Carbon and Forest Management Work Group

Proposed Management Scenarios for the March 13, 2024 Work Group Meeting

In the March 13 meeting, the work group will be voting on a subset of the scenarios that were discussed at the last meeting. DNR believes the scenarios described in this document are developed enough for a vote. Scenarios that need more discussion and clarification will be voted on during the April 10 meeting.

The work group will vote in March on whether to model scenarios under one or more possible climate change projections, which could affect how many of the following scenarios can be modeled. The carbon model may include no more than 16 total scenarios.

In the following document, DNR provides background information and descriptions necessary to understand this first set of scenarios.

Rotation Age Versus Timber Volume

As discussed in both the January and February work group meetings, DNR is proposing longer and shorter harvest rotation scenarios. However, the *mechanism* that DNR will use to lengthen or shorten the harvest rotation will be timber volume[1] rather than age.

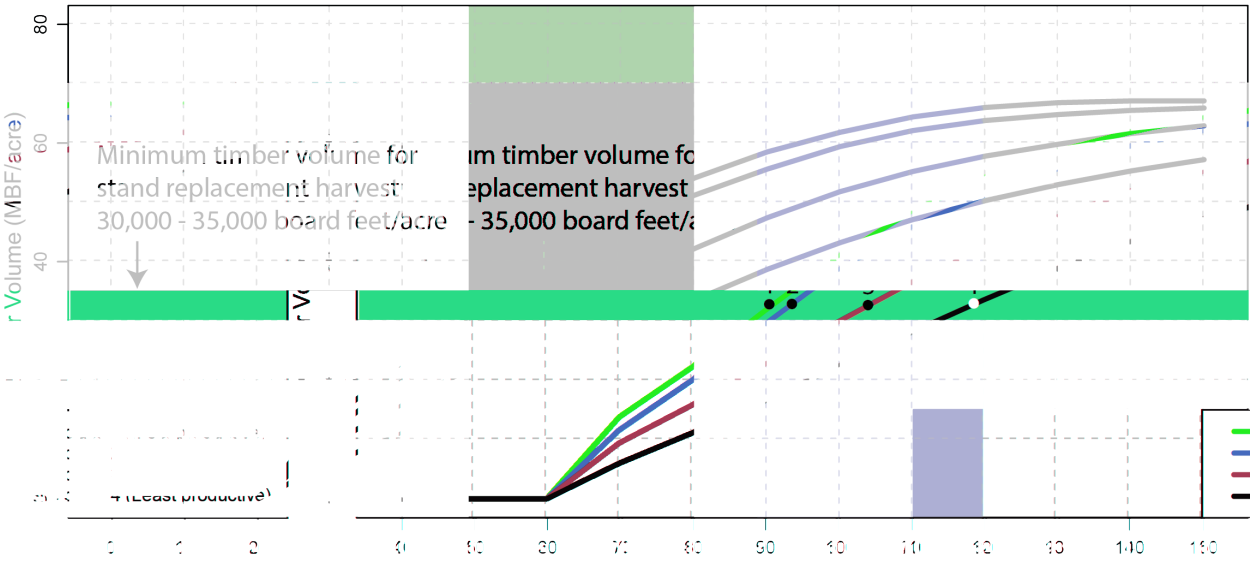
Trees grow differently based on the productivity of the soil, tree spacing, the climate, and other factors. For example, a tree growing in productive soil may be far larger than a tree growing in poor soil, even though both trees are the same age.

For that reason, DNR recommends setting a minimum timber *volume*, rather than *age*, at which a forest can be harvested. Timber volume takes time to develop, so the **higher the minimum timber volume, the longer the harvest rotation**.

Rotation length will not be uniform across state trust lands. For example, a highly productive site will reach the minimum timber volume sooner than a site that has poor soils. This principal can be understood by considering a sample yield curve for Douglas fir on site class 1 through 5.[2] A yield curve predicts how a species of tree will increase in timber volume over time.

[1] Timber volume is the amount of wood in a tree. At the stand level, timber volume is often measured by board feet. A board foot is a piece of wood one foot wide, one foot long, and one inch thick.
[2] Site class indicates the ability of an area to grow repeated crops of trees.

Sample Yield Curve for Douglas Fir in Western Washington



This chart indicates that, at a minimum timber volume of (for example) 30,000 to 35,000 board feet per acre, the rotation length for Douglas fir will be approximately 50 years for Site Class 1, 55 years for Site Class 2, 65 years for Site Class 3, and 78 years for Site Class 4 (the most common site class in western Washington is **Site Class 2)**. To shorten the average rotation for all site classes, DNR would **reduce** the minimum timber volume (in the chart above, lower the orange line). To lengthen the average rotation, DNR would **increase** the minimum timber volume (raise the orange line).

This method reflects how DNR manages forested state trust lands. DNR does not manage according to a set harvest rotation length. Forests are considered for harvest when they have sufficient timber *volume*, not when they reach a pre-determined *age*.

Note that the timber volume minimums indicate when a site is *available* for harvest, not when it *will be* harvested. Every site is different and is investigated thoroughly when DNR plans its harvests. In addition to timber volume, DNR also considers harvest costs, access, number of acres in the stand, environmental concerns that affect the total timber volume that can be removed from the stand, and the projected revenue, which is affected by current timber prices.

Older, Carbon-Dense, Structurally Complex Forest

For the purposes of scenario development for the Carbon and Forest Management Work Group, DNR will use the definition of structurally complex stand in its 2006 *Policy for Sustainable Forests (Appendix C)*:

> A forest in the 'botanically diverse' 'niche diversification' or 'fully functional' stage of stand development. Forests in these phases have varying sizes of trees, understory vegetation and lichen, downed wood and snags, etc.

The Policy for Sustainable Forests uses stand development terms from the booklet *Identifying Mature and Old Forests in Western Washington* by Robert Van Pelt. These terms are different than the terms DNR used in the December 2023 work group meeting, which are based on a different stand classification system. Refer to the table below for a crosswalk between these terms and the general characteristics of each stage.

Term used in December 2023 work group meeting (based on Franklin et al. 2002.)[3]	**Term used in Van Pelt guide and the *Policy for Sustainable Forests* (based on Carey and Curtis 1996.)[4]**	**Characteristics**
Maturation II	Botanically diverse	Small gaps begin to form from natural disturbances such as wind, resulting in a understory developing with different tree species growing into the lower and middle tree (mid-story) canopy. Large pieces of down woody material (fallen trees) and large snags (standing dead trees) are few or absent in the stand.
Vertical diversification	Niche diversification	The lower and mid-story tree canopies have diversified, with more tree species and a greater range in tree diameters. The amount of large down woody material and number of snags has increased.
Horizontal diversification	Fully functional	The original trees from stand initiation are dying out more rapidly, resulting in abundant snags, large pieces of down woody material, and larger gaps in the upper tree canopy. Shade-tolerant trees have reached the upper tree canopy.

[3] Franklin, J.F., Spies, T.A., Van Pelt, R., Carey, A.B., Thornburgh, D.A., Berg, D.R., Lindenmayer, D.B., Harmon, M.E., Keeton, W.S., Shaw, D.C. and Bible, K., 2002. Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forests as an example. *Forest ecology and management*, *155*(1-3), pp.399-423.

[4] Carey, A.B. and Curtis, R.O., 1996. Conservation of biodiversity: a useful paradigm for forest ecosystem management. *Wildlife Society Bulletin*, *24*(4), pp.610-620.
Scenarios

Scenario Descriptions

As explained in the work group meeting, each scenario turns only one dial at a time. Turning one dial will enable the work group to clearly understand that dial's carbon and economic implications.

For stand replacement harvest, DNR typically uses a harvest method called variable retention harvest, which requires DNR to leave a minimum of 8 trees per acre. In addition to leave trees, DNR retains other trees as needed to protect sensitive features such as streams and wetlands.

The commercial thinning method, which is done when the trees are merchantable[5], will depend on stand conditions and objectives. DNR typically uses a thinning method called variable density thinning. As the name implies, some areas are thinned more heavily than others and small gaps may be created in the tree canopy to encourage the diversification of stand structure. Refer to this presentation for more information on harvest methods.

Large increases in pre-commercial thinning (above current levels) can be considered as one of the additional scenarios, or part of a scenario, that will be considered in the April work group meeting.

Timber volume minimums and removal numbers provided in these descriptions **may be further refined** before the March 13 work group meeting and are provided here for comparison purposes only.

Scenario 1: DNR Current Management

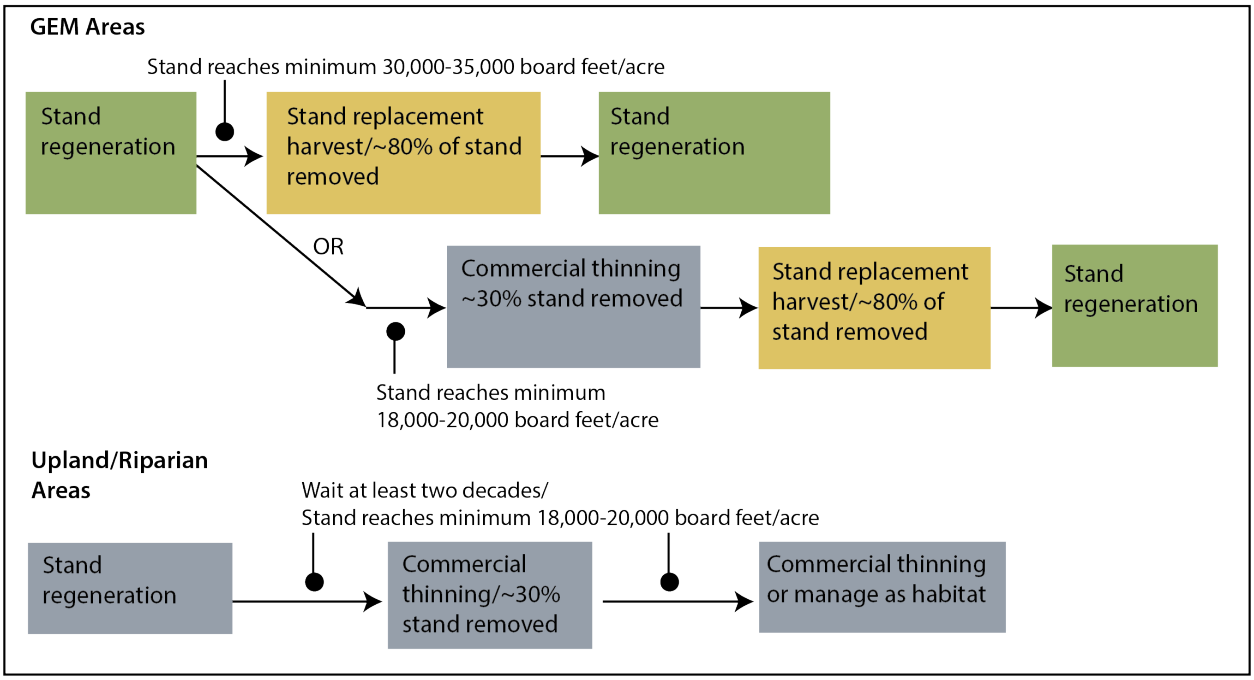
As mentioned above, DNR will provide more information on its current management scenario (including pre-commercial thinning) at the March 13 work group meeting. In the meantime, the metrics below will provide context for the proposed scenarios.

- For stand replacement harvest (GEM areas **only**), forest stands typically have roughly 30,000 to 35,000 board feet per acre, although this range can vary from site to site. For Douglas fir, this range translates to a harvest rotation of roughly 50-80 years depending on site class[6]. Stand replacement harvest removes an average of 80 percent of the stand, although actual removals may vary widely depending on objectives and stand conditions. This yield curve was presented on Page 2 of this document.
- For commercial thinning (GEM, upland, or riparian areas), a forest stand typically has roughly 18,000- 20,000 board feet per acre. Commercial thinning removes an average of 30 percent of the stand, although removals may be higher or lower depending on objectives and stand conditions.
- Commercial thinning may occur in either GEM or upland areas. A thinning in GEM lands will typically be part of a harvest rotation. A thinning in upland areas is typically done for ecological objectives.

[5] Suitable in size and quality for production of forest products.
[6] The 60-80 year rotation provided previously was based largely on past timber sales. In consultation with region staff, DNR revised this estimate based on more recent timber sales to better reflect current operations.

Following is a graphic showing current management practices. Currently, the top track (regenerate, harvest, regenerate) is far more common than the middle track (regenerate, thin, harvest, replant) or the lower track (thin only).

DNR current management



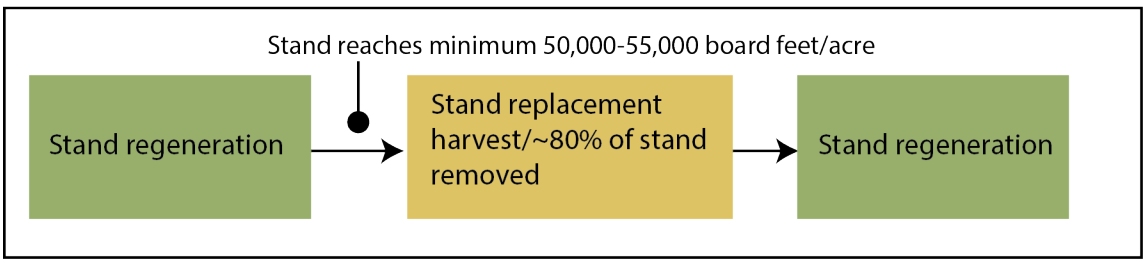
Scenario 2: Lengthen Harvest Rotation

Dial turned: Harvest rotation length

This scenario is specific to stand replacement harvest in **GEM areas only**.

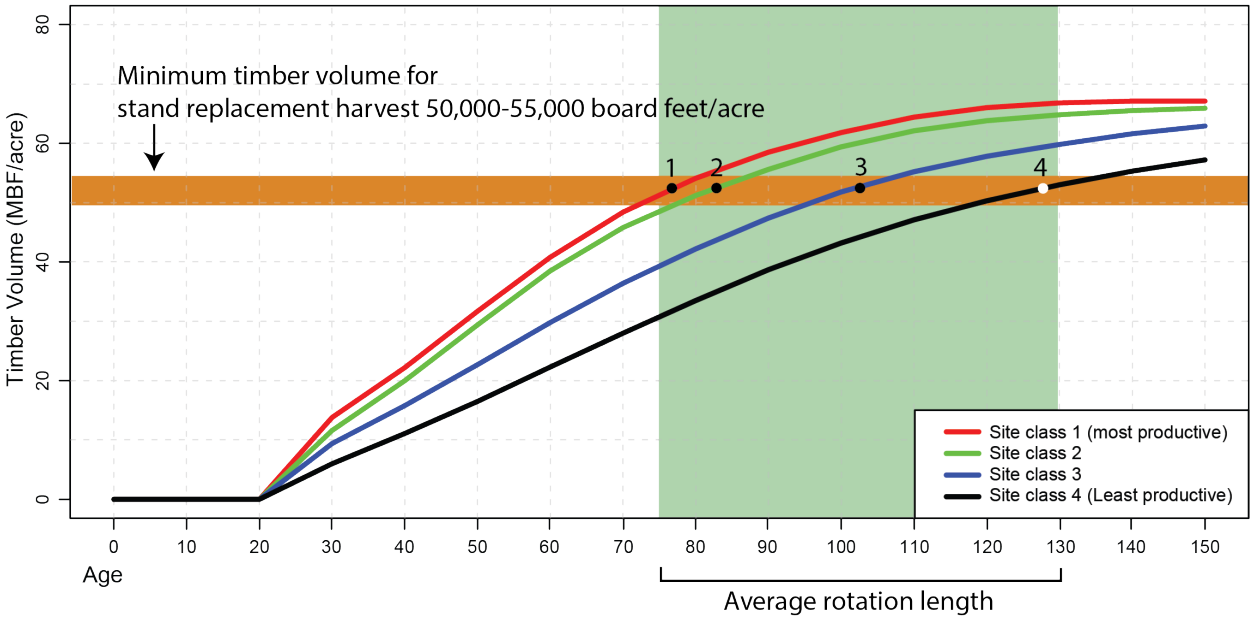
For stand replacement harvest, a forest stand must have a minimum of about 50,000-55,000 board feet per acre to be considered available. For Douglas fir, this range translates to a harvest rotation of roughly 75 to 130 years, depending on site class. Stand replacement harvest removes an average of 80 percent of the stand, although actual removals may vary widely depending on objectives and stand conditions.

Longer harvest rotation



This minimum board feet per acre requirement is much higher than DNR's current minimum of 30,000 to 35,000 board feet per acre. Increasing the minimum board feet per acre requirement will lengthen the harvest rotation, because it will take the forest stand longer to reach this timber volume.

Sample Yield Curve for Douglas Fir in western Washington



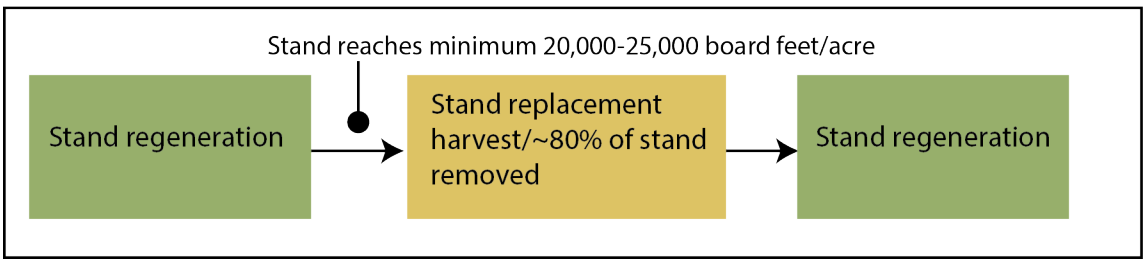
Scenario 3: Shorten harvest rotation

Dial turned: Harvest rotation length

This scenario is specific to stand replacement harvest in **GEM areas only**.

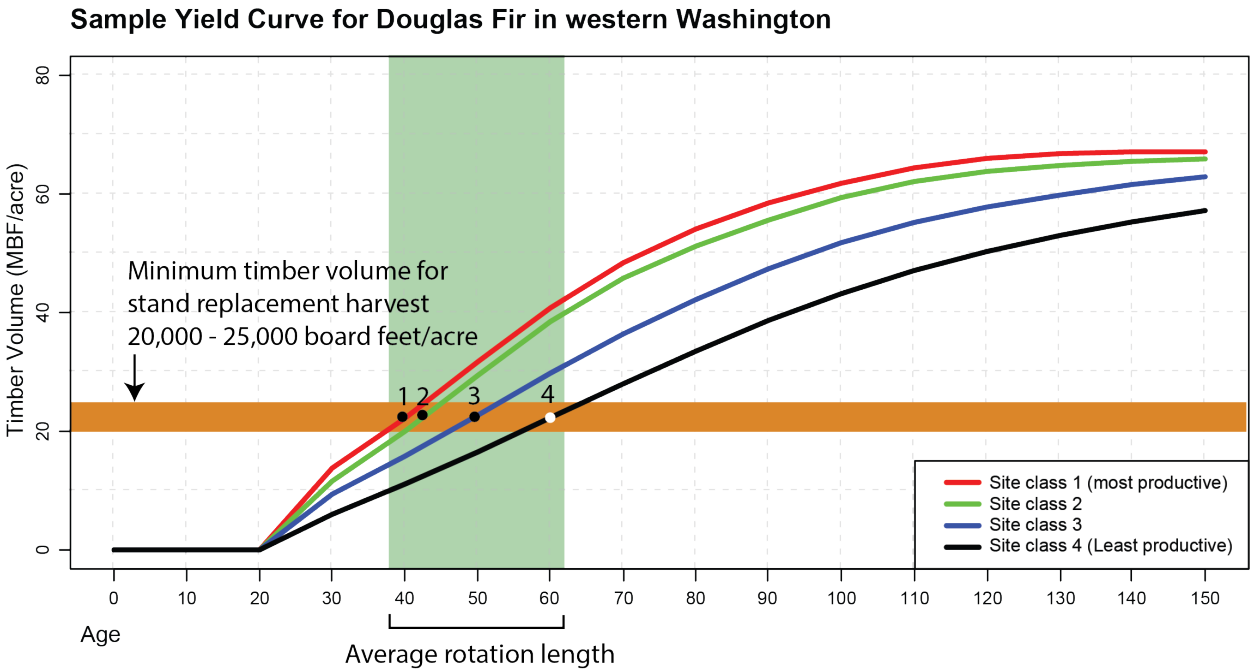
For stand replacement harvest, a forest stand must have a minimum of about 20,000-25,000 board feet per acre to be considered available. For Douglas fir, this range translates to a harvest rotation of roughly 40-60 years, depending on site class. Stand replacement harvest removes an average of 80 percent of the stand, although actual removals may vary widely depending on objectives and stand conditions.

Shorter harvest rotation



This minimum board foot per acre requirement is lower than DNR's current minimum of 30,000-35,000 board feet per acre. Reducing the minimum board feet per acre will shorten the harvest rotation,

because the forest stand will reach this volume sooner than it would if the board feet requirement were higher.



Scenario 4: Significantly increase thinning

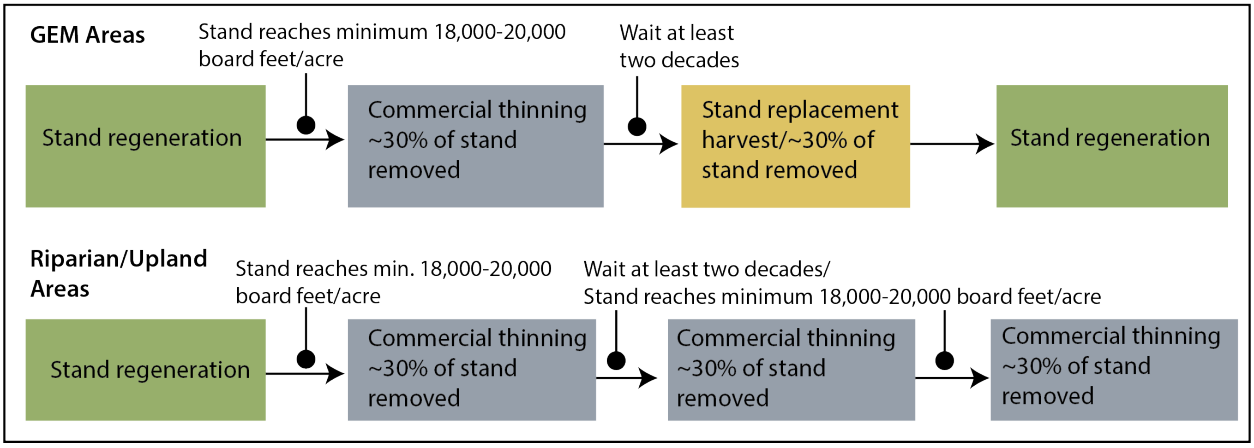
Dial turned: Thinning

This scenario increases commercial thinning in all land classes (GEM, upland, and riparian).

In GEM areas, DNR will require one commercial thinning entry in each harvest rotation. The minimum timber volume for a thinning will be roughly 18,000-20,000 board feet per acre, and the minimum timber volume for a stand replacement harvest will be roughly 30,000-35,000 board feet per acre, which is the same as the current operations scenario.

In this scenario, DNR will also conduct commercial thinning in upland and riparian areas that allow it. These areas are managed for ecological objectives according to the conservation strategies in the *State Trust Lands Habitat Conservation Plan*, and each strategy has its own harvest rules. The minimum timber volume for thinning in these areas will be the same as GEM lands: roughly 18,000-20,000 board feet per acre. Some stands may be thinned a second time depending on stand objectives. If a second thinning is needed, DNR must wait at least two decades to give the stand time to grow.

Increased thinning

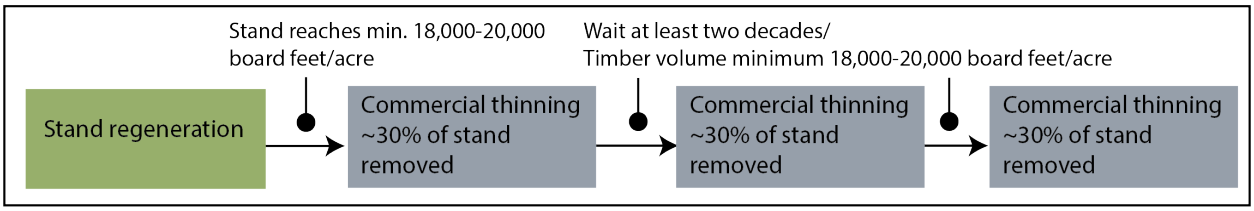


Scenario 5: Thin only

Dial turned: Thinning

Under this scenario, forest stands in all land classifications (GEM, upland, riparian) will undergo commercial thinning repeatedly with **no stand replacement harvest**. Like the current operations scenario, stands must meet the minimum requirement of roughly 18,000-20,000 board feet per acre to be available for thinning. DNR must wait two decades to thin the stand again.

Thinning only



Scenario 6: Increase deferrals of carbon-dense, older, structurally complex forest in GEM areas

Dial turned: Deferrals

For this scenario, DNR will increase deferrals of forest stands in GEM areas that are currently identified (through modeling) as carbon-dense, older, structurally complex forest, **and** not already deferred from stand replacement harvest. These forests will be deferred indefinitely, although they may be thinned to maintain forest health or meet other ecological objectives. DNR will discuss the amount in the March 13 meeting.

Scenario 7: Defer all carbon-dense, structurally complex forest in GEM areas

Dial turned: Deferrals

For this scenario, DNR will defer all forest stands in GEM areas that are currently identified (through modeling) as carbon-dense, older, structurally complex forest, **and** that are not already deferred from stand replacement harvest. These forests will be deferred indefinitely, although they may be thinned to maintain forest health or meet other ecological objectives.