Forest Management Guide for Boreal Landscapes
and
Forest Management Guide for Great Lakes-St. Lawrence Landscapes:
Validating and Revising Milestone Technical Note
And
Milestone Repository

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Milestone Repository

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Introduction

Objective of the Repository

As part of the initial development of both the Forest Management Guide for Boreal Landscapes and the Forest Management Guide for Great Lakes-St. Lawrence Landscapes, milestones were developed to describe a trajectory for each forest management unit and for each landscape guide indicator. Milestones include directional statements (e.g. maintain, increase or decrease) from the present condition (intended to be plan start) over the short (1-10 years), medium (1-20 years) and long term (1-100 years). The intent of the Landscape Guides is that planning teams use these directional statements when developing specific targets and achievement rates for each area-based Landscape Guide indicator.

Area-based indicators:

Boreal (both Regions) *

- Caribou Habitat (where applicable – continuous caribou occupancy)
- Landscape Classes
- Old Growth
- Conifer all ages
- Young Forest
-

Great Lakes – St. Lawrence*

- Landscape Classes
- Old Growth
- Red and White Pine
- Young Forest

* Refer to appropriate landscape guide for precise indicator definitions.

Note: Area-based indicators are those that are characterized using box and whisker diagrams of amount (i.e., hectares), they are non-spatial (e.g. not texture/pattern or patch size class frequency).

The Forest Management Guide for Great Lakes–St. Lawrence Landscapes (GLLG) was approved in 2010 and the Forest Management Guide for Boreal Landscapes (BLG) was approved in 2014. The development and publication of milestones in each guide was based on available inventories at the time each guide was approved. The starting point of the forest condition that directional milestones statements for each forest management unit was based on the state of the forest at the time the development of the guide. As forest management plans are being developed - new, revised and updated inventories representing current forest conditions become available that may be different starting conditions compared to those used when milestones were initially developed. As a result, the milestones found in the appendices of the Landscape Guides may no longer be valid - not achievable.

During the development of both guides it was decided that milestones would be placed in Appendices with an understanding that milestones may need to be revised prior to the normal 5-year (now 10 year) review cycle of the guide.

Milestone validation and revision

Steps

Validation

Step 1: Classify inventory

Step 2: Compare indicators and milestones

Step 3: Verify that current milestones are achievable

If necessary - Develop Revised Milestones

Step 4: Develop an enhanced base model

Step 5: Conduct an analysis on enhanced base model

Step 6: Settle on balanced milestones

Step 7: Document revised milestones

Milestone validation and revisions will be assessed by the Ministry of Natural Resources and Forestry (MNRF) and provided to planning teams.

Milestone validation will be accomplished by summarizing the Base Model Inventory and performing a scoping analysis using the base model (see base model description below).

Step 1: Classify Inventory

The first step in validating milestones is to classify an approved inventory expected to be used in the development of the forest management plan – preferably the approved Base Model Inventory (BMI). This task can be completed using Ontario's Landscape Tool (OLT) or other software. The objective of the classification will be to ensure a consistent comparison (1:1) with each indicator listed in the Forest Management Guide

for Boreal Landscapes (table 2 – Northwest Region and table 3 - Northeast Region) or the Forest Management Guide for Great Lakes-St. Lawrence Landscapes (table 2) for which area-based milestones exist. Validation of texture/pattern-based milestones is not required because the guide direction is to continually move towards – a relative measure regardless of forest condition.

Listing of area-based indicator milestones to validate:

Boreal (both NW and NE Regions)

- Caribou Habitat (where applicable – continuous caribou occupancy)
- Landscape Classes
- Old Growth
- Conifer all ages
- Young Forest

Great Lakes – St. Lawrence

- Landscape Classes
- Old Growth
- Red and White Pine
- Young Forest

Refer to appropriate landscape guide for indicator definitions.

Step 2: Compare indicators and milestones

For each landscape guide indicator - compare the new *plan start* amounts to the simulated ranges of natural variation (SRNV).

From the SRNV box and whisker diagrams the box (e.g. interquartile range only) are used as the desirable levels in the Forest Management Guide for Boreal Landscapes. In contrast, the entire box and whisker are used as the desirable levels in the Forest Management Guide for Great Lakes-St. Lawrence Landscapes.

Step 3: Verify that current milestones are achievable

One of three possible scenarios will exist for each indicator - the plan start amount is within, below or above the desirable level.

Scenario i - The plan start amount is within the desirable level

In cases where the plan start amount is within the desirable level, the milestone statements will read as: short term (10 year) maintain, medium term (20 year) maintain and long term (100 year) maintain.

In cases where any of these statements in the milestone appendices of the guide are different – a revised milestone table will be developed.

Scenario ii - The plan start amount is below the desirable level

In cases where the initial amount is below the desirable level the milestone statement for the short term will be: short term (10 year) increase.

In cases where the milestone statement in the appendices of the guide is different from this short-term milestone statement - a revised milestone table will be developed.

The determination of both the medium term (20 year) and long term (100 year) milestone will be based on the approved base model and scoping methods described below.

Scenario iii - The plan start amount is above the desirable level

In cases where the initial amount is above the desirable level the milestone statement for the short term will be: short term (10 year) decrease**.**

In cases where the milestone statement in the appendices of the guide is different from this short-term milestone statement - a revised milestone table will be developed.

The determination of both the medium term (20 year) and long term (100 year) milestone will be based on the approved base model and scoping methods described below.

Developing Revised Milestones (if necessary)

The objective of the revision of milestones is to determine achievable targets, where a target is a measure of the amount (i.e., specific number, range or trend) for an indicator to be achieved within a specific timeframe. The target will be consistent with the desirable level of the indicator, or the target will be established to encourage movement towards the desirable level. The approved base model will be used to validate or develop the medium (20 year) and long term (100 year) milestones. Milestones will be determined by MNRF using enhanced base models which will be developed as part of the development of the forest management plan at Checkpoint 3 endorsement.

Step 4: Develop an Enhanced Base Model

The base model submitted at Checkpoint 3 includes assumptions related to the landbase (forest classification, ecological zones, land use decisions), forest dynamics (forest succession, growth and yield), strategic silviculture options, as well as some physical and biological limits including other modelling assumptions identified by the planning team.

Generally, the base model does not include constraints typically associated with management objectives. The intent of the enhanced base model is to include general management constraints to ensure an achievable harvest schedule without being too constraining on the development of a future forest condition. The current approved LTMD model can be used to help guide the selection of specific levels for some management constraints in the enhanced base model.

When developing an enhanced base model for milestone development – consider setting constraints as follows (but not limited to):

Forest Renewal Limits

Using achievable renewal limits (e.g. it is unrealistic to assume you can plant, or seed 100% of a forest).

Harvest Flow Policies

Consider using a loose harvest flow constraint on the model, usually much looser than used for the LTMD. Consider statements from the Provincial Wood Supply Strategy to sustain a continuous, predictable, long-term wood supply necessary for industrial processing facilities and to increase the long term available wood supply. It is not recommended to have harvest fluctuating wildly from term to term. Assume 30% for each of the major species groups to be a reasonable starting point

Budgets

Consider running the model using - stumpage revenues of all subunits combined.

Harvest Area Limits by FU and SI – Stage of Management

Ensure the model harvests the areas that are part-way along when in shelterwood regimes to complete the sequentially timed interventions. That is, areas in a shelterwood forest units which have received a seed cut, or a first cut, but have not received a final removal may need to have that scheduled in term 1. Also consider appropriate targets for commercial thinning activities.

Historic Harvest Levels

Identify 5-10-year historic harvest levels from Annual Reports as a lower harvest area minimum target to be used as a guide when determining what a reasonable trade-off of harvest to landscape guide objective achievement while ensuring a balanced distribution of annual available harvest amongst forest units that would normally be addressed in the FMP LTMD.

Growing Stock

You may need to place a growing stock target on the last term of the model to prevent it from harvesting everything that is eligible. This is commonly known as the end of the world effect in unconstrained optimization models when maximizing wood supply over time.

Deferrals

For recently treated shelterwood forest unit areas – ensure that deferrals are identified and turned on so that harvest activities are not scheduled on areas that should have a harvest timing delay recognized for the first 10-20 years.

The intent of the enhanced base model is to develop a realistic harvest schedule than what would be found in an unconstrained base model, but not to develop something as highly constrained as an LTMD.

Step 5: Conduct an Analysis on Enhanced Base Model

The base model submitted for Checkpoint 3 will already have built into it the ability to assess Landscape Guide target achievement. The model generally uses generic yield curves as are used in the Boreal Forest, or a modified habitat matrix as is used in the Great Lakes St Lawrence Forest.

A balance of achievable targets will be developed using an iterative scoping analysis by setting progressively more demanding Landscape Guide targets based on the proximity of the forest starting condition to the SRNVs. The focus should be to ensure that there is an increase in the level when below the desirable level or to remain within the desirable level if starting within, or to decrease when starting above the desirable level.

Depending on what the forest type conditions the indicator represents, it may be difficult to show a sufficiently decreasing trend over time.

The following approach should be considered for exploring the setting of milestones*:

1. The initial run should be the Enhanced Base Model with no added Landscape Guide targets. This ensures that the model is working correctly and gives a benchmark where subsequent runs can be compared.

2. Add constraints for each indicator consistent with initial run keeping the successive indicators within the SRNV. Apply the constraints for up to 100 years of the model horizon. Add a minimum level constraint which equals the lower edge of the SRNV and add a maximum level constraint which equals the upper edge of the SRNV (box in Boreal and entire SRNV in GLSL). A maximum level constraint may not always be appropriate if it causes infeasibility. With the exception of young forest, being above the SRNV is acceptable as long as other indicators are still within and none are below the desirable level. Solve the model. You should achieve a feasible solution and you should save your model as a new Case and then move on to step three. If you did not achieve a feasible solution, then you will have to relax the constraints one at a time to determine which constraint is causing the infeasibility. When a balanced solution is found save your model as a new case.

This is an iterative stepped approach requiring adding in constraints for indicators meeting the criteria above. Apply the constraints for up to 100 years of the model horizon. If the constraints are applied too early the model may be infeasible since it cannot change the forest quick enough. Too late and your indicator trend may vary from being in to being out over the mid horizon terms. It is recommended that these constraints be added in one at a time. The order at which they are added in will depend on your forest, and the trends your indicators follow.

In summary, first stabilize any indicators which are moving away from the SRNV, next attempt to move indicators one at a time closer to the SRNV based on the proximity of the indicator to the SRNV, the relative importance of the indicator (see order of application in the appropriate guide), and how sensitive the indicator is to movement (experience from earlier runs will inform this).

*Note the approach suggested is most compatible with SFMM but the principles may be used if using a spatial model.

Step 6: Settling on Balanced Milestones

Targets are established to ensure that management strategies show movement towards and achievement within the desirable levels range. The recognition of a realistic management strategy implies that targets are influenced by socio-economic considerations.
Final revised milestones, if needed, will be based on the results of the enhanced base model analysis described above.

When developing revised milestones consider the following:

1. Results from the initial unconstrained base model run.
2. Overall Landscape Guide Indicator achievement - remember the order of application.
3. Historic harvest volume from Annual Reports.
4. Harvest flow – beware of unrealistic low levels achievements.
5. While the final LTMD model could be considerably more constrained than what was developed for this exercise, teams need to be aware that the LTMD strategy may result in deviations from the revised milestones. These will have to be rationalized as required by the FMPM.

When a final model run is developed which reflects a ‘realistic’ achievement of Landscape Guide Indicators, the task team will save the appropriate case and document their results.
The documentation will include a milestone table consistent with milestone tables found in the appendices of the landscape guides including - for each Landscape Guide Indicator:

Short term - 10-year directional statement (maintain, increase or decrease)
Medium term - 20-year directional statement (maintain, increase or decrease)
Long term - 100-year directional statement (maintain, increase or decrease)

For each of the short, medium and long term include the calendar year to achieve. For example, if the plan start is 2020 the milestone table would include directional statements in columns as: Short (2030-10 year), Medium (2040-20 year) and Long (2110-100 year).

Step 7: Documenting Revised Milestones

These results will then be used in the plan and provided to Crown Forests and Lands Policy Section - for inclusion into Landscape Guide Milestones Repository (this document).

The revised milestones and the process used will be documented in the materials submitted with Checkpoint 4 – Management Objectives. See FMPM 2017, Appendix 1, App-3, lines 25-32.

Milestone Repository

This repository includes milestones that have been revised. Revisions may be a result of the Validation and Revision process outlined above or may be a result of forest management units amalgamating or de-amalgamating.

The repository is organized in chronological order of milestone revision.
Revisions are listed as non-tabular text. Refer to either Landscape Guide for specific definitions.

Pic Forest

Year of revision: 2017

Rationale:

This Pic Forest revised milestones were based on the planned amalgamation of the Big Pic, Pic River Ojibway and Black River forests.

Each of the forests milestones contained the same directional statements for each indicator and for each period – consequently this revision consisted of creating a single table with one set of directional statements for the amalgamated Pic Forest. The table was developed with a forecasted 2019 start of next plan date.

In the original Boreal Landscape Guide prior to the finalization of Caribou Range Boundaries there was uncertainty around where and how much of continuous caribou range would be included in the Big Pic Forest resulting in no caribou habitat milestones being developed.

Landscape Guide Region 3W – Revised milestones for the Pic Forest:

Milestones are listed in for the following terms; Short (10 years - 2029). Medium (20 years - 2039) and Long (100 years – 2119), Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and late balsam fir mixed: Maintain, maintain, maintain.

Mature and late lowland spruce and low other conifer: Increase, increase, maintain.

Mature and late conifer and conifer mixedwood: Maintain, maintain, maintain.

Mature and late hardwood and hardwood mixedwood: Decrease, decrease, maintain.

Old Growth All: Increase, maintain, maintain.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Increase, increase, maintain.

Caribou Habitat:

Refuge habitat: Increase, increase, maintain.

Winter used and preferred habitat: Increase, maintain, maintain.

Sudbury Forest

Year of revision: 2018

Rationale:

After receiving a new eFRI for the Sudbury Forest an analysis of the validity of existing Landscape Guide Milestones took place. This was deemed necessary as the new inventory may have provided significantly different plan start conditions from the inventory which the milestones were developed. This could result in milestones being either unachievable, illogical, or even not binding enough. The Analysis used for the Milestone Review exercise for Sudbury Forest was based off a Base Model provided to MNRF ahead of planning Checkpoint 3, as well as the methodology described in this document for assessing Landscape Guide Milestones.

Step 1 - was to classify the inventory and how the inventory related to Landscape Guide Indicators. This was completed during Checkpoint 2 and all Landscape Guide indicators were built into the Habitat Matrix of the SFMM Base Model.

Step 2 and 3 were to compare the starting conditions of the forest to the original starting conditions and to the SRNV. The Mixed Pines and Spruce-Fir-Cedar Landscape Classes each had Milestones indicating the need to increase area in the Landscape Class. However, given that the new starting conditions were above the SRNV these milestones would need to be revised.

Step 4 - An enhanced base model was developed to provide some realistic management constraints to the model without restricting as tight as an LTMD type model.

Constraints added to the Sudbury Forest model include:

a) Lower volume limits to major species groups to keep harvest consistent with the previous plan.
b) Harvest flow constraints between terms set at 10%, and for individual species groups set at 10% for SPF and INT and set at 5% for PWR, TOL and OC.
c) Harvest Area fluctuation constraints of between 10% and 30% per PlanFU
d) All Forest Renewal Limits to ensure SFMM assigns an achievable harvest schedule. The majority of these were minimum limits on Extensive regeneration

of between 30% and 80% by PlanFU and term. Some upper limits on the more intensive managements were assigned as well (INTN2 in PJ limited to a maximum of 10%)

e) Some minimum harvest area limits around PWST and PR ComThin.

Step 5 - With a constrained enhanced base model completed, Landscape Guide Targets were applied in an iterative fashion becoming more and more constraining. Eventually with no additional increase in Landscape Guide achievement possible the analysis was considered complete. The results of the analysis showed some of the original milestones may have been overly conservative, and that some more rigorous Milestones could be justified for Sudbury 2020.

Step 6 - In addition to the Mixed Pines and Spruce-Fir-Cedar Milestones which were changed based on a different inventory starting condition, it was determined that the Intolerant Hardwood, Mixedwood and Red and White Pine All Ages milestones should be altered.

Important to note, that of the five milestones changed, three of them became more binding (100 year changed from ‘move towards’ to ‘maintain’, while only two of the milestones were relaxed.

Landscape Guide Region GLSL North – Revised Milestones for the Sudbury Forest

Milestones are listed in for the following terms; Short (10 years - 2030), Medium (20 years - 2040) and Long (100 years – 2120). Refer to Landscape Guides for further definitions.

Landscape Classes:

Tolerant hardwood: Increase, increase, increase.

Intolerant hardwood: Decrease, decrease, maintain.

White pine mixedwood: Increase, increase, increase.

Mixedwood: Decrease, decrease, maintain.

Mixed pines: Decrease, decrease, maintain.

Spruce-fir-cedar: Decrease, decrease, increase.

Red and white pine forest: Increase, increase, maintain.

Gordon Cosens Forest

Year of revision: 2018

Rationale:

Initial scoping runs using the 2016 inventory (checkpoint 2 approved) confirmed that some of the milestones for the GCF are no longer valid - achievable.
The inventory of the forest management plan was classified into forest units decided on the planning team (PLANFU). This classification was based on regional standard forest units and the landscape guide forest unit definitions described in the boreal landscape guide science package. The latter classification was used when establishing the simulated ranges of natural variation (SRNVs). This PLANFU classification had small differences compared to the Boreal Guide forest units and was deemed to be acceptably close by the planning team.
The validation of texture-based milestones is not required, because the direction is to continually move toward the mean of the SRNV. For area-based indicators, the first step was to look at a comparison of the current forest condition and the SRNV. In situations where the current indicator measurement was within the desirable level (i.e. within the Interquartile Range (IQR) of the SRNV), the short, medium, and long-term milestones were either kept or updated to read “maintain”. If the current indicator measurement was below the desirable level, the short-term milestone was either kept or updated to read “increase”. If the current indicator measurement was above the desirable level, the short-term milestone was either kept or updated to read “decrease”.
Under the latter two circumstances, the validation of the medium and long-term milestones requires a scoping exercise that considers a more realistic harvest schedule than what would be found in an unconstrained scenario but is likely less constrained than an LTMD. The original milestones published in the landscape guides were developed considering limited silvicultural, social, and economic values, and the revision of the table followed a similar approach.
Patchworks is a modelling program being used to develop the 2020 GCF FMP and was also used to validate and update the milestone table. The scenario used to establish the

revised milestones included a volume flow that was set based on previous LTMD achievements - allowing +/-10% flow variation between periods, with a maximum deviation over the planning horizon of +/-25%. The following volume objectives were used to calibrate the initial starting position of the volume indicators: 948,127 m^3 for SPF, 96,007 m^3 for OC, 324,968 m^3 for PO, and 38,578 m^3 for BW. Wood supply objectives included a balanced silviculture budget, non-declining closing growing stock, and biological silviculture limits. The area-based landscape guide objectives were given a high priority weighting for the lower IQR of the SRNV. A series of individual scoping runs (i.e. weighting individual indicators) and a no harvest scenario were also considered

Each indicator was assessed at the short, medium, and long term. A 0.5% rule was used in determining if the milestone in the long term (100 years) should read “maintain”, and consideration was given to the no harvest scenario. For example, if the milestone for an indicator was “increase” in the short and medium term, and the long term (100 year) projection was within 0.5% of the lower IQR of the SRNV, the long-term milestone was updated to read “maintain”.

Milestone tables are normally updated by MNRF using the Sustainable Forest Management Model (SFMM). The Patchworks scenario run for this exercise appears to be unable to meet some targets, even when using a high priority weighting. If a scenario with the same parameters described was run in SFMM, it may have been infeasible, and the parameters would have to be adjusted. Patchworks allows for this flexibility in its model, and the scenario was maintained without additional changes in the interest of time.

The lowland conifer indicator appeared to be significantly above the SRNV, and stable through a 150 year projection of a no harvest scenario and a more realistic scenario with parameters described above This would have resulted in the milestone for the lowland conifer being updated to “decrease” for the short, medium, and long term, and the milestone for all conifer indicators combined being updated to “decrease” for the short and medium term. However, it is not realistic to decrease the lowland conifer area through forest management activities. Therefore, the lowland conifer SRNV was

updated with the current forest condition as the median. This resulted in no changes to the milestones provided in Appendix 22 of the boreal landscape guide.

For the caribou mature conifer indicator, the Patchworks model does not include the PolyType “RCK” in its calculation. Patchworks incorporates “TMS” and “RCK” polygons into a category with the “BOG” forest unit. The three of these classifications are considered to always provide online winter suitable (i.e. regardless of age). However, the mature conifer caribou habitat indicator only includes “RCK”,and does not include “BOG” or “TMS” in its calculation. The “RCK” Polytype represents a very small area (~6 ha (0.001%) within the caribou zone and ~65.5 ha (0.004%) within the entire GCF). Therefore, the modelling and analysis task team decided to continue calculating the mature conifer caribou habitat indicator excluding “RCK” and acknowledging that there are no successional rules the create or remove “RCK” from the land base over time.

Another important consideration in the GCF is the dynamic caribou habitat schedule (DCHS). The temporal harvest restrictions imposed by the DCHS can have significant influence on forest management planning, but the deferrals imposed by the DCHS were not considered when validating and updating the milestones for the 2020 FMP. The reasons for this decision includes maintaining comparability to past milestones that did not consider a DCHS, and the DCHS being delineated based on management decisions that could be altered to change line work or timing of harvest to better achieve milestones. Therefore, the MNRF understands the restrictions associated with the DCHS may create challenges in achieving some other indicators (e.g. mature conifer caribou habitat) and expects these challenges to be discussed in the FMP. Direction for documenting deviations from the milestones is provided in section 3.4 of the boreal landscape guide.

There were no changes to the texture-based milestones. For area-based indicators, there were four changes:

- Immature and Older Pine was changed from “Maintain” to “Increase” for the short, medium, and long-term milestones.
- Old Growth (NE) indicator in the short term was changed from “Maintain” to “Increase”

- The caribou winter suitable habitat indicator was updated in the medium term from “Increase” to “Maintain”.
- The mature conifer caribou habitat indicator was updated in the short and
- medium term from “Maintain” to “Increase”.

Landscape Guide Region 3E – Revised milestones for the Gordon Cosens Forest

Milestones are listed in for the following terms; Short (10 years - 2030), Medium (20 years - 2040) and Long (100 years – 2120). Refer to Landscape Guides for further definitions.

Landscape Classes:

Immature and Older Pine: Increase, increase, increase.

Mature and older upland conifer: Increase, increase, maintain.

Immature and older hardwood and immature mixedwood: Maintain, maintain, maintain.

Mature and older mixedwood: Increase, increase, maintain.

Mature and older lowland conifer: Maintain, maintain, maintain.

Old Growth Forest: Increase, increase, maintain.

All Ages Red and White Pine: Increase, increase, increase.

Caribou Habitat:

Suitable Winter: Increase, maintain, maintain.

Mature Conifer: Increase, increase, maintain.

Dog River-Matawin Forest

Year of revision: 2019

Rationale:

The Dog River-Matawin Forest received a new enhanced forest resource inventory (eFRI) for use in its 2021 forest management plan (FMP).

Milestones are achievable time-based targets used in forest management planning. When comparing the (2019) plan-start levels of composition indicators from the new inventory with the milestones found in the appendices of the Boreal Landscape Guide several indicators were found to be unachievable.

Short term milestones (10 year) were determined by comparing the plan-start levels to the desirable level inter-quartile range (IQR). Plan-start levels within the IQR were given a ‘maintain’ short-term milestone, while plan-start levels below or above the IQR were given an ‘increase’ or ‘decrease’ short-term milestone respectively. The determination of both the medium-term (20 year) and long-term (100 year) milestones were based on modelling scenarios from the approved base model which evaluated the rate with which indicators outside of the desirable level at plan start could reach the inter-quartile range. In total, four Landscape Guide Indicators required a milestone revision. In addition, the Old Growth Forest indicator was broken into six Planning Team derived groupings and received milestones, whereas the original Milestone Table had only a single set of milestones for all old growth lumped together.

Below is a summary of those indicators where a milestone changed from the original milestone table.

Mature and late balsam fir mixed – original short-term milestone was ‘maintain’. Plan-start level was above the IQR. Short-term milestone changed to ‘decrease’. No change to medium-term or long-term milestones.

Mature and late lowland spruce and low other conifer – original short-term and medium-term milestones were ‘maintain’. Plan-start level was above the IQR. Decreasing the amount of forest in this landscape class would require longer than 20 years. Short-term and medium-term milestones changed to ‘decrease’.

Mature and late hardwoods and hardwood mixedwoods – original short-term and medium-term milestones were ‘decrease’. Plan-start level is within the IQR with the new inventory compared with the one used for the original milestone table. Short-term and medium-term milestones changed to ‘maintain’.
All ages conifer – original long-term milestone was ‘maintain’ after ‘increase’ in the short-term and medium-term. This indicator is roughly 100,000 ha short of the lower IQR. Although some area is gained in the pure conifer forest units through natural succession, harvesting and converting to increase the area of the upland conifer forest units is not realistically achievable within a 100-year time frame. The long-term milestone has been changed from ‘maintain’ to ‘increase’.

Landscape Guide Region 4W – Revised milestones for the Dog River-Matawin Forest

Milestones are listed in for the following terms; Short (10 years - 2030), Medium (20 years - 2040) and Long (100 years – 2119). Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and late balsam fir mixed: Decrease, maintain, maintain.
Mature and late lowland spruce and low other conifer: Decrease, decrease, maintain.
Mature and late conifer and conifer mixedwood: Maintain, maintain, maintain.
Mature and late hardwood and hardwood mixedwood: Maintain, maintain, maintain.

Old Growth:

Balsam Fir: Maintain, maintain, maintain.
Jack Pine: Increase, maintain, maintain.
Upland Spruce: Increase, increase, maintain.
Lowland Conifer: Increase, increase, maintain.
Hardwood: Maintain, maintain, maintain.
Red and White pine: Increase, increase, increase.

Old growth All: Increase, increase, maintain.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Increase, increase, increase.

Dryden Forest

Year of Revision: 2019

Rationale:

The Dryden Forest received a new enhanced forest resource inventory (eFRI) for use in its 2021 forest management plan (FMP).

Milestones are achievable time-based targets used in forest management planning. When comparing the (2019) plan-start levels of composition indicators from the new inventory with the milestones found in the appendices of the Boreal Landscape Guide several indicators were found to be unachievable.

Short term milestones (10 year) were determined by comparing the plan-start levels to the desirable level inter-quartile range (IQR). Plan-start levels within the IQR were given a ‘maintain’ short-term milestone, while plan-start levels below or above the IQR were given an ‘increase’ or ‘decrease’ short-term milestone respectively. The determination of both the medium-term (20 year) and long-term (100 year) milestones were based on modelling scenarios from the approved base model which evaluated the rate with which indicators outside of the desirable level at plan start could reach the inter-quartile range.

In total, four Landscape Guide Indicators required a milestone revision. In addition, the Old Growth Forest indicator was broken into the four standard Northwest Region groupings and received milestones, whereas the original Milestone Table had only a single set of milestones for all old growth lumped together.

Below is a summary of those indicators where a milestone changed from the original milestone table.

Mature and late balsam fir mixed – original short-term milestone was ‘maintain’. Plan-start level was below IQR. Short-term milestone changed to ‘increase’. No change to medium-term or long-term milestones.

Mature and late lowland spruce and low other conifer – original short-term and medium-term milestones were ‘maintain’. Plan-start level was substantially above the IQR. Decreasing the amount of forest in this landscape class would require longer than 20 years. Short-term and medium-term milestones changed to ‘decrease’.

Mature and late hardwoods and hardwood mixedwoods – original medium-term milestone was ‘maintain’ after ‘decrease’ in the short-term. Plan-start level is notably higher with the new inventory compared with the one used for the original milestone table. Reducing the amount of this landscape class to be within the IQR cannot be reasonably achieved by the medium term.

All ages conifer – original medium-term milestone was ‘maintain’ after ‘increase’ in the short-term. This indicator is roughly 16,000 ha short of the lower IQR. Harvesting and converting this many hectares to increase the pure conifer forest units is not achievable within a 20-year time frame.

Landscape Guide Region 4S/3S – Revised milestones for the Dryden Forest

Milestones are listed in for the following terms; Short (10 years - 2030), Medium (20 years - 2040) and Long (100 years – 2119). Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and late balsam fir mixed: Increase, maintain, maintain.

Mature and late lowland spruce and low other conifer: Decrease, decrease, maintain.

Mature and late conifer and conifer mixedwood: Maintain, maintain, maintain.

Mature and late hardwood and hardwood mixedwood: Decrease, decrease, maintain

Old Growth:

Lowland Conifer: Increase, increase, maintain.

Upland Conifer: Increase, maintain, maintain.

Mixedwood and Hhardwood: Increase, maintain, maintain

Red and White Pine: Increase, increase, increase.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Increase, increase, maintain.

Note: The amount of area in lowland conifer stands in the new inventory is notably higher than the amount of area from the inventory used for the BFOLDS simulation which derived the SRNVs.

Trout Lake Forest

Year of Revision 2020

Rationale:

Initial calculation of the biodiversity indicators at plan start for the 2021 FMP confirmed that some of the milestones for the TLF were no longer valid or achievable. The purpose of this document is to explain how the milestones for the TLF were updated for the 2021 FMP, following the direction in this Technical Note.

Methodology

For area-based indicators, the first step was to look at a comparison of the current forest condition and the simulated range of natural variation (SRNV). In situations where the current indicator measurement was within the desirable level (i.e. within the Interquartile Range (IQR) of the SRNV), the short, medium, and long-term milestones were either kept or updated to read “maintain”. If the current indicator measurement was below the desirable level, the short term milestone was either kept or updated to read “increase”. If the current indicator measurement was above the desirable level, the short term milestone was either kept or updated to read “decrease”.

Under the latter two circumstances, the validation of the medium- and long-term milestones require scoping exercises that includes general management constraints to ensure an achievable harvest schedule without being too constraining on the development of a future forest condition. The original milestones published in the landscape guides were developed considering limited silvicultural, social, and economic constraints, and the revision of the table followed a similar approach. The validation of texture-based milestones is not required, because the direction is to continually move toward the mean of the SRNV.

Milestone tables are normally updated by MNRF using the Sustainable Forest Management Model (SFMM). The strategic development of the TLF 2021 FMP used Patchworks, which is a spatial heuristic modelling program. Patchworks was also used

to validate and update the milestone table in 2019. Multiple scenarios were explored during the development of the long-term management direction (LTMD), and also used to inform the milestone validation process. These scenarios included:

- Null scenario with no harvest and no targets applied to biodiversity indicators.
- Scenario that maximizes biodiversity indicator achievement, both including and excluding the DCHS. No harvest constraints were applied.
- Maximum harvest and maximum volume scenarios with no constraints placed on biodiversity indictor achievement.
- Base scenarios with a +/-20% harvest flow constraint between terms for species groups, a positive silviculture budget constraint, renewal limits, biological limits, non-declining yield constraint on the last 50 years of the modelling horizon (150 years), and multiple combinations of weighting applied to biodiversity indicators.
- Spatial scenarios where constraints on all variables were added, including spatial targets of creating larger patch sizes and road buildings/hauling/maintenance costs.

An important aspect to consider is that there were substantial changes made to the DCHS between scenarios, which may account for some differences in indicator achievement. Some of these changes were made due to fires that occurred north of Trout Lake in 2019 during the development of the DCHS. Other changes were made to try to adjust the balance of socioeconomic and biodiversity indicators.

Another important consideration is that the updated forest resource inventory had a higher amount of lowland conifer area in comparison to the previous inventory that was used in the 2009 FMP and development of the SRNVs. Additionally, the old growth lowland polygons appear to have been interpreted in the inventory to a maximum age category (e.g. >120 years) that may have implications on the classification of old growth lowland conifer. These considerations may be relevant to indicators related to the proportion of upland and lowland, as well as the age of lowland conifer.

Summary of Results

The updated milestone table is attached to this document and is considered interim direction that overrides Appendix 4 of the boreal landscape guide. There were no changes to the texture-based milestones.

For area-based indicators, there were five milestone changes:

- Mature and late balsam fir indicator was changed from “Maintain” to “Decrease” for the short-term milestone.
- Mature and late lowland spruce and low other conifer indicator was changed from “Maintain” to “Decrease” for the short- and medium-term milestones.
- Mature and late hardwood and hardwood mixedwood indicator was changed from “Maintain” to “Decrease” for the medium-term milestone.
- Old growth lowland conifer indicator was changed from “Maintain” to “Increase” in the short-term.
- Upland pine and spruce all ages conifer indicator was changes from “Maintain” to “Increase” in the medium-term.

Landscape Guide Region 4S/3S – Revised milestones for the Trout Forest

Milestones are listed in for the following terms; Short (10 years - 2031), Medium (20 years - 2041) and Long (100 years – 2121). Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and Late Balsam Fir: Decrease, maintain, maintain.

Mature and Late Lowland Spruce and Low other Conifer: Decrease, decrease, maintain.

Mature and Late Conifer and Conifer Mixedwood: Maintain, maintain, maintain.

Mature and Late Hardwood and Hardwood Mixedwood: Decrease, decrease, maintain.

Old Growth:

Lowland Conifer: Increase, maintain, maintain.

Upland Conifer: Maintain, maintain, maintain

Conifer-mixed and Pure Hardwood: Maintain, maintain, maintain.

Red and White Pine: Increase, increase, increase.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Increase, increase, maintain

Caribou Habitat:

Refuge: Maintain, maintain, maintain.

Winter Used and Preferred: Maintain, maintain, maintain.

Lake Nipigon Forest

Year of Revision 2020

Rationale:

The updated Lake Nipigon Forest Management Unit boundary, which divides the LNF from the former Armstrong Forest, resulted in the need to create new milestones. The purpose of this document is to explain how the new milestones for the LNF were created for the 2021 FMP, following the direction in this Technical Note.

Methodology

For area-based indicators, the first step was to look at a comparison of the current forest condition and the simulated range of natural variation (SRNV). In situations where the current indicator measurement was within the desirable level (i.e. within the Interquartile Range (IQR) of the SRNV), the short, medium, and long-term milestones were established as “maintain”. If the current indicator measurement was below the desirable level, the short-term milestone was established as “increase”. If the current indicator measurement was above the desirable level, the short-term milestone was established as “decrease”.

Under the latter two circumstances, the creation of the medium- and long-term milestones require scoping exercises that considers realistic harvest schedules with fewer constraints than may be found in a selected Long-Term Management Direction (LTMD). The original milestones published in the landscape guides were developed considering limited silvicultural, social, and economic values, and the creation of the LNF milestone table followed a similar approach. The assessment of texture-based milestones is not required, because the direction is to continually move toward the mean of the SRNV.

Milestone tables were updated by MNRF using the Sustainable Forest Management Model (SFMM). Multiple scenarios were explored during the development of the LTMD and these scenarios were also used to inform the milestone creation process. These scenarios included:

- Null scenario with no harvest and no targets applied to biodiversity indicators.

- Scenario that maximizes biodiversity indicator achievement, with and without the DCHS applied. No other harvest constraints were applied.
- Maximum harvest and maximum volume scenarios with no constraints placed on biodiversity indicator achievement. Harvest flow and DCHS applied.
- Base scenarios with a +/-20% harvest flow (SPF, Po, Bw) constraint across all terms, silviculture budget constraint, renewal limits, and biological limits.

Landscape Guide Region 3W – Revised milestones for the Lake Nipigon Forest

Milestones are listed in for the following terms; Short (10 years - 2031), Medium (20 years - 2041) and Long (100 years – 2121). Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and Late Balsam Fir: Decrease, decrease, decrease.
Mature and Late Lowland Spruce and Low other Conifer: Decrease, decrease, maintain.
Mature and Late Conifer and Conifer Mixedwood: Maintain, maintain, maintain.
Mature and Late Hardwood and Hardwood Mixedwood: Decrease, decrease, maintain.

Old Growth:

Lowland Conifer: Maintain, maintain, maintain.
Upland Conifer: Maintain, maintain, maintain.
Conifer-mixed and Pure Hardwood: Decrease, decrease, decrease.
Red and White Pine: Increase, increase, increase.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Increase, increase, increase.

Caribou Habitat:

Refuge: Maintain, maintain, maintain.
Winter used and preferred: Maintain, maintain, maintain.

Lac Seul Forest

Year of Revision 2020

Rationale:

Initial calculation of the biodiversity indicators at plan start for the 2021 FMP confirmed that some of the milestone for the LSF were no longer valid or achievable. The purpose of this document is to explain how the milestones for the LSF were updated for the 2021 FMP, following the direction in this Technical Note.

Methodology

For area-based indicators, the first step was to look at a comparison of the current forest condition and the simulated range of natural variation (SRNV). In situations where the current indicator measurement was within the desirable level (i.e. within the Interquartile Range (IQR) of the SRNV), the short, medium, and long-term milestones were either kept or updated to read “maintain”. If the current indicator measurement was below the desirable level, the short term milestone was either kept or updated to read “increase”. If the current indicator measurement was above the desirable level, the short term milestone was either kept or updated to read “decrease”.

Under the latter two circumstances, the validation of the medium- and long-term milestones requires a scoping exercise that considers realistic harvest schedules with fewer constraints than may be found in a selected Long-Term Management Direction (LTMD). The original milestones published in the landscape guides were developed considering limited silvicultural, social, and economic values, and the revision of the table followed a similar approach. The validation of texture-based milestones is not required, because the direction is to continually move toward the mean of the SRNV.

Milestone tables are normally updated by MNRF using the Sustainable Forest Management Model (SFMM), which is a linear modelling program. The strategic development of the LSF 2021 FMP also used SFMM. Multiple scenarios were explored during the development of the LTMD, and these scenarios were also used to inform the milestone validation process. These scenarios included:

- Null scenario with no harvest and no targets applied to biodiversity indicators.

- Scenario that maximizes biodiversity indicator achievement, both including and excluding the DCHS. No harvest constraints were applied.
- Maximum harvest scenarios with no constraints placed on biodiversity indicator achievement.
- Base scenarios with a +/-20% harvest flow constraint between terms for species groups, a positive silviculture budget constraint, renewal limits, and biological limits.

Summary of Results

The updated milestone table is attached to this document and is considered interim direction that overrides Appendix 7 of the boreal landscape guide. There were no changes to the texture-based milestones.

The milestones for seven area-based indicators were changed (see Table 1):

- Mature and late balsam fir indicator was changed from “Maintain” to “Increase” for the short- and medium-term milestones.
- Mature and late lowland spruce and low other conifer indicator was changed from “Maintain” to “Decrease” for the short- and medium-term milestones.
- Mature and late conifer and conifer mixedwood indicator was changed from “Increase” to “Maintain” for the short-term milestone.
- Mature and late hardwood and hardwood mixedwood indicator was changed from “Maintain” to “Decrease” for the short-, medium-, and long-term milestones.
- Old growth upland conifer indicator was changed from “Increase” to “Maintain” for the medium-term milestone.
- Old growth conifer-mixed and pure hardwood indicator was changed from “Increase” to “Maintain” for the medium-term milestone.
- Upland pine and spruce all ages conifer indicator was changes from “Maintain” to “Increase” for the medium- and long-term.

Landscape Guide Region 4S/3S – Revised milestones for the Lac Seul Forest

Milestones are listed in for the following terms; Short (10 years - 2031), Medium (20 years - 2041) and Long (100 years – 2121). Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and Late Balsam Fir: Increase, increase, maintain.

Mature and Late Lowland Spruce and Low other Conifer: Decrease, decrease, maintain.

Mature and Late Conifer and Conifer Mixedwood: Maintain, maintain, maintain.

Mature and Late Hardwood and Hardwood Mixedwood: Decrease, decrease, decrease.

Old Growth:

Lowland Conifer: Increase, increase, maintain.

Upland Conifer: Increase, maintain, maintain.

Conifer-mixed and Pure Hardwood: Increase, maintain, maintain.

Red and White Pine: Increase, increase, increase.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Increase, increase, increase.

Caribou Habitat:

Refuge: Maintain, maintain, maintain.

Winter used and preferred: Maintain, maintain, maintain.

White Feather Forest

Year of Revision 2020

Rationale:

The Whitefeather forest has a newer inventory than was used in developing the original milestones. There are significant differences in initial inventory starting condition and stand ages. There are several indicators that now disagree with the short-term and medium-term milestones, and therefore some revisions are required to allow for the correct direction of movement to be indicated in the milestones.
The Whitefeather forest has 40% of it's forested area in protected areas and reserves. Natural disturbance rates were included in the analysis, but even including both managed natural disturbance rates and harvest, it is not possible to lower many of the mature and old classes to get inside their SRNV's. Given the significant forested area is in protected areas or reserves, it will be difficult or impossible to reduce the mature and late or old growth indicators into the SRNV in the short or medium term (and in some cases in the long-term) without significantly large natural disturbance events occurring. The details of the scoping analysis for the Landscape Guide indicators is provided in the Analysis Package for the 2022 FMP. The rationale for the specific milestone revisions is provided below, followed by summary graphs of the indicators from the model run emphasizing achievement of Landscape Guide indicators and the implementation of the DCHS. A revised Milestones Table is provided at the end of this document.
Mature Late Balsam Fir Mixed

- Inventory shows very low levels of BfDom forest unit. To reach the lower SRNV, there would need to be a forty-four-fold increase in Mature and Late Balsam Fir. Currently there is only 27 ha (8%) of the BfDom forest unit in mature and late age classes.
- The intended direction on the forest is to try to limit the balsam fir increasing through silviculture. However, at this time there is limited silvicultural history on the Whitefeather Forest. With the focus on maintaining caribou habitat, there is no desire to force the increase in balsam fir.
- At this time the directional statement will be to maintain below the SRNV.

- This milestone will need to be re-evaluated in the next FMP when hopefully we will have an updated inventory and more silvicultural information.

Mature Late Lowland Conifer

- The newer inventory is indicating more mature and late lowland conifer than previously. The starting condition is now above the SRNV and the milestone will need to be adjusted to change the trajectory from maintain to decrease.

Mature Late Conifer and Conifer Mixewood

- The newer inventory is indicating more mature and late conifer and conifer mixedwood than previously. The starting condition is now above the SRNV and the milestone will need to be adjusted to change the trajectory from increase to decrease.

Mature Late Hardwood and Mixedwood

- The newer inventory is indicating more mature and late hardwood and mixedwood than previously. The starting condition is now above the SRNV and the milestone will need to be adjusted to change the trajectory from maintain to decrease.

Old Growth

- This plan is using Regional Old Growth Groupings, so milestones have been added for the new groupings to reflect their current starting points in the newer inventory.
- Old growth for red and white pine is not considered an applicable indicator on the Whitefeather forest. Red and white pine is on the extreme edge of the range. There are no stands that fit into red or white pine-based forest units on the Whitefeather Forest and none are expected to be created. Red and white pine are managed on isolated tree basis if encountered.

Red and White Pine Forest

- Red and white pine forest is not considered an applicable indicator on the Whitefeather forest. Red and white pine is on the extreme edge of the range.

There are no stands that fit into red or white pine-based forest units on the Whitefeather Forest and none are expected to be created. Red and white pine are managed on isolated tree basis when encountered.

Upland Pine and Spruce

- The newer inventory is indicating more upland pine and spruce than previously. The starting condition is now well above the SRNV and the milestone will need to be adjusted to change the trajectory from maintain to decrease.

Landscape Guide Region 4S/3S – Revised milestones for the Whitefeather Forest

Milestones are listed in for the following terms; Short (10 years - 2031), Medium (20 years - 2041) and Long (100 years – 2121). Refer to Landscape Guides for further definitions.

Landscape Classes:

Mature and Late Balsam Fir: Maintain, maintain, maintain.

Mature and Late Lowland Spruce and Low other Conifer: Decrease, decrease, maintain.

Mature and Late Conifer and Conifer Mixedwood: Decrease, decrease, maintain.

Mature and Late Hardwood and Hardwood Mixedwood: Decrease, decrease, maintain.

Old Growth:

Lowland Conifer: Increase, increase, maintain.

Upland Conifer: Maintain, maintain, maintain.

Conifer-mixed and Pure Hardwood: Increase, increase, maintain.

All Ages Red and White Pine: Increase, increase, increase.

All Ages Conifer: Decrease, decrease, maintain.

Caribou Habitat:

Refuge habitat: Maintain, maintain, maintain.

Winter used and preferred habitat: Maintain, maintain, maintain.