

Chapter 5. Monitoring

As this subsection plan is implemented, monitoring of forest management activities is critical to achieve the goals of the CP-PMOP Plan. Many DNR forest management activities are currently tracked, such as cover type acres treated; treatment methods and acres; timber volumes sold and harvested; and regeneration methods, species, and success. However, some management activities and objectives are not readily tracked, such as stand composition changes. Monitoring of forest activities includes both site-level monitoring (*MFRC Voluntary Site Level Forest Management Guidelines*) and landscape-level monitoring (forest management consistent with the goals of the CP-PMOP Plan). Discussed below are the annual reviews and tracking of stand treatments and the landscape-level monitoring that will be used to monitor the implementation of CP-PMOP Plan.

5.1 Annual Stand Examination Plan Review among Divisions of DNR

Each year as Annual Stand Exam Plans are developed from the subsection plan, the Divisions of Fish and Wildlife and Ecological Resources will provide input to forestry staff regarding selection of stands and stand treatments. The Annual Stand Exam Plans developed by each Forestry Area are based on the state's fiscal year, July 1 – June 30. These annual harvest plans are typically prepared and cruised during the fall and winter months leading up to the start of the fiscal year. During development of the CP-PMOP Stand Exam List and also during each Forestry Area's identification of their Annual Stand Exam Lists other divisions are provided an opportunity to identify stands where they would like to participate in a joint field visit/stand evaluation. These joint visits allow all divisions to affect the stand prescriptions applied and stand management objectives. These review opportunities are also provided for annual plan additions (i.e., stands added during the year due to windthrow salvage, new information about a stand, etc.). A public review process is included for both the annual plans and additions.

5.2 Stand Treatments and Site level Monitoring

Approximately one-tenth of the stands selected for treatment, as identified in the CP-PMOP, will be field visited each year during the 10-year plan period. Final stand treatment prescriptions will be determined after the field visit/stand examinations are completed. Prescriptions and objectives assigned to stands during the SFRMP planning process are preliminary and may be adjusted based on current stand conditions and other information and input at the time of the stand examination.

Following timber sales or after forest development projects are contracted, forestry staff administers timber harvest permits, forest development projects (e.g., site preparation and tree planting), and road projects as the work is completed. Forestry staff regularly monitors these activities to ensure that permit regulations and contract specifications are being met. In addition, standardized timber sales inspections are completed on at least 10 percent of active timber sales each year. The application of site-level forest management guidelines (e.g., riparian management zone guidelines) is monitored during permit and contract supervision and inspections.

In addition to Division of Forestry monitoring, the MFRC site-level monitoring program will also periodically sample sites in these subsections as part of its overall statewide monitoring program. The objective of this statewide monitoring program is to evaluate the implementation of the MFRC's *Voluntary Site-Level Forest Management Guidelines* through field visits to randomly selected, recently harvested sites across the various forest land ownerships (state, county, national forest, tribal, forest industry, non-industrial private lands, etc.). The monitoring results from sites on state lands in these subsections will be used to determine implementation of the MFRC's site-level guidelines.

5.3 Landscape level monitoring

To monitor landscape-level forest management by DNR against the goals of the CP-PMOP Plan, two types of monitoring questions will be addressed:

1. Implementation Monitoring, which determines whether the management actions are being implemented as written in the CP-PMOP Plan, meaning:

Are management actions being carried out in a manner that is consistent with the plan?
and,

2. Effectiveness Monitoring, which determines the appropriateness or effectiveness of specific management actions designed and implemented to accomplish specific objectives identified in the CP-PMOP Plan, meaning:

Are management actions having the desired on-the-ground effect?

It is often not possible to see the results of prescriptions and objectives assigned to stands, for many years. Many of the treatments assigned to stands in this plan may not be accomplished until after the 10-year plan is over. Some reasons are: 1) a portion of the stands identified for treatment won't be field-examined (and for many, offered for sale) until late in the 10-year plan implementation period, 2) the harvest of timber sales occurs up to five years after the sale date, 3) forest development activities may be needed to regenerate the site to the desired species after the timber sale harvest is completed, 4) desired structural changes in stands may take many years or decades to occur, and 5) forest inventory data may not capture the forest stand composition components or changes for many years or capture it at all. Because of this, preliminary stand-management objectives (see Appendix I *Standard Codes in SFRMP*) have been developed to record the intent or objectives of stand treatments. Preliminary objectives may be assigned to some stands during the SFRMP process to provide preliminary guidance for the appraiser to consider during the on-site stand evaluation. Final objectives will be assigned after the stand examination/appraisal for a timber sale or other treatment is completed. The assignment of objectives to stands allows recording of the various stand treatments on an annual basis to assist in monitoring the implementation of the CP-PMOP Plan. This will help determine if strategies are being applied and if management objectives and goals are being met.

A significant portion of the data needed to monitor plan implementation and effectiveness will be collected from existing databases. Other data, especially those relating to effectiveness of management actions, are more difficult to obtain.

The following data sources and existing forestry management tools will be used to implement CP-PMOP monitoring:

1. **Forest Inventory Module (FIM)**
The primary source of information about the current condition of DNR forest lands is the Forest Inventory Module (FIM). FIM is a stand-level forest inventory. A stand is a contiguous group of trees similar in age, species composition, and structure; and growing on a site of similar quality, to be declared a distinguishable forest unit. A forest is comprised of many stands. FIM captures essential information about every forest stand on more than four million acres of DNR forest land. It is the basic data set from which decisions are made about if, when, where, and in what manner DNR forest stands will be treated. Information gathered includes overstory and understory tree species, stand age, timber volumes, site productivity, shrub and ground species, insects and diseases, and other specific site conditions. Native plant community (NPC) classification will be captured on stands for which evaluations have been completed.
2. **Silvicultural and Roads Module (SRM)**
The Silviculture and Roads Module (SRM) enables foresters to plan and record management objectives and actions on state lands. An SRM site is the piece of land for which the manager has developed a prescription (i.e., a series of actions). The site may be a FIM stand, part of a stand, or more than one stand. SRM allows for multi-year prescriptions for sites to manage the site for a specified objective. The site prescription consists of all the actions prescribed for a site to obtain a desired future condition. Actions include all the timber harvesting, site prep, planting, and seeding, TSI, and regeneration survey work needed to manage a stand for a specified objective. This long-range schedule and record of completed work helps track management activities, obligations, and management objectives. It is the foundation for budget requests and work plans.
3. **Timber Sales Module (TSM)**

The Timber Sales Module (TSM) includes the following functions: timber sales reporting, supports the appraisal and sale of timber harvest permits, tracking security provided by permit holders, accounting for harvested timber, and collecting revenue.

4. CP-PMOP Stand Exam List Shapefile

The SFRMP shapefile includes FIM stand data for all state-administered forest lands in the subsection plans. Subsection boundaries may have been slightly adjusted to avoid splitting of stands for consideration of access, etc. Therefore, the SFRMP subsection shapefile boundaries may be somewhat different than the original ECS subsection shapefile.

In addition to the standard FIM data fields, the SFRMP shapefile includes fields added during the planning process to identify stands for specific purposes (e.g., ERF, EILC, patches, preliminary objectives, new access data, and stand-selection fields). This will make it possible to create a statewide shapefile and provide a uniform set of fields for importing into SRM, posting on the DRS, reporting, and monitoring purposes

5. Annual Harvest List and Annual Plan Additions Shapefiles

Annual Harvest Lists and Plan Additions are drawn from SFRMP shapefiles and include additional information (including prescription, treatment acres, etc.). Adjustments can be made to add or remove stands, revise comment fields, or change joint visits (etc.).

6. DNR Data Resource Site (DRS)

The Data Resource Site (DRS) is a standardized collection of GIS data, metadata and programs. A DRS is a place where GIS resources are stored and made available to the users. The layers available on the DRS are designed such that use by DNR staff is intuitive and efficient. Many layers have been converted to shapefiles that are statewide in extent and targeted to a specific piece of information.

7. Internal Assessments and Inventories

Data from existing and pending assessments and inventories conducted by the Divisions of Ecological Resources, Fish and Wildlife, and Waters will be used. Examples of possible data sources include: wildlife population surveys (ruffed grouse, deer, goshawk, red-shouldered hawk, etc.); harvest reports; and water sampling results (impaired waters).

8. External Assessments and Inventories including resource management information, studies, and surveys conducted by other stakeholders.

9. Imagery available through the Forestry Resource Assessment Center.

Sampling of Sites

Because so much of the monitoring data comes from the SRM database, it is important to attempt to validate the accuracy of SRM data entry and consistency between the site objective and vegetation conditions (incorporating both implementation and effectiveness monitoring). The SFRMP Process Work Group will develop a method of site sampling (number of sites, site selection, techniques, etc.), emphasizing the application of existing survey tools/efforts such as timber sale inspections and regeneration surveys to gather validation data.

Baseline Data

Every effort will be made to identify baseline data for each indicator. The subsection assessments done at the beginning of the planning process contain all or most of the necessary data. Some indicators are tracked as a frequency or occurrence, for which there was not prior record keeping (e.g., the number of treatment deferrals). Although most pre-plan implementation data is lacking, data will be recorded annually so trend information during the plan's time frame will be available.

Data Collection, Analysis and Interpretation

Data from the SRM and FIM databases, and GIS shape files (primarily for implementation monitoring) will be collected periodically during the life of the plan. Effectiveness monitoring data will be collected and compiled at a mid point and at the end of a plan's time frame (2017). This information will be provided to the subsection team for interpretation and analysis as the basis for preparing the landscape level monitoring of implementation of the CP-PMOP Plan.

Data is entered into the FIM, SRM, and TSM continually. Fiscal year entries must be completed by September 1 of the following year. Data for the previous fiscal year can be extracted anytime after September. Plan shape files and DRS files are continually available.

5.4 Monitoring Roles and Responsibilities

Monitoring implementation of the CP-PMOP SFRMP will be the responsibility of the following individuals:

Forestry Field Staff has responsibility to:

Accurately record data and clearly document decisions regarding site objectives and associated actions for entry into appropriate databases.

Timber Sales, Silviculture and Inventory Program Foresters have responsibility to:

Accurately record data into the appropriate database (FIM, SRM, TSM) in a timely manner. Screens field data/decisions for consistency between actions and objectives, and with SFRMP plan directions.

CP-PMOP Team Core 4 has the responsibility to:

Review the monitoring results and is responsible for follow up on issues that arise. Follow up may include convening the full team, conducting additional training, re-emphasizing certain plan goals, initiating the plan amendment process, etc. The existing SFRMP decision-making process will be followed to guide the Core 4 process as monitoring issues are addressed. The CP-PMOP Core 4 consists of a regional wildlife member, regional forestry member; an ecological resources member, and the forest planner.

CP-PMOP Team

The CP-PMOP Team meets at the request of the Teams' Core 4 to discuss and interpret monitoring results and determine appropriate course of action.

CP-PMOP Forest Planner

The forest planner has the responsibility to: incorporate monitoring in SFRMP training for field staff, communicate the nature and importance of SFRMP monitoring to field staff, work with SFRMP Teams to incorporate monitoring considerations in formulating goals (i.e., measurable DFFCs) during plan development, convene the Core 4 to review monitoring reports, provide brief summaries of monitoring reports for review by FRIT, and assist with preparation of monitoring reports.

Central Office Forest Planner

The Central Office Forest Planner works with the subsection Teams' forest planner and the Core 4 to compile baseline data; facilitates annual extraction of data from databases and other sources, and assists the subsection Teams' Core 4 in obtaining and analyzing monitoring data; coordinates the preparation of monitoring reports; and maintains a central data and report storage system.

Monitoring questions and indicators have been identified for both implementation and effectiveness monitoring (Table 5.1). Indicators are a particular unit of information that, when measured over time, document changes in a specific condition referenced in the monitoring question.

5.5 Communicating Results

Each subsection team's Core 4 will analyze and summarize monitoring results following collection of the data. A written report, summarizing results of the annual efforts, will be prepared mid-term and at the end of the plan's time frame. These reports will be distributed internally and be accessible via the DNR Web site. Monitoring will guide future actions for CP-PMOP Plan amendments or plan adjustments.

The CP-PMOP SFRMP, maps, and Appendices can be viewed online at:
http://www.dnr.state.mn.us/forestry/subsection/cp_pmop/plan.html

Table 5.1 SFRMP Monitoring questions, indicators, outcomes, data sources, frequency, and priority.

*1 - measurements we can do fairly easily and will start immediately; 2 - measurements we are currently working on and hope to do soon; 3 - measurements we want to do and will continue to investigate, but are currently not able to undertake.

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
Implementation Monitoring: are management actions being carried out in a manner that is consistent with the plan? (numbers 1 – 27)						
1. Are the numbers of acres treated (by cover type) consistent with the plan?	Acres treated	Acres by cover type by type of treatment	<i>This column will be filled in with the measurable outcomes specified in the subsection plans.</i>	SRM Location Detail Properties and Actual Actions	Annual	1
2. Which management actions (prescriptions) were carried out or scheduled (by cover type)?	Management actions (prescriptions) carried out	Actions by cover type and acres		SRM Location Detail Properties and Actual Actions	Annual	1
3. Are the numbers of acres reforested and the species used consistent with the plan (by cover type)?	Acres reforested and the species used	Acres and species by reforestation method		SRM Objectives and Actual Actions	Annual	1
4. Are the acres and age of ERF stands treated in a way that is consistent with the plan (by cover type)?	Acres and age of ERF stands treated	Acres and age by cover type		FIM SFRMP Shape File	Annual?	1
5. Are the numbers of “normal rotation” acres treated consistent with the plan (by cover type)?	“Normal Acres” treated	Acres by cover type	<i>This column will be filled in with the measurable outcomes specified in the subsection plans.</i>	FIM SFRMP Shape File	Annual?	1
6. Were all selected stands field visited?	Stands field visited	Number of stands (percent)		SRM Actual Actions	Annual	1
7. What is the frequency of stand treatment being a deferral (by cover type)?	Stand treatment = deferral	Number of stands by cover type and acres		SRM Location Detail Properties Actual Actions	Annual	1
8. What is the frequency of stand treatment being a FIM alteration (by cover type)?	Stand treatment = alteration	Number of stands by cover type and acres		SRM Actual Actions	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
9. Is the number of stands managed to maintain cover type consistent with the plan (by cover type)?	Stands managed to maintain cover type	Number of stands by cover type and acres		SRM Objectives and Actual Actions	Annual	1
10. Is the number of stands managed to maintain cover type but increase stand species composition consistent with the plan (by species)?	Stands managed to maintain cover type but increase stand species composition	Number of stands by cover type and acres		SRM Objectives and Actual Actions	Annual	1
11. Is the number of stands managed to maintain cover type but change structural composition consistent with the plan (by type of change)?	Stands managed to maintain cover type but change structural composition	Number of stands by cover type and acres	<i>This column will be filled in with the measurable outcomes specified in the subsection plans.</i>	SRM Objectives and Actual Actions	Annual	1
12. Is the number of stands managed to convert to another cover type consistent with the plan (by cover type)?	Stands managed to convert to another cover type	Number of stands by desired cover type and acres		SRM Objectives and Actual Actions	Annual	1
13. Is the frequency and location of stand management to maintain a large patch consistent with the plan?	Stand management to maintain a large patch	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
14. Is the frequency of stand management to increase patch size consistent with the plan?	Stand management to increase patch size	Number of instances and acres		SRM Objectives and Actual Actions	Annual	1
15. Is the frequency and location of stand management to enhance smaller patches consistent with the plan?	Stand management to enhance smaller patches	Number of instances and acres	<i>This column will be filled in with the measurable outcomes specified in the subsection plans.</i>	SRM Objectives and Actual Actions	Annual	1
16. Are the numbers of RMZ acres managed for long-	RMZ acres managed for	Acres		SRM Objectives and Actual	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
lived conifers consistent with the plan?	long-lived conifers			Actions, GIS		
17. Are the numbers of RMZ acres managed to maintain shade to trout streams consistent with the plan?	RMZ acres managed to maintain shade to trout streams	Acres		SRM Objectives and Actual Actions, GIS	Annual	1
18. Is the frequency of stand management to maintain existing NPC and structure (by NPC) consistent with the plan?	Stand management to maintain existing NPC and structure	Number of stands by NPC and acres		SRM Objectives and Actual Actions	Annual	1
19. Is the frequency of stand management to retain NPC older growth stage components consistent with the plan?	Stand management to retain NPC older growth stage components	Number of stands by NPC and acres	<i>This column will be filled in with the measurable outcomes specified in the subsection plans.</i>	SRM Objectives and Actual Actions	Annual	1
20. Is the number of stands managed to protect rare plant and animal locations consistent with the plan (by species)?	Stands managed to protect rare plant and animal locations	Number of stands and acres (note whether a portion of stand)		SRM Objectives and Actual Actions	Annual	1
21. Is the frequency of stands under special management for species or habitat consistent with the plan?	Stands under special management for species or habitat	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
22. Is the frequency of stand management to maintain adequate residual BA within an identified corridor consistent with the plan?	Stand management to maintain adequate residual BA within an identified corridor	Number of stands and acres		SRM Objectives and Actual Actions	Annual	1
23. Are the known locations of rare native plant considered and protected (by species)?	Stands managed to protect a rare native plant	Number of stands and acres	<i>This column will be filled in with the measurable outcomes specified in the subsection plans.</i>	SRM Objectives and Actual Actions	Annual	1
24. Is the frequency of use	Use of prescribed	Number of		SRM Objectives	Annual	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
of prescribed burning as a management tool consistent with the plan?	burning as a management tool	instances and acres		and Actual Actions		
25. Is the frequency of use of less intensive TSI or site preparation techniques consistent with the plan?	Use of less intensive TSI or site preparation techniques	Number of instances and acres		SRM Objectives and Actual Actions	Annual	1
26. Are the known locations of cultural resource considered and protected (by species)?	Stands managed to protect a known cultural resource	Number of stands and acres (note whether a portion of stand)		SRM Objectives and Actual Actions	Annual	1
27. Is the number of new access miles built and closure methods used consistent with the plan?	New roads built and road closure methods used	Miles and methods		SRM	Annual	1
Effectiveness Monitoring: are management actions having the desired on-the-ground effect? (numbers 28 – 41)						
28. Change in the amount of forest land and timberland?	Amount of forest land and timber	Acres of forest land and timberland	Increase	FIM Satellite Imagery GIS/DRS	Plan Mid Point & Renewal	1
29. Change in representation of forest cover types?	Cover type representation	Total forest acres in each cover type and percent change	To be specified based on subsection plan	FIM Satellite Imagery	Plan Mid Point & Renewal	1
30. Change in forest size and age-class distribution?	Forest size and age-class distribution	Total forest acres in each size and age-class and percent change	Desired outcome varies; to be specified based on subsection plans	FIM	Plan Mid Point & Renewal	1
31. Change in percent of young forest?	Young forest	Acres and percent of total forest	Increase	FIM	Plan Mid-Point & Renewal	1
32. Change in percent of old forest?	Old forest	Acres and percent of total forest	Increase as stated in plan	FIM	Plan Mid-Point & Renewal	1
33. Change in the percent of effective ERF?	Effective ERF	Acres and percent of total forest	Increase as stated in plan	FIM	Plan Mid-Point & Renewal	1

Monitoring Question	Indicator	Report by	Desired Outcome	Data Source	Initial Freq.	Priority* Rating
34. Change in the number of stands with long-lived conifers?	Stands with long-lived conifers	Total acres and percent change	Increase	FIM Possibly Satellite Imagery	Plan Mid-Point & Renewal	2
35. Change in area of forest affected by potentially damaging agents (tree mortality and damage, wildfire, flooding, invasive/exotic species, insects and diseases, animals, and utility/road construction)?	Area of forest affected by potentially damaging agents	Acres affected by agent and percent change	Decrease affected acres	FIM (look into surveys by Forest Health staff)	Plan Renewal	2
36. Change in forest spatial patterns (patch and connectivity)?	Forest spatial patterns	Number of and size (acres) of patch and index of connectivity	Larger patches with greater connectivity	FIM GIS/modeling	Plan Renewal	2
37. Change in miles of impaired streams within forests?	Miles of impaired streams within forests	Miles of impaired streams and change	Decrease in miles of impaired streams	Work with Waters GIS/DRS	Plan Renewal, when data is available	2
38. Change in forest-associated species of concern by taxonomic group?	Forest-associated species of concern	Indicator of population size and change	Healthier populations	Work with Wildlife & Eco Services, etc.	Plan Renewal, when data is available	2
39. Change in forest game populations?	Forest game populations	Population estimates	Healthier populations			
40. Change in forest bird populations?	Forest bird populations	Indicator of population size and change; possibly red-shouldered hawk, goshawk	Healthier populations	Collaborate, possibly with university study, Eco Services	Plan Renewal, when data is available	3
41. Change in known rare plant communities (number of sites, area, and composition)?	Known rare plant communities	Number of and size (acres) of sites, and measure (indices) of health	Maintain or enhance	Work with Eco Services	Plan Renewal, when data is available	3

*1 - measurements we can do fairly easily and will start immediately; 2 - measurements we are currently working on and hope to do soon; 3 - measurements we want to do and will continue to investigate, but are currently not able to undertake.