monitoring Report Results for MON-TE&V-Focal 01, Western white pine treatments**

| Indicator | Monitoring date | | |
|---|---|---|---|
| | 2021 | | |
| **IND-TE&V Focal-03:** Acres treated for the purpose of improving species composition to improve resilience, with focus on restoring western white pine | 2019 = 1191 acres | | |
| **IND-TE&V Focal-04:** Survival of planted western white pine seedlings | 1st yr stake row surveys (3 surveys) 2018-2020 100% survival | | |

## *Discussion of Results*

Increased presence of western white pine is desired. Increases may indicate that the species is developing increased natural resistance to whitepine blister rust over time, both through natural selection and through reforestation in harvest and fire areas by planting blister-rust resistant seedlings. Increased area of western white pine may also, over the long term, provide insight into the influence of climate warming on ecological conditions. For example, warming climate conditions may favor expansion of the range of western white pine, if associated with maintaining or increases in precipitation. However, this may be tempered by the close association and perhaps requirement of the species to soils of relatively high productivity, and particularly those with a relatively deep ash layer. Areas with these deeper ash layers are less widespread on the FNF as compared to forests in Northern Idaho.

A very slight increase in western white pine presence forestwide and in the cool moist PVT appears to occur, though it is very small and uncertain whether it reflects a true increasing trend over time. Similarly, for the slight decrease in the species presence in the warm moist PVT, where this species is most desirable.

The forest is continuing to conduct activities for the purpose of improving conditions for western white pine and increasing its presence across the Forest over time. These treatments include planting of rust-resistant seedlings and non-commercial thinning in young sapling stands.

## *Recommended changes in monitoring indicators and data sources*

**Table 38. Recommended changes in western white pine monitoring indicators under MON-TE&V-01.**

| Original Indicator in the Plan | Change recommended |
|---|---|
| **IND-TE&V-Focal 02**. Proportion (percentage of total acres) forestwide of forest size classes in the areas where western white pine is present | Drop this indicator – see discussion in the methods section above. |

## *Evaluation of Results for Adaptive Management Finding*

The following findings and recommendations resulted from the evaluation of monitoring results as documented above.

**Table 39. Summary of Findings for Monitoring Item MON-TE&V-FOCAL 01 and 02**

| |
|---|
| **1. Plan Monitoring Results**: Does the monitoring question and indicator(s) provide the information necessary to understand the status of the associated plan component listed above? |
| YES, but recommend changes in indicator |
| Recommendations – Drop original indicator IND-TE&V-Focal02, for efficiency in monitoring. See discussion under Methods section. |
| **2. Plan Implementation Status [1]: Do monitoring results demonstrate progress of the associated plan components for with this monitoring item?** |
| UNCERTAIN (B) **-** More time/data are needed to understand status or progress of the Plan Component(s) – that is at least until the next monitoring cycle or perhaps even longer. |
| **Recommendation** – |
| **3. Type of change under consideration [2]:** If corrective action/change was indicated under either #1 or #2, where might that change might be needed? |
| Forest plan monitoring program – drop one indicator; |

[1] **PLAN IMPLEMENTATION STATUS: (A) Uncertain –** Availability of data or Interval of data collection beyond this reporting cycle (*indicate date of next time this monitoring item will be evaluated*); **(B) Uncertain -** More time/data are needed to understand status or progress of the plan component(s)**; (C) Uncertain -** Methods inadequate to assess the status or progress toward achieving plan component(s); (**D**) **NO** - Implementation of plan component(s) ARE NOT trending, progressing, and/or conducted as desired**; (E) YES -** Implementation of plan component(s) ARE trending, progressing, and/or conducted as desired

[2] **CHOICES for where change may be needed include**: Monitoring program, plan component, management activity, plan assessment, program strategy or approaches documents, public engagement strategy.

# APPENDIX A - Terrestrial Vegetation Monitoring Guide Result Tables

## *Result Tables for monitoring item MON-TE&V-01 indicators: What is the change in key ecosystem characteristics for forest and non-forest vegetation?*

The tables in this document display the RESULTS for **all** vegetation indicators associated with monitoring item MON-TE&V-01. There is a table for each vegetation indicator showing the **current (and desired) condition percentage estimates**, which are from the Flathead Forest Plan (2018), followed by result tables that show the **new percentage estimates** for the vegetation indicator for the forest plan monitoring report. At each biennial monitoring cycle, if an updated Region 1 Forest Inventory and Analysis (R1 FIA) Dataset is available, new estimates will be added into these results tables. This will allow for comparison of conditions and assessing trends over time.

### *Data Source and Deriving Estimates*

The estimates for all indicators are obtained from the R1 FIA Summary Database, published in reports that are produced at the regional level for the Broad Scale Monitoring Strategy (BSMS Reports). Most of the estimates in the BSMS reports are acre estimates, so it is necessary to convert acres into percentages for comparison to the Forest plan desired conditions. Also, not all the vegetation classes in the FNF Plan match up exactly with the vegetation classes in the BSMS reports, so some reconciliation between the two is necessary.

To accomplish this task more easily, and ensure that acres are converted to percentages correctly, a spreadsheet was developed to automatically calculate percentages for each indicator and to reconcile classification differences (see **"Monitoring_Guide_TERRESTRIAL_VEG_FIA_Calculations.xlxs** located in the project record of the monitoring report). Therefore, once new FIA data is available for future monitoring reports, all one need do is copy the correct data table out of the new regional BSMS spreadsheet and insert it into the correct spot into the "calculations" spreadsheet. The final table the spreadsheet produces, with the percentages and correct vegetation classes, is then copied directly out of the spreadsheet and incorporated in this "Appendix A 'Results Tables'" document.

A new FIA Analysis Dataset is created about every 5 years by the Region, using updated FIA field data. At that time, a new set of BSMS reports would be produced by the Region, which would be used for the subsequent Forest Plan monitoring cycle. The FIA Analysis dataset used for the development of the 2018 Flathead Forest plan was the R1 FIA Hybrid 2011 dataset. The table below shows which FIA dataset is used to report estimates at each monitoring cycle.

**Table 1. FIA dataset used to report estimates for each monitoring cycle**

| Year of Monitoring Report | FIA Data Set Used for Vegetative Conditions Estimates |
|---|---|
| 2021 | R1 FIA Hybrid 2015 (for most indicators).<br>R1 FIA Hybrid 2011 for the snag and live tree density/presence estimates (estimates using the Hybrid 2015 dataset were not available for the monitoring report) |

## *Vegetation Indicator Tables*

Displaying Baseline Conditions (Existing conditions in Forest Plan), Desired Conditions (from the Forest Plan), and the Conditions at Each Forest Plan Monitoring Cycle. NOTE: at each plan monitoring cycle, if an updated FIA analysis dataset is available, new tables will be ADDED into each resource indicator section below, to display and readily compare changes and trends over time

### IND-TE&V-01. Vegetation Dominance Types –Forestwide Estimates

**Table 2. BASELINE CONDITION (2018 Forest Plan) - Vegetation Dominance type**

| FNF DOMINANCE TYPES | Estimated Percent Forestwide | Desired Condition Percent Range |
|---|---|---|
| Aspen/Hardwood tree | 1.3 | 1 - 2.5 |
| Ponderosa pine | 0.4 | 0.5 – 5.0 |
| Douglas-fir / Grand Fir-Cedar | 19 | 15.5 - 30 |
| Western larch | 5.7 | 8 - 15 |
| Lodgepole pine | 15 | 10 - 20 |
| Subalpine fir / Spruce | 43 | 30 - 45 |
| Whitebark pine | 2.4 | 0.5 - 5 |
| Persistent Grass/Forb/Shrub | 5 | 5-7 |

**Table 3. 2021 Forest Plan Monitoring Report – Dominance type Percent Forestwide**

| FNF DOMINANCE TYPES | Estimate Percent | 90 Percent Confidence Interval-Lower Bound | 90 Percent Confidence Interval-Upper Bound |
|---|---|---|---|
| Aspen/Hardwood tree | 1.4% | 0.7% | 2.1% |
| Ponderosa pine | 0.4% | 0.0% | 0.9% |
| Douglas-fir / Grand Fir-Cedar | 19.3% | 15.7% | 23.0% |
| Western larch | 6.7% | 5.0% | 8.2% |
| Lodgepole pine | 15.7% | 12.8% | 18.2% |
| Subalpine fir / Spruce | 41.5% | 37.9% | 44.9% |
| Whitebark pine | 1.9% | 1.1% | 2.8% |

## IND-TE&V-02. Tree Species Presence –Forestwide Estimates

**Table 4. BASELINE CONDITION (2018 Forest Plan) - Tree Species Presence Forestwide**

| Tree Species | Estimated percent mean | Desired Condition percent range |
|---|---|---|
| Ponderosa pine | 0.9 | 2-8 |
| Douglas-fir | 35 | 30-55 |
| Western larch | 18 | 22-35 |
| Lodgepole pine | 26 | 20-35 |
| Subalpine fir | 61 | 55-74 |
| Engelmann spruce | 44 | 40-63 |
| Grand fir | 2.7 | 1-6 |
| Western red cedar | 1.3 | 0.5-5 |
| Whitebark pine | 11 | 13-20 |
| Western white pine | 1.6 | 3-10 |
| Aspen/Hardwood Trees | 0.9% Aspen; 1.4% Birch; 2.0% Cottonwood | 4-6 (any species present) |

**Table 5. 2021 Forest Plan Monitoring Report - Tree Species Presence Forestwide**

| SPECIES | Estimate Percent Mean | 90 Percent Confidence Interval-Lower Bound | 90 Percent Confidence Interval-Upper Bound |
|---|---|---|---|
| Ponderosa pine | 0.83 | 0.26 | 1.54 |
| Douglas-fir | 35.06 | 31.69 | 38.55 |
| Western larch | 18.14 | 15.45 | 20.96 |
| Lodgepole pine | 28.82 | 25.45 | 32.27 |
| Subalpine fir | 60.38 | 56.78 | 63.93 |
| Engelmann spruce | 44.27 | 40.89 | 47.76 |
| Grand fir | 3.20 | 1.98 | 4.55 |
| Western red cedar (includes Western Hemlock) | 1.79 | 0.65 | 3.22 |
| Whitebark pine (includes Alpine Larch) | 11.25 | 8.63 | 14.09 |
| Western white pine | 1.73 | 0.90 | 2.64 |
| Aspen | 1.60 | 0.83 | 2.49 |
| Birch | 1.49 | 0.71 | 2.38 |
| Cottonwood | 1.77 | 0.96 | 2.66 |

## IND-TE&V-02. Tree Species Presence –Estimates by Potential Vegetation Type (PVT)

**Table 6. BASELINE CONDITION (2018 Forest Plan) - Tree Species Presence by PVT**

| Tree Species | Estimated Mean Percent | Desired Condition Percent Range |
|---|---|---|
| **WARM DRY PVT** | | |
| Ponderosa pine | 4.2 | 15-50 |
| Douglas-fir | 76 | 30-60 |
| Western larch | 19 | 10-30 |
| Lodgepole pine | 28 | 15-35 |
| **WARM MOIST PVT** | | |
| Ponderosa pine | 0 | 5-15 |
| Douglas-fir | 50 | 40-70 |
| Western larch | 52 | 45-80 |
| Lodgepole pine | 30 | 4-15 |
| Western white pine | 11 | 10-25 |
| Grand fir | 30 | 10-36 |
| Western red cedar | 22 | 15-30 |
| Subalpine fir | 44 | 10-40 |
| Engelmann spruce | 58 | 20-50 |
| **COOL MOIST PVT** | | |
| Douglas-fir | 35 | 35-60 |
| Western larch | 19 | 28-45 |
| Lodgepole pine | 29 | 15-35 |
| Western white pine | 1.6 | 5-10 |
| Subalpine fir | 69 | 69-85 |
| Engelmann spruce | 54 | 45-73 |
| Whitebark pine | 6.9 | 4.8-9.2 |
| **COLD PVT** | | |
| Lodgepole pine | 22 | 20-35 |
| Subalpine fir | 81 | 50-90 |
| Engelmann spruce | 40 | 45-85 |
| Whitebark pine | 38 | 55-85 |

**Table 7. Forest Plan Monitoring Report - Tree Species Presence by PVT**

| Species | Estimate Percent Mean | 90 Percent Confidence Interval-Lower Bound | 90 Percent Confidence Interval-Upper Bound |
|---|---|---|---|
| **WARM DRY PVT** | | | |
| Ponderosa pine | 4.49 | 0.53 | 9.85 |
| Douglas-fir | 76.07 | 66.04 | 85.47 |
| Western larch | 25.00 | 15.63 | 35.00 |
| Lodgepole pine | 29.27 | 18.61 | 40.39 |
| **WARM MOIST PVT** | | | |
| Ponderosa pine | 0.00 | 0.00 | 0.00 |
| Douglas-fir | 48.96 | 35.87 | 62.00 |
| Western larch | 52.08 | 37.07 | 67.11 |
| Lodgepole pine | 30.21 | 16.38 | 44.74 |
| Western white pine | 10.42 | 2.68 | 19.57 |
| Grand fir | 28.13 | 14.47 | 42.71 |
| Western red cedar (+W.Hemlock) | 5.21 | 0.00 | 13.33 |
| Subalpine fir | 46.88 | 33.75 | 60.00 |
| Engelmann spruce | 53.13 | 40.00 | 66.07 |
| **COOL MOIST PVT** | | | |
| Douglas-fir | 35.57 | 31.37 | 39.81 |
| Western larch | 18.87 | 15.48 | 22.38 |
| Lodgepole pine | 31.47 | 27.17 | 35.88 |
| Western white pine | 1.73 | 0.74 | 2.87 |
| Subalpine fir | 67.38 | 63.13 | 71.62 |
| Engelmann spruce | 53.73 | 49.55 | 57.99 |
| Whitebark pine (+Alpine Larch) | 6.47 | 4.38 | 8.69 |
| **COLD PVT** | | | |
| Lodgepole pine | 22.69 | 15.28 | 30.71 |
| Subalpine fir | 76.39 | 69.44 | 83.13 |
| Engelmann spruce | 33.22 | 26.04 | 40.52 |
| Whitebark pine (+Alpine Larch) | 37.96 | 27.80 | 48.90 |

## IND-TE&V-03. FOREST SIZE CLASS –Forestwide estimates

**Table 8. BASELINE CONDITION (2018 Forest Plan) - Forest Size Class - Forestwide**

| Forest Size Class | Estimated percent Forestwide | Desired Condition percent |
|---|---|---|
| Seedling and sapling (<5” dbh) | 14 | 7-38 |
| Small tree (5-9.9” dbh) | 33 | 18-38 |
| Medium tree (10-14.9” dbh) | 23 | 8-25 |
| Large tree (15-19.9” dbh) | 10 | 20-43 |
| Very large tree (>=20” dbh) | 5.8 | 6-20 |

**Table 9. 2021 Forest Plan Monitoring Report - Forest Size Class Percent Forestwide**

| Forest Size Class | Estimate Percent | 90 Percent Confidence Interval-Lower Bound | 90 Percent Confidence Interval-Upper Bound |
|---|---|---|---|
| Seedling and sapling (<5” dbh) | 14.1% | 11.1% | 17.9% |
| Small tree (5-9.9” dbh) | 34.1% | 30.7% | 36.8% |
| Medium tree (10-14.9” dbh) | 23.6% | 20.8% | 26.0% |
| Large tree (15-19.9” dbh) | 9.6% | 7.7% | 11.3% |
| Very large tree (>=20” dbh) | 5.4% | 3.5% | 7.1% |

## IND-TE&V-03 – FOREST SIZE CLASS – Estimates by PVT

**Table 10. BASELINE CONDITION (2018 Forest Plan) – Forest Size Class by PVT**

| Forest Size Class | Estimated percent | Desired Condition percent |
|---|---|---|
| **WARM DRY PVT** | | |
| Seedling and sapling (<5” dbh) | 14 | 5-35 |
| Small tree (5-9.9” dbh) | 31 | 10-45 |
| Medium tree (10-14.9” dbh) | 21 | 8-30 |
| Large tree (15-19.9” dbh) | 13 | 15-35 |
| Very large tree (>=20” dbh) | 5.7 | 6-20 |
| **WARM MOIST PVT** | | |
| Seedling and sapling (<5” dbh) | 5.7 | 3-40 |
| Small tree (5-9.9” dbh) | 45 | 20-55 |
| Medium tree (10-14.9” dbh) | 35 | 5-30 |
| Large tree (15-19.9” dbh) | 9.1 | 10-40 |
| Very large tree (>=20” dbh) | 2.3 | 8-44 |
| **COOL MOIST PVT** | | |
| Seedling and sapling (<5” dbh) | 14 | 5-35 |
| Small tree (5-9.9” dbh) | 33 | 20-39 |
| Medium tree (10-14.9” dbh) | 24 | 5-20 |
| Large tree (15-19.9” dbh) | 11 | 25-48 |
| Very large tree (>=20” dbh) | 7.6 | 8-25 |
| **COLD PVT** | | |
| Seedling and sapling (<5” dbh) | 19 | 10-35 |
| Small tree (5-9.9” dbh) | 38 | 10-32 |
| Medium tree (10-14.9” dbh) | 21 | 5-20 |
| Large tree (15-19.9” dbh) | 7.5 | 15-65 |
| Very large tree (>=20” dbh) | 2.2 | 2-5 |

**Table 11. 2021 Forest Plan Monitoring Report - Size Class Percent By PVT**

| Forest Size Class | Estimate Percent | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|
| **WARM DRY PVT** | | | |
| Seedling and sapling (<5” dbh) | 17.3% | 6.1% | 30.2% |
| Small tree (5-9.9” dbh) | 33.1% | 22.0% | 44.5% |
| Medium tree (10-14.9” dbh) | 29.3% | 19.8% | 39.1% |
| Large tree (15-19.9” dbh) | 14.3% | 6.9% | 22.0% |
| Very large tree (>=20” dbh) | 6.0% | 0.8% | 13.0% |
| **WARM MOIST PVT** | | | |
| Seedling and sapling (<5” dbh) | 6.5% | 0.0% | 15.4% |

| Forest Size Class | Estimate Percent | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|
| Small tree (5-9.9” dbh) | 43.5% | 30.7% | 55.6% |
| Medium tree (10-14.9” dbh) | 37.0% | 24.5% | 49.2% |
| Large tree (15-19.9” dbh) | 9.8% | 3.2% | 17.2% |
| Very large tree (>=20” dbh) | 3.3% | 0.0% | 7.7% |
| **COOL MOIST PVT** | | | |
| Seedling and sapling (<5” dbh) | 15.5% | 11.0% | 20.9% |
| Small tree (5-9.9” dbh) | 38.0% | 33.5% | 42.3% |
| Medium tree (10-14.9” dbh) | 26.9% | 23.0% | 30.6% |
| Large tree (15-19.9” dbh) | 11.8% | 9.1% | 14.4% |
| Very large tree (>=20” dbh) | 7.8% | 4.9% | 10.8% |
| **COLD PVT** | | | |
| Seedling and sapling (<5” dbh) | 21.6% | 12.8% | 31.7% |
| Small tree (5-9.9” dbh) | 46.2% | 37.7% | 53.8% |
| Medium tree (10-14.9” dbh) | 22.9% | 16.8% | 29.6% |
| Large tree (15-19.9” dbh) | 7.6% | 3.7% | 12.0% |
| Very large tree (>=20” dbh) | 1.7% | 0.0% | 3.6% |

## IND-TE&V-04 – FOREST DENSITY (CANOPY COVER) –Estimates forestwide and by PVT

**Table 12. BASELINE CONDITION (2018 Forest Plan) - Canopy Cover Forestwide and by PVT**

| Area of analysis | Canopy cover <40% | Canopy cover 40 to 100% | Desired Condition for Forest Density (canopy cover percent) |
|---|---|---|---|
| **FORESTWIDE** | **47% of area** | **53% of area** | **Very Low to Low canopy cover (<40%): <50% of area**<br>**Moderate to High canopy cover (>=50%): 50-75% of area** |
| Warm Dry PVT | 45 | 55 | Moderate to high less common; Very low to low most common |
| Warm Moist PVT | 22 | 78 | Moderate to high most common; Very low to low less common |
| Cool Moist PVT | 45 | 55 | Moderate to high more common; Very low to low less common |
| Cold Pvt | 53 | 47 | Moderate to high less common; Very low to low more common |

**Table 13. 2021 Forest Plan Monitoring Report - Canopy Cover Percent Forestwide and by PVT**

| | Canopy Cover Less Than 40 Percent | Canopy Cover 40 to 100 percent |
|---|---|---|
| **FORESTWIDE** | **47%** | **53%** |
| warm dry | 48% | 52% |
| warm moist | 22% | 78% |
| cool moist | 46% | 54% |
| cold | 52% | 48% |

## IND-TE&V-05 – OLD GROWTH FOREST –Estimates forestwide and by PVT.

**Table 14. BASELINE CONDITION (2018 Forest Plan) - Old Growth Forest, Forestwide and by PVT**

| Area of analysis | Estimate Percent Old Growth | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound | Desired Conditions |
|---|---|---|---|---|
| **FORESTWIDE** | **9.5** | **7.75** | **11.48** | **Maintain or Increase** |
| Warm Dry PVT | 9.5 | 4.76 | 15.00 | Maintain or Increase |
| Warm Moist PVT | 3.8 | 0 | 9.21 | Maintain or Increase |
| Cool Moist PVT | 10.9 | 8.43 | 13.46 | Maintain or Increase |
| Cold Pvt | 8.7 | 4.55 | 13.43 | Maintain or Increase |

**Table 15. 2021 Forest Plan Monitoring Report – Old Growth Percent Forestwide and by PVT**

| Area of analysis | Estimate Percent Old Growth | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|
| **FORESTWIDE** | **9.61** | **7.8** | **11.6** |
| Warm Dry | 8.97 | 4.03 | 14.67 |
| Warm Moist | 4.51 | 0.00 | 10.42 |
| Cool Moist | 11.18 | 8.70 | 13.78 |
| Cold | 7.64 | 4.00 | 11.77 |

## IND-TE&V-06 – LARGE TREE STRUCTURE –Estimates forestwide and by PVT

At the first biennial monitoring period (2021), modifications were made to **IND-TE&V-06** to allow for monitoring of very large trees using the Large Tree Structure attribute in FIA database. See table below; for more details, see documentation and reference in 2021 Monitoring report.

**Table 16. Definition of "Large Tree Structure" attribute in the R1 FIA Summary Database**

| | Region 1 Broad PVT | Large[a] (TPA greater than or equal to 15-inch) | Very Large[b] (TPA greater than or equal to 20-inch) | Both[c] | None[d] |
|---|---|---|---|---|---|
| Western Montana | Warm Dry | 10 | 8 | Both the Large and Very Large TPA criteria are met | Neither the Large or Very Large TPA criteria are met |
| | Warm Moist or Cool Moist | 10 | 10 | | |
| | Cold | 10 | 10 | | |

a. "Large" is assigned to stands/plots that contain the required TPA >=15" but do not contain the TPA >=20" to qualify as Very Large
b. "Very Large" is assigned to stands/plots that contain the required TPA >=20" but do not contain the TPA >=15" to qualify as Large. The total stands/plots that contain Very Large tree structure would include those classified as Very Large and Both.
c. "Both" is assigned to stands/plots that contain the required TPA >=15" to qualify as Large, as well as the required TPA >=20" to qualify as Very Large.
d. "None" is assigned to stands/plots that do not have the required TPA to qualify as either Large or Very Large Tree class.

DESIRED CONDITION in FOREST PLAN – Very Large Trees: **FW-DC-TE&V-12** - Very large live trees (greater than 20 inches d.b.h.) are present not only in the very large forest size class (see FW-DC-TE&V-10 and 11) but are also distributed throughout other forest size classes across the matrix of Forest lands, including areas where timber harvest activities occur. Forest vegetation conditions support maintaining or increasing the density and distribution of very large live trees across the landscape. Desired species are listed in table 8. Very large live trees contribute to forest structural diversity, to long-term forest resilience, and to recovery after disturbances (such as fire). Very large trees contribute to future snag habitat in the late successional and old-growth forest, providing for long-term recruitment of large rotten trees, broken-top trees, and snags that are important habitat for species such as pileated woodpeckers, flammulated owls, lynx, fisher, and others. Very large trees contribute to scenic quality and to the economic value of forest products in areas suitable for timber production.

**Table 17. BASELINE CONDITION (2018 Forest Plan) – Large Tree Structure Forestwide and by PVT**

| Large Tree Structure | Estimate Percent | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|
| **FORESTWIDE** | | | |
| None | 69.52 | 66.43 | 72.57 |
| Large | 16.35 | 14.05 | 18.52 |
| Very Large ("Both") | 14.12 | 11.91 | 16.54 |
| **WARM DRY PVT** | | | |
| None | 68.28 | 58.97 | 77.08 |
| Large | 15.31 | 9.20 | 22.07 |
| Very Large ("Both") | 16.41 | 10.12 | 23.26 |
| **WARM MOIST PVT** | | | |
| None | 59.47 | 46.38 | 72.22 |
| Large | 31.06 | 20.00 | 42.86 |

| Large Tree Structure | Estimate Percent | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|
| Very Large (“Both”) | 9.47 | 3.07 | 17.06 |
| **COOL MOIST PVT** | | | |
| None | 67.46 | 63.45 | 71.35 |
| Large | 15.83 | 13.11 | 18.61 |
| Very Large (“Both”) | 16.71 | 13.6 | 20.00 |
| **COLD PVT** | | | |
| None | 77.58 | 70.83 | 83.95 |
| Large | 14.32 | 9.41 | 19.69 |
| Very Large (“Both”) | 8.10 | 4.26 | 12.36 |

**Table 18. 2021 Forest Plan Monitoring Report - Large Tree Structure Forestwide and by PVT**

| Large Tree Structure | Estimate Percent | 90 Percent Confidence Interval - Lower Bound | 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|
| FORESTWIDE | | | |
| None | 69.46% | 66.80% | 72.85% |
| Large | 17.22% | 14.85% | 19.41% |
| Very Large | 0.00% | 0.00% | 0.00% |
| Both (VLg) | 13.32% | 10.94% | 15.32% |
| WARM DRY PVT | | | |
| None | 71.24% | 62.14% | 80.95% |
| Large | 13.73% | 7.05% | 20.56% |
| Very Large | 0.00% | 0.00% | 0.00% |
| Both(VLg) | 15.03% | 8.09% | 22.09% |
| WARM MOIST PVT | | | |
| None | 58.06% | 44.83% | 68.33% |
| Large | 31.18% | 20.83% | 42.75% |
| Very Large | 0.00% | 0.00% | 0.00% |
| Both(VLg) | 10.75% | 4.54% | 19.93% |
| COOL MOIST PVT | | | |
| None | 66.56% | 62.95% | 70.73% |
| Large | 17.60% | 14.62% | 20.40% |
| Very Large | 0.00% | 0.00% | 0.00% |
| Both(VLg) | 15.84% | 12.67% | 18.65% |
| COLD PVT | | | |
| None | 80.14% | 74.63% | 86.36% |
| Large | 14.08% | 9.21% | 18.75% |
| Very Large | 0.00% | 0.00% | 0.00% |
| Both(VLg) | 5.78% | 2.46% | 9.06% |

## IND-TE&V-07 - VERY LARGE LIVE TREE DENSITY – Estimates by PVT, Inside and Outside Wilderness/Roadless areas (See Forest Plan Desired Condition above under IND-TE&V-06)

**Table 19. BASELINE CONDITION (2018 Forest Plan) – Very Large Tree Density (tpa) by Snag Analysis Groups (R1 Broad PVT Groups & PICO dominance type)**

| Wilderness / Roadless | Snag Analysis Group | 20-inch + Mean | 20-inch + 90 Percent Confidence Interval - Lower Bound | 20-inch + 90 Percent Confidence Interval - Upper Bound |
|---|---|---|---|---|
| IN | PICO | 0.3 | 0.0 | 0.7 |
| | Warm Dry | 4.5 | 2.1 | 7.1 |
| | Warm Moist | 6.0 | 0.0 | 13.4 |
| | Cold/Cool Moist | 5.3 | 3.9 | 6.7 |
| OUT | PICO | 0.0 | 0.0 | 0.0 |
| | Warm Dry | 4.7 | 2.0 | 7.9 |
| | Warm Moist | 2.2 | 0.4 | 4.5 |
| | Cold/Cool Moist | 5.8 | 4.2 | 7.5 |
| IN | Cold | 1.5 | 0.6 | 2.6 |
| | Cool Moist | 6.8 | 5.0 | 8.8 |
| OUT | Cold | 9.5 | 2.4 | 18.1 |
| | Cool Moist | 5.5 | 3.9 | 7.2 |

**Source:** Table 3 in Appendix B of the following publication: Bush, Renate, and Brian Reyes. 2020. Estimates of Snag and Live-Tree Densities for Western Montana Forests in the Northern Region Based on FIA Hybrid 2011 Analysis Dataset. Region One Vegetation Classification, Mapping, Inventory and Analysis Report 20-02 v. 1.0. USDA Forest Service Region 1, Missoula, MT. October 16, 2020.

2021 Forest Plan Monitoring Report - Very Large Tree Density (tpa) by Snag Analysis Group (R1 Broad PVT Groups and PICO dominance type): The regionally produced “Snag and Live Tree Density Reports” were not updated with the FIA Hybrid 2015 dataset in time for the 2021 Forest Plan Monitoring report. It is anticipated that these reports will be available for the next monitoring cycle. Data for IND-TE&V-07 would come directly from these reports.

## IND-TE&V-08 – SNAG DENSITY –Estimates by PVT

**Table 20. BASELINE CONDITION (2018 Forest Plan) – Snag densities (number/acre) by Snag Analysis Group**

| Snag Analysis Group | Mean (10"+) | 90 Percent Confidence Interval Lower Bound (10"+) | 90 Percent Confidence Interval Upper Bound (10"+) | Mean (15"+) | 90 Percent Confidence Interval Lower Bound (15"+) | 90 Percent Confidence Interval Upper Bound (15"+) | Mean (20"+) | 90 Percent Confidence Interval Lower Bound (20"+) | 90 Percent Confidence Interval Upper Bound (20"+) |
|---|---|---|---|---|---|---|---|---|---|
| PICO | 8.6 | 4.8 | 13.0 | 1.0 | 0.3 | 1.9 | 0.4 | 0.0 | 0.9 |
| Warm Dry | 11.0 | 6.3 | 16.3 | 4.2 | 2.0 | 6.9 | 1.2 | 0.2 | 2.6 |
| Warm Moist | 11.1 | 5.2 | 18.0 | 5.4 | 2.5 | 8.6 | 1.5 | 0.3 | 3.1 |
| Cool Moist | 18.6 | 15.3 | 22.3 | 5.8 | 4.4 | 7.3 | 2.1 | 1.4 | 3.0 |
| Cold | 17.2 | 12.2 | 22.8 | 4.5 | 2.6 | 6.7 | 1.4 | 0.6 | 2.5 |

**Source:** Table 1 in Appendix B of the following publication: Bush, Renate, and Brian Reyes. 2020. Estimates of Snag and Live-Tree Densities for Western Montana Forests in the Northern Region Based on FIA Hybrid 2011 Analysis Dataset. Region One Vegetation Classification, Mapping, Inventory and Analysis Report 20-02 v. 1.0. USDA Forest Service Region 1, Missoula, MT. October 16, 2020.

**Table 21. Forest Plan Desired Condition: FW-DC-TE&V-15 Desired minimum in average snags per acre of conifer species, as measured across all forested acres of the Forest, by forest dominance type, potential vegetation type, and snag diameter.**

| Forest dominance types | Potential vegetation type | Desired minimum in average number of snags per acre greater than or equal to 10 inches d.b.h. | Desired minimum in average number of snags per acre greater than or equal to 15 inches d.b.h. | Desired minimum in average number of snags per acre greater than or equal to 20 inches d.b.h. |
|---|---|---|---|---|
| All except lodgepole pine | Warm-dry | 5.0 | 2.9 | 0.7 |
| All except lodgepole pine | Warm-moist | 13.0 | 5.9 | 1.8 |
| All except lodgepole pine | Cool-moist | 15.0 | 4.0 | 1.2 |
| All except lodgepole pine | Cold | 10.0 | 3.0 | 0.9 |
| Lodgepole pine | All | 6.0 | 1.0 | 0.1 |

2021 Forest Plan Monitoring Report - Snag densities (number/acre) by Snag Analysis Group (R1 Broad PVT Groups and PICO dominance type): The regionally produced “Snag and Live Tree Density Reports” were not updated with the FIA Hybrid 2015 dataset in time for the 2021 Forest Plan Monitoring report. It is anticipated that these reports will be available for the next monitoring cycle. Data for IND-TE&V-08 would come directly from these reports.