Extended Rotation Forest

Policy Review and Recommendations

Minnesota Department of Natural Resources

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Extended Rotation Forest Policy Review Team

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Executive Summary

The MN Department of Natural Resources (DNR) adopted extended rotation forest (ERF) management guidelines in 1994 to maintain a range of forest age classes on DNR-managed lands, including some forest stands that are beyond traditional silvicultural rotation age. During the first round of subsection forest resource management planning (SFRMP) for DNR lands about 12% of even-aged forest covertypes were selected to be managed as ERF. The Commissioner of the DNR initiated this ERF policy review project to document the current status of ERF management and analyze the environmental, economic, and social effects of the policy to date. The ERF Policy Review Team was asked to recommend modifications to the ERF policy to reflect current conditions. The ERF project team believes modifications to the ERF policy are warranted and the recommended changes are addressed in this report. DNR senior management will decide which, if any, changes to ERF policy will be implemented and on what timeline.

Changing Forest Conditions

The DNR establishes a desired future forest condition for DNR-managed timberlands that describes the acreage of each forest cover type and its age class distribution for each ecological subsection. Forest stands are then selected for harvest or other treatments that will help move the forest toward the desired conditions.

The DNR's timber management actions are only part of what changes the character of forests on the landscape. Ecological processes, the actions of other forest land owners, and the demand for forest products are other forces acting on the forest. The demand for forest products, as measured by the volume of timber harvested statewide, has been substantially lower over the past two decades than it was at the time the DNR's ERF guidelines were initially adopted. The net result is that the amount of older forest across all ownerships on the landscape exceeds the DNR's desired forest condition.

Factors that indicate a modification of ERF policy is warranted include decreasing statewide timber harvest levels, an overall increasing age of the forests, the application of other forest management policies that contribute to older forest attributes, and the evolution of School Trust lands management policy.

Policy Recommendations

The ERF Policy Review Team recommends that the DNR change its older forest management by:
1. Using an adaptive approach to management of older forests. The amount of older forest on the landscape and harvest levels will be monitored to determine what amount of ERF to designate on DNR-administered timberlands.
2. Preparing an older forest analysis as part of each SFRMP to determine the status of forests over normal rotation age. The analysis should be done separately for DNR-managed timberlands and for all forest ownerships in the subsection.
   a. If the amount of older forest exceeds the desired age class distribution from the prior SFRMP, normal rotation ages can be used for stand selection on state timberlands. In this case, there would be no ERF designation on state timberlands

for the upcoming planning period or in amendments to current plans as appropriate.

    b. If the current older forest for a given covertype (or group of similar covertypes) on all ownerships is less than the desired age class distribution for that covertype on DNR-managed timberlands in the prior SFRMP, ERF designation should be used to ensure older forest exists on DNR timberlands in future planning periods or in amendments to current plans as appropriate.

3. Monitoring forest conditions and management activities as part of the adaptive management approach for older forest management. The ERF project team recommends that the proposal to develop a "stand exam layer" monitoring tool be implemented quickly.

4. Pursuing development of a plot-based continuous forest inventory system on state lands (possibly county and federal lands as well), that will aid in monitoring various SFRMP goals including age structure, conversion goals, and species composition.

In completing its assigned tasks, the ERF Policy Review Team became aware of additional stakeholder concerns. The ERF project team presents the following recommendations to address these related concerns:

1. That planted red pine stands be managed as a separate covertype from natural origin red pine stands. The rotation age for planted stands should be an economic rotation age while the rotation age for natural origin stands should reflect a more natural age class distribution. There should be a final harvest pool in both the planted and natural origin stands. The regeneration strategy for natural origin stands should mimic the creation of a natural stand.

2. That a workgroup be formed as soon as possible to evaluate how rotation ages are set in the SFRMP process. Stakeholder comments received indicate concern over rotation ages used in SFRMP stand selection. The ERF team anticipates that using the adaptive management approach for older forest management will largely address this concern.

Introduction

The 1980's saw a substantial investment in and expansion of the forest products industry in Minnesota attracted by a large amount of available and mature forests in the state at that time. As a result of these investments, timber harvest levels substantially increased and so too did concerns about associated impacts to forests, including those related to a projected decline in the amount of older-aged forests over time. The DNR began development of its old growth policy, and subsequently its extended rotation forest (ERF) policy, in the late 1980's. A 1990 lawsuit settlement related to a proposed new wood mill required the DNR to address older forest management.

As the DNR moved toward an ecosystem-based approach to forest management in the early 1990's, it recognized the value of maintaining a range of forest age classes on the landscape, including some forest stands beyond traditional silvicultural rotation age. The DNR has been managing older forests for over 15 years. Currently, the DNR's older forest management approach includes designation of forest stands as either 'old growth forest' or 'extended rotation forest' and other forest management practices that maintain older forest characteristics.

Recently, stakeholders with an interest in state forest land management have raised concerns about the effects of older forest management policy. The Commissioner of the DNR initiated this ERF policy review project to document the current status of ERF management and analyze the environmental, economic, and social effects of the policy to date. The ERF Policy Review Team was asked to make recommendations to update the DNR's older forest management approach to reflect current conditions. The revised older forest management approach will be incorporated into the DNR's *Subsection Forest Resource Management Planning Guidebook*.

ERF Policy Review Process

In late 2011, the MN DNR initiated the ERF Policy Review project. An ERF project team was established to:

- Document the current status of ERF policy implementation on DNR-administered forest land
- Develop a common understanding among internal and external stakeholders of how the DNR implements the ERF policy
- Describe the anticipated benefits of older forests including wildlife habitat, environmental conditions (hydrology, carbon storage and cycling), timber production, ecological variability and resiliency
- Analyze the effect of ERF policy and other factors (historic market demand, etc.) on current and anticipated age class distribution on DNR-administered forest lands
- Estimate the effects of ERF policy on current and long-term timber volume production on DNR-administered forest lands
- Develop and recommend adjustments to ERF policy for consideration by DNR decision-makers
- Identify steps needed to implement any selected changes in ERF policy in future state forest management planning projects

- Complete the ERF policy review project by July 2012

The ERF project team described the evolution of older forest management from the initial 1994 ERF Guideline to the current ERF designation process contained in the *DNR Subsection Forest Resource Management Planning Guidebook IV* (MN DNR, 2008). The team then identified issues or policy questions related to older forest management on state lands. A current snapshot of forest inventory data on all DNR-administered timberlands was created to model the effects of ERF designation on timber harvest volume and revenue. The inventory compilation and modeling was done for both School Trust lands and all DNR-administered timberlands combined. The ERF project team then developed summary presentations describing the effects on the DNR's older forest management efforts on wildlife habitat, environmental conditions (hydrology, carbon storage and cycling), timber production, ecological variability and resiliency. An ERF stakeholder meeting was held to present information on current statewide forest age classes and harvest levels, the DNR's older forest management goals, and the results of the preliminary model runs. The stakeholders identified their objectives and concerns related to older forest management and suggested policy changes for DNR consideration. ERF project team members and DNR senior managers discussed potential ERF policy change scenarios. The ERF project team then refined the preferred policy change proposal and developed recommendations for implementation of the revised older forest management policy.

Initial Policy Development in 1990's

The 1980's saw a substantial investment in and expansion of the forest products industry in Minnesota attracted by a large amount of available and mature forests in the state at that time. As a result of these investments, timber harvest levels substantially increased and so too did concerns about associated impacts to forests, including those related to older forests.

DNR began development of its old growth forest policy, and subsequently its ERF policy, in the late 1980's. A 1990 lawsuit settlement related to a proposed new wood mill required the DNR to manage forests to ensure that some older forests are maintained on the landscape. The DNR ERF Guideline was adopted in 1994. The 1994 Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota (GEIS) assumed that a certain amount of DNR forest lands would be managed as extended rotation forests as part of the study's analysis to identify potential significant impacts likely to occur at several different assumed levels of statewide timber harvesting.

Since then, the DNR has applied and implemented the ERF Guideline via various sub-state forest management planning processes, the most current being the DNR Subsection Forest Resource Management Planning (SFRMP) process. Implementation of the ERF Guideline via the SFRMP process has resulted in some modifications to how the guideline is applied on DNR forest lands. However, the overall intent to maintain a certain amount of DNR forest lands in an older forest condition over time remains constant. In addition to providing for older forest in general, there are other specific objectives that are accomplished through DNR's ERF policy. Some examples are:

- By designating ERF along riparian corridors, and specifically along trout streams, a longer interval between harvests allows time for more conifers to develop in the understory. This is a strategy to achieve the SFRMP desired future forest condition for increased long-lived conifers in these corridors.
- ERF is also designated in and around known winter deer yards to develop the conifer understory for more thermal cover for deer.
- ERF designation is used to connect old growth location centers to allow time for components of older growth stages to develop in the connecting stands.

The DNR has recently completed the first full round of SFRMPs across the state. As such this was deemed a good time to review the results of applying the current ERF Guideline statewide via the SFRMP process.

Application of the ERF Guideline in SFRMP

Since the year 2000, DNR has been establishing ERF goals via the SFRMP process. Key inputs and decisions that define ERF goals for a particular forest type in a particular SFRMP are: rotation ages (i.e., merchantable, normal, and maximum); desired amount of the forest type to maintain beyond the normal rotation age (i.e., the older forest goal); and the desired age-class distribution including the amount in age-classes between the normal rotation age and the maximum rotation age.

Rotation Ages

There are three important "rotation" ages needed to help develop desired age-class distributions for each forest type managed primarily under even-aged systems:

- Age of merchantability is when most trees within stands of this forest type normally become large enough (i.e., sufficient diameter and height) to be commercially marketable. This does not necessarily mean that stands will be "operable" from a logger's perspective.
- Normal rotation age as used in SFRMP is considered a "biological" rotation age and is based primarily on the culmination of mean annual increment (MAI) using data from the federal permanent plot inventory (i.e., Forest Inventory and Analysis, or "FIA" plots) augmented by the DNR forest inventory data where there are not enough FIA plots on state lands to provide adequate precision. MAI (in its purest form) is the average annual growth of a stand up to a particular age. Theoretically, wood fiber production is optimized where MAI peaks (i.e., culminates).
- Maximum rotation age is defined in SFRMP as the maximum age at which a forest type will retain its biological ability to regenerate to the same forest type and remain commercially viable as a marketable timber sale. This is a subjective determination based largely on the knowledge and experience of DNR resource managers.
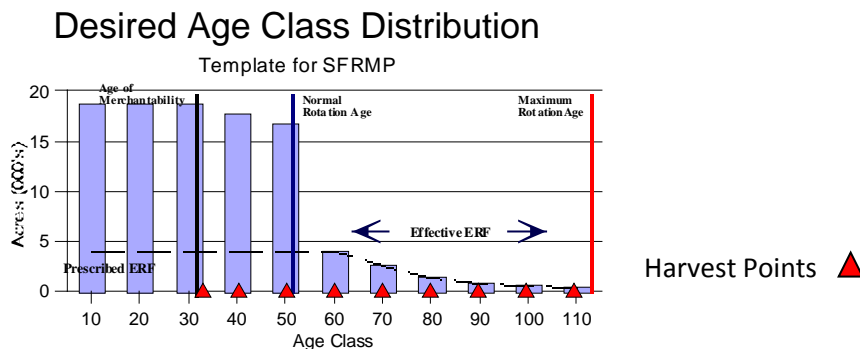
Older Forest Goal

To increase consistency in the application of the ERF Guideline in SFRMP, the DNR established a statewide, interdisciplinary work group to determine desired older forest goals for each SFRMP. This statewide group was charged with identifying older forest goals for all even-aged cover types, including the slope of decline between the normal and maximum rotation ages. The work group was directed to use a 10% older forest goal as the initial starting point for each forest type managed primarily under even-aged systems that have substantial acres within the subsection. The final older forest goal would be higher or lower than 10% based on rationale provided by the work group, such as:

- Amount of old forest likely to be provided in the future on surrounding ownerships and in reserved areas.
- Direction provided by the MFRC regional landscape plans.
- Older forest goals established in adjacent DNR SFRMPs.
- Estimates of historic age class and cover type distributions; and historic disturbance regimes developed from the original land survey bearing tree data for the subsection.
- Analysis of the effects of ERF on timber volume production.
- Sustainability.

Defining the Desired Age-Class Distribution

The following chart displays the general template used in SFRMP for the long-term desired future age-class distribution for forest types managed primarily under even-aged systems (e.g., aspen, birch, jack pine, black spruce upland/lowland, tamarack, etc.) that have substantial acres within the subsection. Note the desire to develop an age-class distribution that mimics what is referred to as a "reverse-J" curve that is associated with more natural systems. Distinguishing features of this age-class distribution are the potential harvest points at any time after the age of merchantability and the declining "tail" of older forest between normal and maximum rotation ages. The acres, age-classes, and rotation ages used in the chart below are hypothetical examples.

Note: ERF, Prescribed ERF, and Effective ERF are defined in the *DNR SFRMP Guidebook IV* (MN DNR, 2008).Effective ERF is that portion of ERF that is older than the normal rotation age. Effective ERF is synonymous with 'older forest' in this report.

Results of Applying the ERF Guideline in SFRMP

The following table provides a summary of the statewide results to date of applying the ERF Guideline in SFRMPs for forest types managed primarily under even-aged systems. For each forest type the table lists the percentage of ERF in the subsection with the least amount of older forest, the percentage of ERF in the subsection with the highest amount of older forest, and the acreage-weighted average amount of ERF in all subsections for which SFRMPs were completed. If the desired future conditions in each SFRMP (harvest levels, regeneration, cover type conversions, amount of older forest, etc.) were achieved, there would be about 12% of the DNR-administered timberland in even-aged forest types over normal rotation age.

Older Forest Goal

| Forest Type	SFRMP Effective ERF %		
	Lo	Hi	Average
Aspen/Balm of Gilead	3.0%	13.5%	11.5%
Birch	4.0%	20.0%	11.6%
Jack Pine	6.0%	15.0%	10.0%
BSL 23-29	6.0%	16.0%	13.7%
BSL 30-39	6.0%	14.0%	12.7%
BSL 40+	6.0%	16.0%	11.6%
Tamarack <40	5.0%	15.0%	14.4%
Tamarack 40+	5.0%	15.0%	14.2%
Balsam Fir	0.0%	18.0%	9.4%
Red Pine	5.0%	53.3%	21.7%

The SFRMP process also set the normal, extended, and maximum rotation age for each even-aged forest type in each subsection. The attached Rotation Age Tables show the lowest, highest, and acreage-weighted average normal, extended, and maximum rotation age for each even-aged forest type from the first generation SFRMPs. The tables also include the recommended normal and extended rotation ages established in the 1994 ERF Guideline for comparison purposes.

Changes in the Forest and Forest Management Policies

The DNR's ERF policy should not be viewed in isolation. The condition of the forests in Minnesota and related forest management policies (i.e., policies other than the ERF Guideline) provide the environment within which the DNR manages older forests. This section describes changes in statewide timber harvest levels and forest age class structure since the development of the ERF Guideline in the 1990's. It also explains a variety of forest management policies that affect the amount of older forest on the landscape. This provides context for understanding the recommended changes in the DNR's older forest management approach.

Statewide Harvest Levels

In 1994 when the original ERF Guideline was adopted, the statewide timber harvest level was 4.1 million cords per year. Projections at the time suggested harvest levels would rise to around 4.8 million cords/year. In reality the harvest rate has declined and remained under 4 million cords per year for over a decade. The statewide harvest estimate was 2.73 million cords in 2009 (see chart below). Recent events, including the May 2012 fire that resulted in the permanent closure of the Verso Paper mill in Sartell and the shutdown of the Georgia Pacific plant in Duluth, indicate that statewide harvest levels are likely to remain substantially below the sustainable timber production level estimated in the Timber Harvesting and Forest Management GEIS.
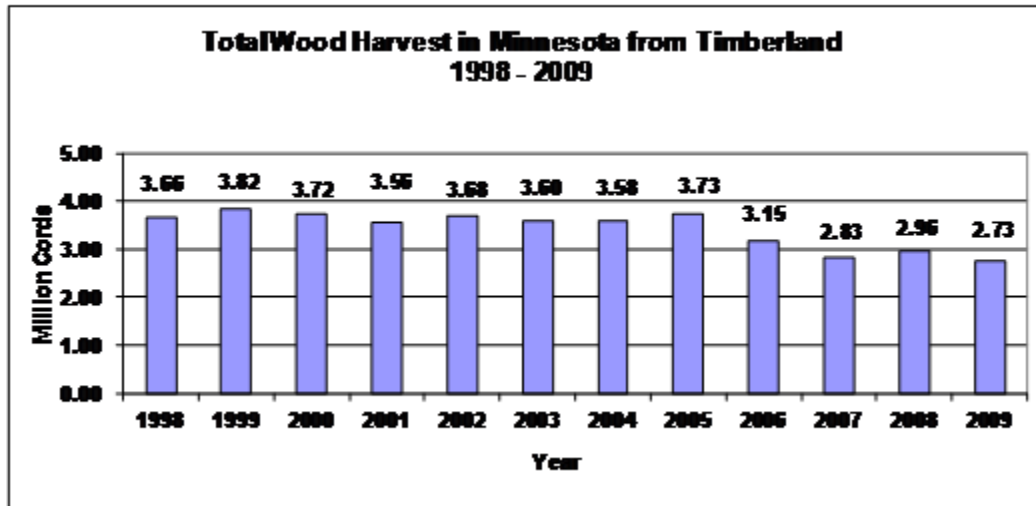
Statewide Forest Age Class Structure

Due to lower than expected harvest levels, older forests on timberlands statewide (all ownerships) have been maintained and are generally at or above desired levels set for DNR-managed timberlands. The implementation of the ERF Guideline on DNR-managed timberlands has contributed to the increase in the amount of older forest statewide. The charts and tables below illustrate the age class distributions for the combined Aspen/Balm of Gilead/Birch covertypes, the combined Upland Conifer covertypes, and the combined lowland conifer covertypes on timberlands of all ownerships in the ecological subsections for which SFRMPs are prepared in 1977, 1990, 2003, and 2011.

The Aspen/Balm of Gilead/Birch chart for the 1977 to 2011 period shows:

- modest increases in the <30 year age classes,
- substantial reductions in the 31 – 60 year age classes,
- increases in the 61 – 80 year age classes, and
- stable but low acreages in the >81 year age classes.

The age class distribution for the combined Aspen/Balm of Gilead/Birch covertypes is moving toward the "reverse-J" age class distribution pattern for covertypes managed under an even-aged silvicultural system illustrated by the black desired future forest condition (DFCC) line on the age class distribution. Subsection level Aspen/Balm of Gilead/Birch age class charts for each SFRMP planning unit with a substantial acreage of these cover types are attached.

The Upland Conifer chart for the 1977 to 2011 period shows:

- substantial decline in acres of the <10 year old class,
- decline in the 91-100 year age class, and
- increase in the acreage in the >100 year age class.

Interpretation of the combined Upland Conifer age class distribution is complicated in that the rotation ages vary significantly (shorter rotations for jack pine and balsam fir, longer for red pine). Due to the variation in Upland Conifer rotation ages it is not possible to draw a composite DFFC age class line. Subsection level Upland Conifer age class charts for each SFRMP planning unit with a substantial acreage of these cover types are attached.

The Lowland Conifer chart for the 1997 to 2011 period shows:

- low acreage of young stands (<40 years) especially in 2003 and 2011,
- high acreage of mid-aged stands (41 to 80 years), and
- relatively small and steady acreage of very old stands (>141 years).

The increase in total acres of lowland conifers shown in the table (from 1.5 million acres in 1977 to 2.4 million acres in 2011) is due to changes in the definitions of timberland, not to an actual increase in the prevalence of lowland conifers on the landscape. Inventory plots with low site index were defined as unproductive prior to 1990 and were not included in the timberland acreage. There is no DFFC line on the lowland conifer chart because rotation ages vary significantly based on site index. Low site index stands have a longer rotation age than higher site index stands. The lowland conifer ownership pie chart shows that the State owns a much larger portion of lowland conifers (49%) than it does for either the Aspen/Balm of Gilead/Birch (21%) or Upland Conifer (20%) covertypes.

Chart 1: Acres of **Aspen/Balm of Gilead/Birch Timberlands** by age class for all ownerships - **Selected SFRMP Planning units**
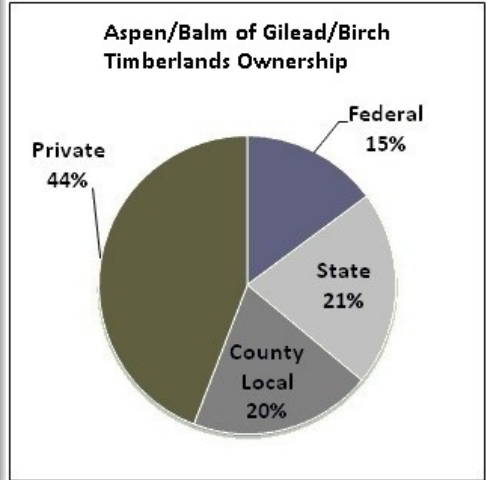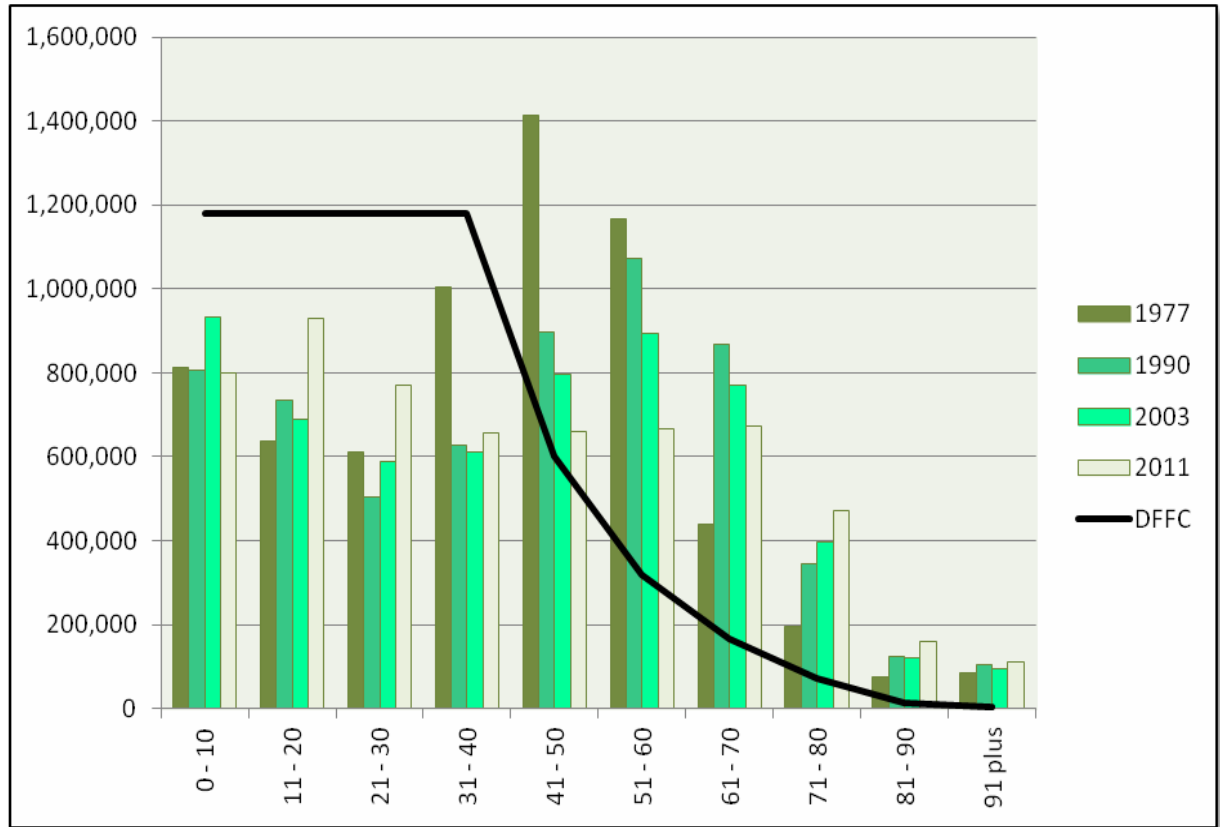
Age class	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	91 plus	Total Acres
1977	813,681	636,238	610,784	1,004,956	1,413,801	1,167,421	439,418	195,508	76,700	86,027	6,444,534
1990	805,482	735,119	503,257	628,607	897,805	1,073,493	867,278	343,499	124,699	104,098	6,083,337
2003	932,578	687,842	587,846	610,170	796,767	893,380	772,032	396,053	120,717	94,484	5,891,869
2011	799,307	930,012	770,625	655,904	658,579	665,430	673,873	471,036	159,190	111,089	5,895,045
DFFC	1,179,520	1,179,520	1,179,520	1,179,520	603,204	319,322	164,775	70,922	14,394	4,348	5,895,045

Source: FIA Data   MN DNR P. Olson – July 2012

Chart 2: Acres of **Upland Conifer Timberlands** by age class for all ownerships - **All SFRMP Planning units**
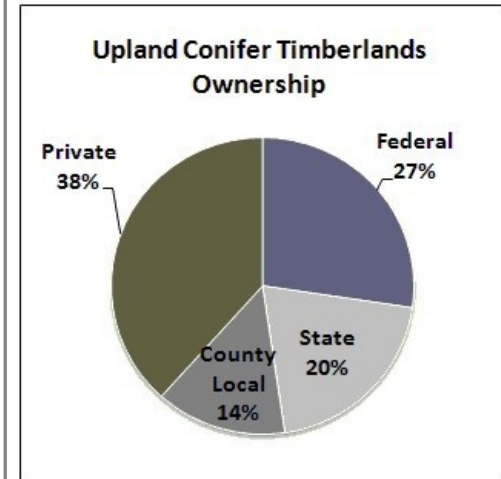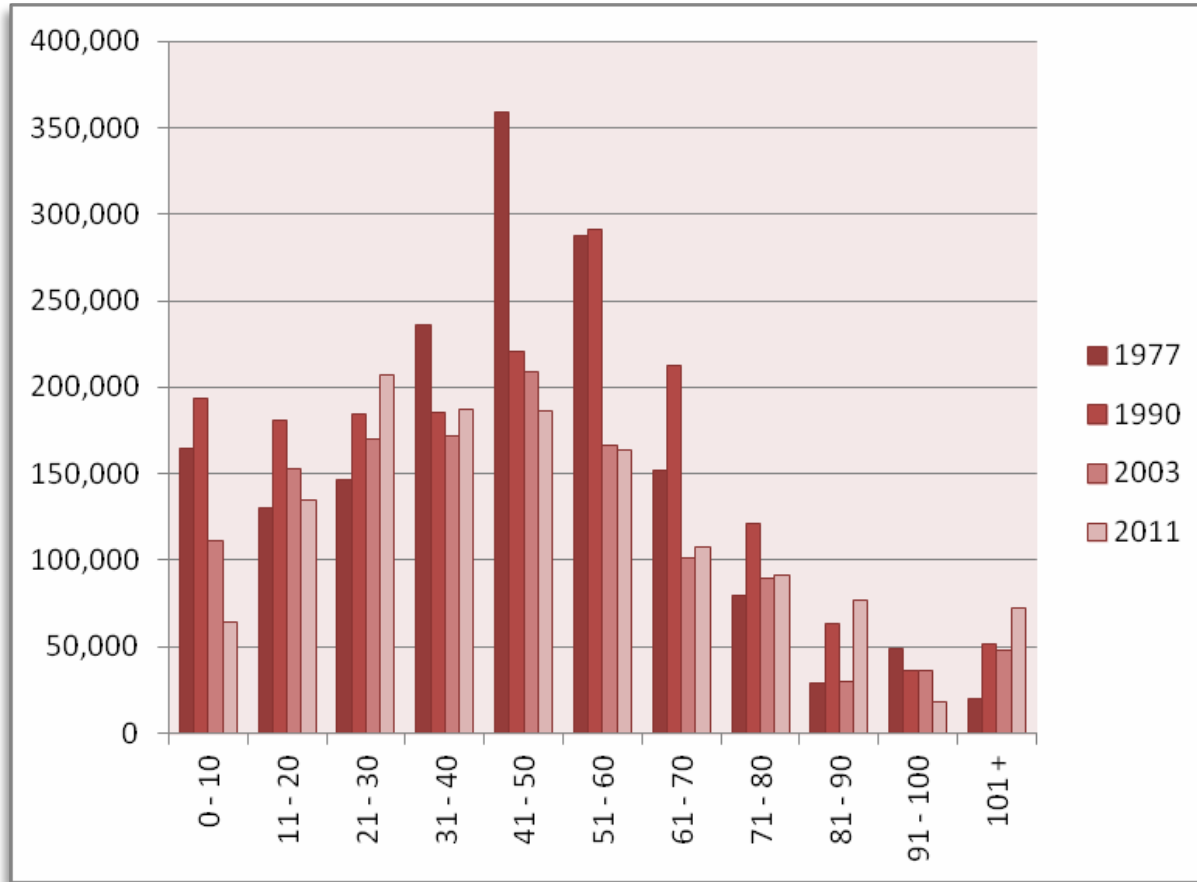
Age class	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	91 - 100	101 +	Total Acres
1977	164,396	130,010	146,200	236,076	358,792	287,420	152,150	79,883	28,997	48,861	20,008	1,652,793
1990	193,510	180,499	184,596	185,187	220,594	291,591	212,907	121,123	63,201	36,003	51,801	1,741,012
2003	111,027	152,954	170,260	172,127	208,955	166,435	101,154	89,313	30,102	36,459	47,580	1,286,366
2011	63,985	135,018	206,852	187,656	186,283	163,807	107,794	91,036	76,596	18,046	72,158	1,309,231

Source: FIA Data   MN DNR P. Olson – July 2012

Chart 3: Acres of **Black Spruce and Tamarack Timberlands** by age class for all ownerships - **Selected Planning units**
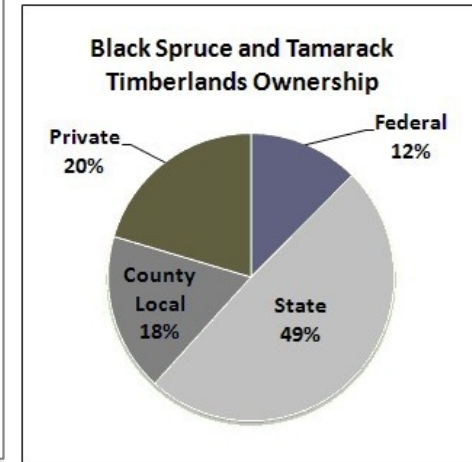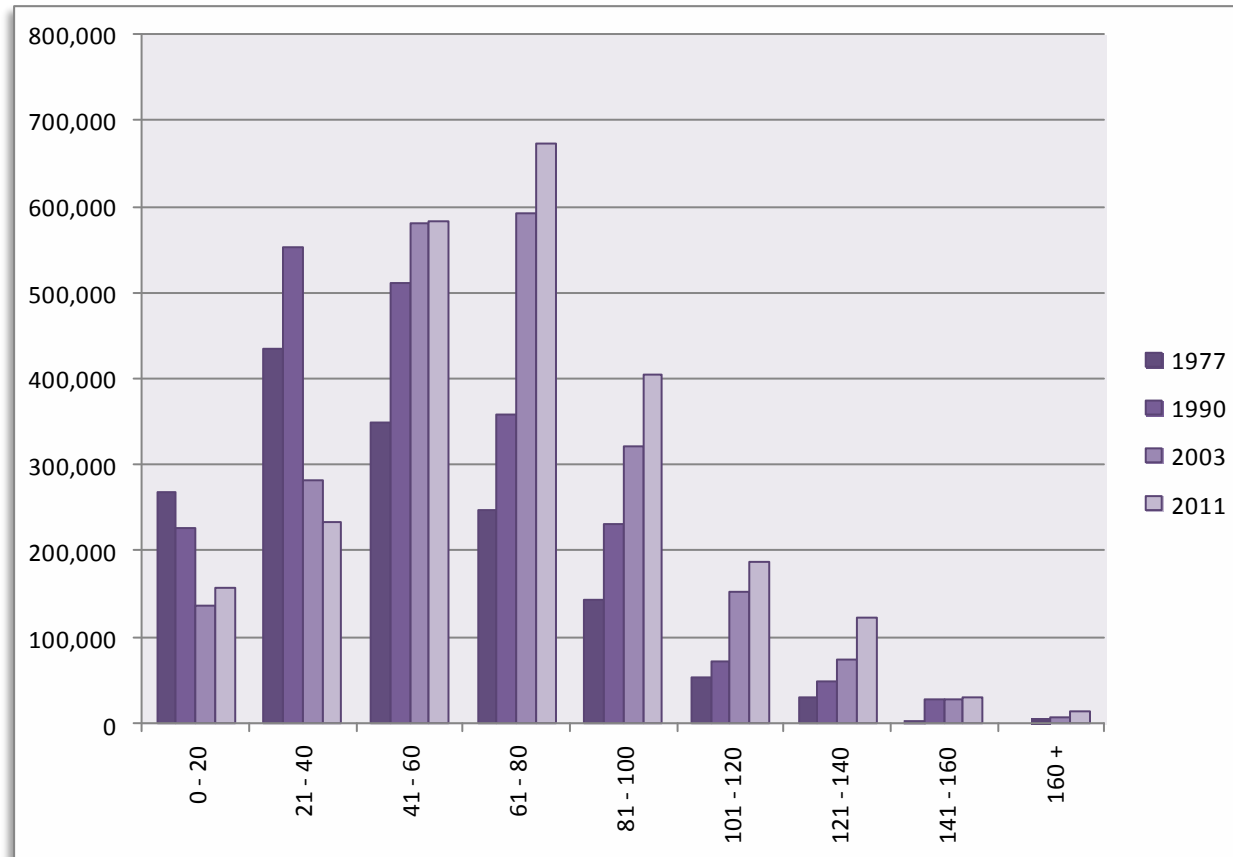
Age Class	0 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101 - 120	121 - 140	141 - 160	160 +	Total Acres
1977	268,691	435,392	347,923	247,525	142,697	52,897	30,298	2,600	0	1,528,023
1990	225,294	552,546	510,787	357,996	231,086	71,701	48,900	26,799	3,600	2,028,709
2003	135,451	280,755	581,197	592,928	321,179	152,194	74,013	27,572	6,630	2,171,919
2011	157,899	233,369	583,784	672,320	404,907	188,063	122,697	29,550	12,559	2,405,148

Source: FIA Data   MN DNR P. Olson – July 2012

Forest Management Policies that Affect Older Forests

There are a number of forest management policies, in addition to the ERF Guidelines, that result in greater or lesser amounts of older forest and older forest attributes on the landscape. These policies and their effects on older forest conditions are described below.

Designation of Old Growth Forest

ERF and MN DNR-designated old growth forests are separate, but related forest conditions that contribute to the goal of maintaining some older forests on the landscape. Old growth designation removes stands from the harvest pool while ERF retains some of the harvest pool for a period beyond normal rotation age before final harvest. From 1998 to 2002 the DNR designated about 38,000 acres (762 stands) of old growth forest:

- 21,376 acres on Division of Forestry Timberlands;
- 1,820 acres in Scientific and Natural Areas;
- 8,669 acres in State Parks;
- 2,191 acres on Division of Fish and Wildlife lands; and
- 4,050 acres in BWCAW/Shipstead-Newton-Nolan lands (no harvest zones along lakeshores in NE Minnesota).

By 2006, old growth forest designations totaled 44,000 acres. These old growth forest stands are not harvested and thus contribute to older forest goals.

Surrounding the designated old growth stand is a special management zone (SMZ) which extends a minimum of 330 feet from the edge of the old-growth stand. Timber harvest, including clear-cut, is allowed within the SMZ although the amount clear-cut at any point in time cannot exceed 25% of the old growth stand perimeter. Even-aged covertypes within old growth SMZs have often been a focus area for ERF placement on State lands.

Voluntary Site-Level Forest Management Guidelines

The Minnesota Forest Resources Council (MFRC) was charged under the Sustainable Forest Resources Act of 1995 with coordinating the development of site-level timber harvesting and forest management guidelines. The initial guidelines were published in 1999. The 2005 version of the *Voluntary Site-Level Forest Management Guidelines* (MFRC, 2005) includes some recommended practices that can contribute to older forest values although their primary purposes are focused on ecological functions, wildlife habitat, and water quality. DNR policy has been to adhere to the guidelines except in rare instances. Guideline examples that contribute to older forest conditions include:

- Reserving trees, either as scattered individuals or in clumps, in harvested areas.
- Filter strips – areas adjacent to streams, lakes, wetlands, seasonal ponds, seeps and springs that help minimize runoff into these water bodies by 1) allowing remaining vegetation to remain essentially undisturbed, and 2) allowing the forest floor to trap sediment from adjacent land areas.
- Riparian Management Zones – the area adjacent to water features where objectives of maintaining water quality and riparian wildlife habitat are important. Management actions in

some riparian zones are directed toward establishing and maintaining long lived conifer species which can also contribute to older forest conditions.

- Sensitive native plant communities and sites – as applied in the *Guidelines* these are rare native plant communities that are sensitive to timber harvest and other forest management activities. The *Guidelines* intent is to increase awareness of these occurrences and to maintain or enhance them where they are found

Shipstead-Newton-Nolan Areas

In 1930 the US Congress passed the Shipstead-Newton-Nolan (SNN) Act to protect water levels and lakeshores by prohibiting dams and restricting logging within 400 feet of recreational waterways in the then existing Superior National Forest in NE Minnesota. Three years later Minnesota enacted similar state legislation, known as the "Little Shipstead-Newton-Nolan Act," to protect State-owned shorelines within the same area. The 400-foot buffers within which timber harvest is subject to certain restrictions are established adjacent to waters (lakes, rivers, and streams) that are determined to be navigable, irrespective of the land status of these adjacent lands. The SNN areas contribute to older forest values.

Forest Certification

In 1997, Minnesota DNR and Aitkin County obtained third-party forest certification for about 370,000 acres of forest lands**.** These were the first public forest lands to be certified in the United States, thereby establishing MN DNR and Aitkin County as nation-wide leaders in forest certification. In 2005, DNR obtained dual certification from both the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI) of 4.5 million acres, covering all State Forests and most Wildlife Management Areas. In December, 2010, DNR's Forest Certification program grew to 4.96 million acres, covering 90% of the 5.53 million acres managed by DNR. The sustainably managed certification applies to both School Trust lands and non-trust lands. Today, MN DNR is the largest single FSC certified land manager in the U.S.

Some forest certification principals or standards, either explicitly or implicitly, require attention to older forests. ERF designation has been one of the tools the DNR uses to manage older forest. However, neither the SFI Principles, Objectives, and Performance Measures nor the FSC Principles, Criteria, and Indicators make specific mention of "extended rotation forests" or similar language that would require that some level of forest *must* be kept beyond "normal rotation age." Instead, both SFI and FSC have standards or principles (or portions thereof) that can be met, either wholly or in part, by an ERF policy or similar device that maintains some older forests. It should be noted that most, but not all, of these certification requirements are *specific* to the lands that are included on the DNR's certificate and must be met by actions implemented on those lands. It is not always possible to meet these requirements by taking credit for what is occurring on other ownerships or on the landscape.

School Trust Land Management Policy

In 2012, the DNR issued Operational Order 121 which provides guidance for the management of School Trust lands. Also, the 2012 State Trust Lands law (2012 MN Laws, Chapter 249) and previous legislation provides additional oversight and direction for management of School Trust lands. Forty nine percent of the land DNR manages lands is School Trust land. School Trust lands are to be managed for the long term economic interest of the School Trust. School Trust lands must be managed consistent with sound

natural resources conservation principles but where conflict exists between conservation and maximizing the long term economic return to the Trust, the economic interest will take precedence. If the DNR decides that the conservation values are of such importance that they should be protected and doing so restricts or prohibits long term economic return, the Permanent School Fund must be compensated for that loss.

Effects of ERF Designation on School Trust Lands

Forest modeling indicates that current DNR ERF designations would reduce both the timber volume harvested and the gross stumpage revenue from School Trust lands when compared to forest management without ERF designation.

The model predicts that the current ERF designations would reduce annual average volume harvested by slightly more than 50,000 cords in the first decade with smaller reductions in the following four decades.

PREDICTED CORD HARVEST AMOUNTS OVER THE NEXT 50 YEARS, TRUST LANDS

Acres of 2,348,410
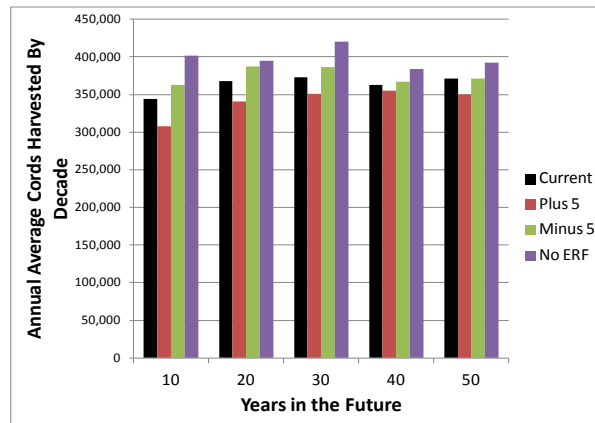
The discounted gross stumpage revenues to the Permanent School Fund are predicted to be reduced by about $25 million over 50 years when compared to a 'No ERF scenario (see chart below). If the DNR decides to continue with ERF designation on School Trust lands and manages that designation in a way that restricts or prohibits maximizing long term economic return, the DNR must find a way to compensate the Permanent School Fund.

PREDICTED GROSS STUMPAGE REVENUES OVER THE NEXT 50 YEARS, TRUST LANDS
(Discounted to Present Value)
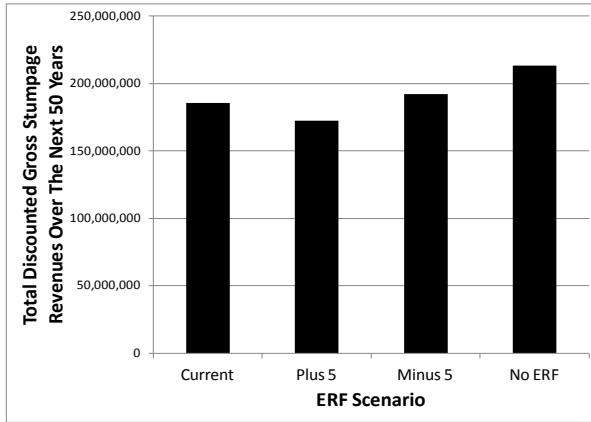
Notes:

1) Discount interest rate 4%
2) Revenue projections based on stumpage prices weighted by product class (pulpwood, bolts, sawlogs) by species using recent statewide DNR-land stumpage receipts
3) Excludes University Trust lands

Model Runs

The ERF project team used a forest model to analyze the potential effects of ERF policy on timber harvest volumes and gross stumpage receipts from DNR-managed forest lands over a period of 50 years. The ERF policy alternatives analyzed included 'No-ERF,' current level of ERF as designated in the first generation SFRMPs (roughly 12% ERF), minus 5% from current ERF (roughly 7%), and plus 5% from current ERF (roughly 17%). The DNR's stand level forest inventory, adjusted to current age and volume, was the starting forest condition. The inventory data was separated into School Trust land stands (2,348,410 acres) and non-School Trust land stands. University Trust lands were considered non-School Trust for this analysis. The model was run for both the School Trust lands separately and for all DNR-managed timberlands combined. Timber harvest volumes, stumpage receipts, and forest age class structure were modeled using five-year periods for 75 years into the future. Model outputs were only reported for the initial 50 years. The last 25 years are to help create realistic management scenarios near the end of the initial 50 year projection period.

Management regimes were established for each cover type, including the number and frequency of intermediate thinnings, final clear cut harvests, and rotation ages based on site quality. Old growth forest stands and other stands where harvest is prohibited were excluded. Stumpage revenues were discounted to present values using a 4% discount rate. An even-flow harvest constraint was used so that harvest volumes by cover type would not fluctuate by more than 20% within any five-year period from the average harvest level across all 75 years.

The model objective function was to maximize harvested volume. As expected, the 'No-ERF' alternative resulted in the greatest timber harvest volume and gross stumpage revenues over the 50 year period. The 'Plus 5%' policy would result in the lowest harvest volume and gross revenue of the alternatives analyzed.

Stakeholder Meeting

On April 18, 2012 an ERF stakeholder meeting was held in Grand Rapids. Stakeholder invitees included individuals from organizations that were involved in the development of the initial ERF policy or who had commented on ERF during SFRMP reviews. Invitees were from forest products industrial organizations, environmental organizations, forest wildlife interest groups, academia, forest policy organizations, and natural resource agency staff. Information presented at the stakeholder meeting was placed on the DNR website and written comments were accepted from all interested parties.

The stakeholder meeting was facilitated by a consultant with the Management Analysis & Development (MAD) unit of the MN Department of Management & Budget (MMB). Presentations at the stakeholder meeting included:
- DNR perspective on older forest management
- History of ERF policy development and application by the DNR
- Statewide perspective from FIA data on forest age and harvest levels
- Wildlife habitat values of older forests
- Ecological values of older forests
- Preliminary modeling result

The DNR presentations and speakers' notes were placed on the DNR website and comments were gathered via email.

The MAD consultant facilitated stakeholder reflection, discussion, and suggested modifications to DNR ERF policy. A summary of the stakeholder meeting was prepared by the consultant and DNR staff for use by the ERF project team. Invited stakeholders and others with an interest in ERF policy were also asked to submit written comments. The written comments were compiled and considered by the ERF project team when alternative policy change scenarios were analyzed.

ERF Related Issues

The assessment phase of the ERF policy review project involved:
- Reviewing the results of ERF designation in the first generation SFRMPs
- Analyzing statewide harvest levels and forest age class data
- Considering the effects of other forest management policies and guidelines on older forests
- Modeling the effects of the current levels of ERF designation on harvest volumes, stumpage receipts, and future age class distributions – then running alternative scenarios with 5% less and 5% more ERF relative to the current ERF levels and No-ERF
- Compiling stakeholder input

The ERF Policy Review Team developed the following issue or concern statements related to ERF policy to help focus on topics that might be addressed by team recommendations:
1. How can we account for all older forest components on state timberlands (e.g. reserves, leave trees, sold but not yet harvested)?

2. When do management designations other than ERF [e.g. Ecologically Important Lowland Conifer (ELIC), Old Growth Forest, Representative Sample Areas (RSA), High Conservation Value Forest (HCVF), large old patch management] contribute to older forest conditions and how can they be included in older forest goals.

3. How do we locate ERF on the landscape (consideration of other ownerships, parks, or wilderness areas that have older forest)?

4. Should site index be a consideration in assigning ERF designations?

5. How does the School Trust lands policy (Operational Order 121) affect ERF designation on trust and non-trust lands?

6. Should focus be more on native plant community growth stage (young, mature, old, and transitional) rather than age?

7. Should forest cover types typically managed as uneven-aged stands be designated as ERF?

8. ERF in 'plantations' – should there be a difference in how ERF is applied to planted and natural origin stands? Should red pine be considered as two cover types – plantation and natural origin?

9. There has been an evolution from 1994 ERF Guideline to current policy as reflected in SFRMP Guidebook. Do DNR staff and external stakeholders have a common understanding of current ERF policy application?

10. How important is consistency of ERF policy application in various SFRMPs (subsections)?

11. Will changes in ERF policy impact Forest Certification?

12. Stand prescriptions on ERF – what intermediate treatments prior to final regeneration harvest are appropriate?

13. Should ERF stand designations be permanent?

14. What is the impact of 'even flow harvest level constraints' on the ability to meet older forest objectives?

Older Forest Policy Recommendations

The ERF project team was asked to evaluate the status of the DNR ERF policy and its impact on forests and related values and to recommend whether modifications need to be made to reflect current conditions. The ERF project team believes that modifications to the ERF policy are warranted. Factors that indicate a modification of ERF policy is warranted include decreasing statewide timber harvest levels, an overall increasing age of the forests, the application of other forest management policies that contribute to older forest attributes, and the evolution of School Trust lands management policy.

The ERF project team recommends the following adjustments to the ERF policy. DNR senior management will decide which, if any, changes to ERF policy will be implemented and on what timeline.

Adaptive Management Approach

The ERF project team recommends an adaptive approach to management of older forests. The amount of older forest on the landscape and harvest levels will be monitored to determine if there is a need to designate ERF on DNR-administered timberlands.

Adaptive management promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders (Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2009).
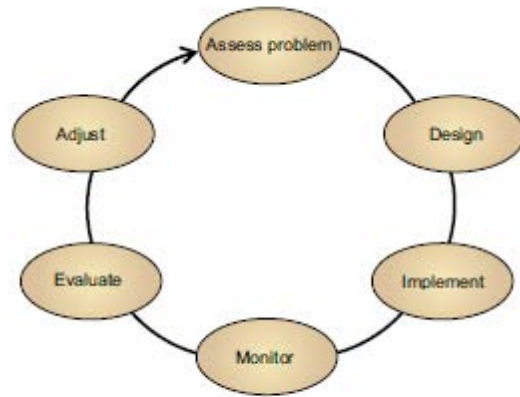

Figure 1.1. Diagram of the adaptive management process.

To implement an adaptive older forest management approach the following must be in place:
- Continually updated forest inventory;
- Monitoring capacity – methods, information systems, staff;
- Modeling of future forest conditions;
- Defined "trigger points" that would warrant adaptation of old forest management policy.
  - The ERF project team recommends that if statewide harvest levels reach 3.5 million cords per year the DNR's older forest management policy be re-examined. This is based on the baseline or lowest harvest level examined in the GEIS (4.0 million cords) which assumed ERF designation as a mitigation measure. The ERF team thought the trigger point for reconsidering the need for ERF designation should be somewhere less than 4.0 million cords if there will be no active ERF designation in the next round of SFRMPs.
  - Major natural disturbance that results in large areas of young forest over an extensive portion of an ecological subsection and reduces older forest below desired levels. These would be very large events - even the 1999 BWCA blow down or the 2011 St. Croix storm in Pine County don't seem to have reduced older forest to a degree that would warrant a change in old forest policy;
  - Amount of older forest (% of acres above normal rotation age) on all ownerships is lower than some minimum threshold. The ERF project team recommends that this trigger point be the percentage of desired ERF on state timberlands in the initial SFRMP for each subsection.
  - New information that supports a change in direction.

SFRMP Process

Before SFRMP planning begins for a planning unit, an older forest analysis should be done to determine the status of forests over normal rotation age. The analysis should be done separately for DNR-managed timberlands and for all forest ownerships because older forests on non-state lands contribute to older forest habitat and ecological goals in the subsection.

If older forest acreage exceeds the desired age class distribution (i.e. the DFFC for state timberlands) from the prior SFRMP, normal rotation ages can be used for stand selection on state timberlands. In this case, there would be no ERF designation on state timberlands for the upcoming planning period. In some ecological subsections, there will not be enough FIA inventory plots to reliably assess age class structure for each individual cover type within acceptable levels of uncertainty. In these instances, it may be necessary to combine similar even-aged forest types (e.g., Aspen/Balm of Gilead/Birch or Upland Conifers) to assess age class structure.

If the current older forest acreage for a given covertype (or group of similar covertypes) on all ownerships is less than the desired age class distribution for that covertype on DNR-managed timberlands in the prior SFRMP, ERF designation should be used to ensure older forest exists on DNR timberlands in the future. ERF designation on state timberlands would follow the process described in the *SFRMP Guidebook IV* (MN DNR, 2008). If ERF designation is necessary, ERF should be preferentially located on non-School Trust lands. If a decision is made to designate ERF on School Trust lands, economic modeling will be done to determine if there is a negative impact on maximizing the long term economic return to the Trust. If there is a negative impact, a plan will be developed to compensate the Trust.

Even where normal rotation ages are used, the stand selection model will maintain some older forest. Within Remsoft Woodstock harvest scheduling model, stands have the potential to grow beyond normal rotation age.

In relation to designated old growth forest stands, there should still be an effort to encourage older forest conditions within the SMZ. In the first generation SFRMPs ERF was often designated in the SMZ to "buffer" the old growth stand and allow some older forest attributes to develop within the SMZ. Old Growth Amendment #5, directed the designation of additional ERF surrounding the old growth and SMZ, in Old Forest Management Complexes (OFMC). There needs to be additional thought given to how to enhance older forest conditions within the SMZ if there are no ERF designations in the future.

Monitoring

The ERF project team recommends a monitoring program that can support the needs of an adaptive management approach for older forest management. However, it is beyond the scope and capacity of the ERF project team to design such a monitoring program.

Practices that contribute to older forest conditions at either the stand-level or individual old forest feature scale that should be monitored include:
1. Stands above normal rotation age that were selected for exam but did not result in a harvest;

2. Stands above normal rotation age that are sold but not yet harvested;
3. Stands over normal rotation age in riparian management zones with limited or no harvesting;
4. Even-aged covertype stands over normal rotation age that receive selection harvest as opposed to final harvest (set some canopy, BA, or ? threshold for this one to count);
5. Uneven-aged covertype stands [that are >x years old];
6. Even-aged covertypes over normal rotation age in Old Growth SMZs, HCVF, or OFMCs;
7. Stands above normal rotation age (or > x years for uneven-aged types) designated for no harvest (e.g. RSAs, old-growth);
8. Legacy patches, reserve islands, rare species protections, etc.;
9. 5% minimum leave trees in harvested areas from the Site-level Guidelines.

NOTE: Items 1-7 could be potentially monitored via the stand exam layer (in concept stage). The ERF project team recommends that the "stand exam layer" be developed quickly. Items 8-9 would need to be monitored by a yet-to-be-determined system.

Monitoring reports on the above items should be run for each SFRMP planning unit every 5 years – or roughly at the mid-point of the stand exam list period and just before the SFRMP is updated.

Higher level older forest monitoring (e.g. age class structure by covertype) should be FIA based, covering all ownerships at the statewide and ecological subsection levels. Harvest rates also need to be monitored to ensure that harvest stays below levels that would trigger concerns about meeting older forest goals. Statewide harvest level monitoring will be via the annual harvest level report prepared by the DNR Forestry Utilization and Marketing Program.

In addition, the ERF project team recommends pursuing development of a plot-based continuous forest inventory system on state lands, possibly county and federal lands as well, that will aid in monitoring various SFRMP goals including age structure, conversion goals, and species composition.

Related Recommendations

The ERF policy review project team was specifically asked to recommend changes in the DNR's older forest management policy. The team's older forest policy recommendations were discussed in the previous section of this report. In completing its assigned tasks, the ERF project team became aware of additional stakeholder concerns. The ERF project team presents the following recommendations to address these related concerns.   DNR Senior Managers may want to implement these related recommendations in addition to the adaptive management approach to older forest management, SFRMP process changes, and monitoring recommendations.

Red Pine Covertype

Stakeholder comments indicate special concern for the red pine covertype. Red pine is used by the forest products industry both as a small sawlog product and large sawlog product. There is also attention focused on natural origin pine stands in the FSC certification principles. The vast majority of red pine stands on DNR-managed lands are planted stands. Historically, red pine management consists of thinning harvests approximately every 10 years and final harvest based on either normal rotation age

or ERF designations. In some subsections the entire red pine covertype is being managed to achieve older forest conditions.

Planted stands tend to be less valuable as habitat than natural origin stands. Also, some planted stands may be on inappropriate sites based on ecological native plant community classification. Using a shorter rotation on these sites would allow an earlier conversion to a more appropriate species composition.

The team recommends that planted red pine stands be managed as a separate covertype from natural origin stands. The rotation age for planted stands should be an economic rotation age while the rotation age for natural origin stands should reflect a more natural age class distribution. There would be no ERF designation in planted red pine stands. Because there are sawmills that use large sawlogs, there should be a final harvest pool in the natural origin stands. The regeneration strategy for natural origin stands should try to mimic the creation of a natural stand. Prescribed fire, natural seeding and artificial seeding are examples.

Rotation Ages

Stakeholder comments received indicate concern over rotation ages used in SFRMP stand selection for all covertypes. Although the team anticipates that using the adaptive management approach for older forest management will largely address this concern, the team recommends a workgroup be formed as soon as possible to evaluate how rotation ages are set in the SFRMP process.

References

Minnesota Department of Natural Resources. 2008. *DNR Subsecton Forest Resource Management Planning Guidebook IV.* MN DNR – Division of Forestry, St. Paul,MN.

Minnesota Forest Resources Council. 2005. *Sustaining Minnesota Forest Resources: Voluntary Site-Level Guidelines for Landowners, Loggers and Resource Managers.* Minnesota Forest Resources Council, St. Paul, MN.

Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2009. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC. International Standard Book Number: 978-1-4133-2478-7

Acronyms – ERF Related

BA	Basal Area
DFFC	Desired Future Forest Condition
DNR	Department of Natural Resources
EILC	Ecologically Important Lowland Conifers
ERA	Extended Rotation Age
ERF	Extended Rotation Forest
FSC	Forest Stewardship Council
GEIS	Generic Environmental Impact Statement
HCVF	High Conservation Value Forest
MAI	Mean Annual Increment
MFRC	Minnesota Forest Resources Council
MRA	Maximum Rotation Age
NRA	Normal Rotation Age
OFMC	Old Forest Management Complex
PSF	Permanent School Fund
RMZ	Riparian Management Zone
RSA	Representative Sample Area
SFI	Sustainable Forestry Initiative
SFRMP	Subsection Forest Resource Management Plan
SMZ	Special Management Zone
SNN	Shipstead-Newton-Nolan
WMA	Wildlife Management Area