Scientific Forest Management Area

10-Year Forest Management Plan

July 2025 – June 2035

Total GIS acreage: 29,631 acres
Total wooded acreage: 27,222 acres
Parcel Location: Trout Brook and T6R10, Piscataquis County
Plan preparation date: May 2025

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Contents

Introduction

The following Forest Management Plan (FMP) provides guidance for the management of the Scientific Forest Management Area (SFMA) within Baxter State Park (BSP) from 2025 to 2035. It serves as an essential link between the overarching goals of the SFMA and operations. The FMP discusses the most effective approaches to achieve Percival Baxter's goals for the SFMA over the next ten years, including an overview of silvicultural options, a maintenance plan, habitat recommendations, forest inventory analysis, a ten-year allowable harvest rate, and a financial analysis. Detailed information on the goals, principles, and history of the SFMA or to review SFMA policies will be included in the SFMA Master Plan.

Deeds of Trust

Percival Baxter gave, IN TRUST, all lands comprising the Scientific Forest Management Area of Baxter State Park to the people of Maine. As TRUSTEES, our responsibility is to carry out the wishes of the TRUSTOR, and the management of the Scientific Forest Management Area represents our commitment to that responsibility. Therefore, all management actions within the SFMA are guided by Percival Baxter's communications about this gift in trust, which was presented in 1955 to the 97th Maine Legislature.

Percival P. Baxter's Vision

The goals, principles, history, and communications that pertain to the SFMA will be detailed in the forthcoming SFMA Master Plan. However, a quick summary will aid in understanding the rest of the Forest Management Plan. The following quotes are from Percival Baxter's communications about his vision to Governor Muskie in 1955. Baxter designated the SFMA as a place *"for recreation and for scientific forestry management" that "can be made to produce a continuing crop of timber to be harvested and sold as are potatoes or any other product of the soil."* Ultimately, he wanted the SFMA *"to become a show place for those interested in forestry, a place where a continuing timber crop can be cultivated, harvested, and sold; where reforestation and scientific cutting will be employed; an example and an inspiration to others."* He was also clear that *"Fishing and hunting will be allowed under the general Fish and Game Laws of the State",* and that *"all revenue derived from the sale of said products shall be used by said state for the care, management and protection of Baxter State Park".*

Baxter did not define his vision of scientific forestry, likely as science continually evolves with additional information. For example, in the 20th century, two dominant scientific methods for managing forests were production silviculture and sustained yield forestry. Early on, management in the SFMA decided that production silviculture does not align with some of Baxter's multi-use objectives, such as recreation. In contrast, sustainable yield forestry, as seen by Baxter in Europe, is likely closer to his original vision for the SFMA. However, significant advances in the science of ecology have altered our understanding of forests and forest science since the establishment of the SFMA. As a result, management in the SFMA has adopted a new, ecosystem-based approach to forest management, known as ecological forest management.

Ecological Forest Management in the Scientific Forest Management Area

According to D'Amato et al., Ecological Forest Management aims "to achieve management objectives, such as the maintenance of native biodiversity". Additionally, "These approaches generally use natural disturbance processes and their structural and compositional outcomes as models for designing silvicultural prescriptions that restore or sustain complex structural and compositional conditions in actively managed forests."[1]

We use many of the silvicultural techniques and tools that are common in production and sustained-yield forestry. However, our objective is to manage forests in a manner that imitates natural disturbance patterns, with the aim of promoting and improving structural diversity and native biological systems. By adopting this approach, we can ensure a regular supply of timber, while also providing opportunities for recreational and educational activities, and developing a diverse and resilient forest ecosystem.

Management Units and Cover Types

The SFMA is divided into management units. A traditional forest stand is delineated based on the composition, structure, age, size, distribution, spatial arrangement, or condition of the trees on the site. While overstory trees are considered, the management units in the SFMA are primarily delineated based on terrain, aquatic features, herbaceous plant communities, shrubs, wildlife habitat, soils, and other elements within a forest ecosystem. Within a tree-focused system, these other elements of a forest, along with natural succession pathways, operability, and the effects of past human disturbance are often ignored.

The SFMA adopted this system of delineation to avoid aquatic features and/or terrain that would increase the risk of negatively affecting soil health and water quality. In addition to protecting soil and water quality, operational efficiency is improved. Additionally, by avoiding a tree-based system, the SFMA manages the units based on the forest type that would naturally occur on the site, not only the forest (or other landcover) that is there at a given moment in time. The result is that the units are managed as a part of a forest ecosystem, not just a crop of trees.

[1] D'Amato, Anthony W.; Palik, Brian J.; Franklin, Jerry F.; Foster, David R. 2017. Exploring the Origins of Ecological Forestry in North America. Journal of Forestry. 115(2): 126-127. https://doi.org/10.5849/jof.16-013.

Summary of Management Unit Types

Unit Classification	Acres	Percent of Total Area	Percent of Forested Area	Percent of Operational Forestland
Operational	18,346	62%	67%	100%
Riparian Management Zone	4,566	15%	17%	NA
Benchmark	2,135	7%	8%	NA
Ecological Reserve	1,847	6%	7%	NA
Representative Site	183	1%	1%	NA
Frost Pond Forest	142	0%	1%	NA
Administrative	8	0%	NA	NA
Roads and Right of Way	644	2%	NA	NA
Great Pond	537	2%	NA	NA
Wetlands (non-forested)	1,108	4%	NA	NA
River	92	0%	NA	NA
Other wet sites	22	0%	NA	NA
Total Area				29,630
Total Forested Area				27,219
Total Operational Area				18,346
Total Reserved Area				4,165

Operational Forest Land

Within the SFMA, a total of 18,346 acres are currently under active management.

Undesignated Forest Land

In 2024, the final undesignated areas were classified as operational, riparian, representative, benchmark or ecological designations. The following process was used to determine designation:

1. Does the site contain rare communities or geological features, critical wildlife habitat, etc., and is greater than 100 acres? If so, it will be designated as an ecological reserve.

2. Does the site contain rare communities or geological features, critical wildlife habitat, etc., but is less than 100 acres? If so, it will be designated as a representative site.

3. Is the site a non-forested wetland? If so, it will be designated as a wetland.
4. Is the site:

    a. Too wet for harvest operations.

    b. Within 75 feet of a stream that drains between 300 acres and 25mi^2.

    c. Within 250 feet of a stream that drains more than 25mi^2.

    d. Within 75 feet of a pond or wetland between 4,300 ft^2 and 10 ac.

    e. Within 250 feet of a pond or non-forested wetland greater than 10 acres.

    If so, it will be designated as a riparian management zone.

5. Would the site improve connectivity of riparian zones or critical wildlife habitat, aid in the establishment of more mature development classes and/or does the site fill a need to make the benchmark system representative of the SFMA? If so, continue to next step to determine reserve status. If not, classify the site as operable.

6. Will adding the reserve increase the percentage of the operable land base in benchmark reserves above 6%? If not, designate it as a benchmark.

7. Are there other Benchmarks that are not improving connectivity or aiding in the establishment of more mature development classes and the extension of riparian habitats and/or filling a need to make the benchmark system representative of the SFMA? If so, designate the site as a benchmark and redesignate the other site as operational. If no better site is available, designate the site as operational.

Changes to status designation will be documented in a block narrative, which will include site information and justification for the change, and in the management unit data in our GIS.

Riparian Management Zone

Riparian management zones (RMZ) are semi protected areas next to hydrological features. The SFMA has a Riparian Management Zone Policy that describes what areas should be included and regulates management activities within the zones. For more information, refer to the SFMA Master Plan.

As of January 2025, approximately 17% of the forested area of the SFMA is classified as a Riparian Management Zone. During the timeframe of this management plan, SFMA staff will evaluate the current RMZ designations using new GIS data; we expect that this assessment will increase the RMZ area from the current 4,566 acres.

Benchmarks and Reserves

Reserved areas are excluded from the SFMA silvicultural management. These areas are reserved for fulfilling specific conservation or forest management goals. There are three reserve designation types in the SFMA, which are treated as independent stands and do not receive any silvicultural treatments. Currently, reserves make up 17% of the SFMA, which is equivalent to 4,165 acres. The three sub-designations are:

- Benchmark reserves: 2,135 acres
- Representative Sites: 183 acres
- Ecological reserves: 1,847 acres

Ecological reserves are to remain untouched and unmodified. They are made up of large tracts (over 100 acres) containing rare communities, geological features, and/or critical wildlife habitat. Webster Ledge (195 ac) and Boody Bog Natural Area (1,621 ac), make up 7% of the SFMA's forested area.

Like ecological reserves, representative sites are to remain untouched and unmodified. They are made up of small tracts (less than 100 acres) containing rare communities, geological features, and/or critical wildlife habitat. They account for an additional 183 acres (>1% of forested area). New sites will be added as they are mapped.

Benchmark reserves are flexible, and adjusted as the SFMA is mapped. They are situated on operable ground that is set aside to function as a control for management in our Operational Units. The aim is to maintain 6%, or approximately 1,229 acres of the operable land base (operational units plus benchmarks) in benchmark reserves. Lands in this category are intended to be representative of the land base. Therefore, if 30% of the SFMA is covered by spruce/fir forest, 30% of the benchmark reserves should also be spruce/fir forest. The benchmark reserves are also intended to improve riparian and habitat connectivity.

Currently, 10% of the operable land base is designated as benchmarks, which reflects 906 acres over the target benchmark reserve area. Over the next 10 years, current benchmarks will be evaluated and possibly reclassified as operational or representative as needed to reach the intended 6% goal.

Frost Pond Forest

Frost Pond Forest is a 142-acre old growth stand located in Trout Brook township. While silvicultural options are permitted, management of this forest is limited to forest health treatments and performed only as needed. Frost Pond Forest is not included in the growth and yield modeling for the SFMA and is treated as a separate entity. The decision to remove Frost Pond Forest from the operational unit's category was made by consensus by the SFMA Advisory and SFMA Staff in the fall of 2023. A management plan will be drafted for Frost Pond Forest in the coming decade.

Non-Forested or Developed Area

Any forest management operation requires infrastructure and other managed areas. In the SFMA, those areas consist of:

- Building areas: Just under 6 acres
- Building structures: 5 camps in three sites
- Gravel or ledge pits: 3 pits covering just under 3 acres
- Roads and Right of Way: 122 miles covering 644 acres.

Water Bodies

Lakes and Ponds

- Large waterbodies (>10 acres)
  - Webster Lake (515 acres, not all within the SFMA)
  - Frost Pond (40 acres)
  - Hudson Pond (121 acres)
  - Blunder Pond (20 acres)
  - Lost Pond (12 acres)

- Small waterbodies (<10 acres)
    - Thissell Bog (9 acres)
    - 15 small unnamed ponds

Streams/Brooks (Named)

- Webster Stream (also known as Webster Brook)
- Trout Brook
- South Branch Brayley Brook
- Murphy Brook
- Hudson Brook
- Hinkley Brook
- Thissell Brook
- Wadleigh Brook
- Boody Brook

Non-Forested Wetlands

There are 1,108 acres of wetland in the SFMA.

Summary of Recommended Activities

Silvucultural Activities	Calendar Year	Season
Harvest up to 7,098 cords	Annually	Summer/Fall/Winter
100 acres of Pre-Commercial Thinning	Annually	Summer
Other Timber Stand Improvement (TSI)	Annually	All
Herbicide treatment	As Needed	

Monitoring Activities	Calendar Year	Season
Monitor Frost Pond Forest for bark beetle	2025, 2030	Summer
Establish Maine Adaptive Silviculture Network (MASN) site	2025, 2026, 2027	Summer/Winter
Install/retrieve water/air probes	Biannually	Spring/Fall
Continuous Forest Inventory (CFI)	Annually	Summer
Forest inventory	Annually	Summer

Infrastructure Activities	Proposed Calendar Year	Season
Replace roof over Halfway Brook pavilion	2025	Summer
Replace single wall fuel tank at North End Camps	2025	Summer
Replace roof on snowmobile and supply sheds at Hemlock Camps	2025	Summer
Install bridge over brook at the mouth of Hinkley	2025	Summer
Install harvest demonstration signage	2026	Summer
Replace Hinkley Brook bridge	2026	Summer
Replace mile markers on Brayley and Wadleigh	2026	Summer
Replace roof on the Blunder Bog pavilion	2026	Summer
Replace Webster Camp roof	2027	Summer
Install bridge over brook 1/4-mile up Hinkley	2027	Summer
Replace 6 gates	2027	Summer
Paint outbuildings	2027	Summer
Brush, blaze, and paint 8 miles of boundary line	2026, 2029, 2032	Winter
Survey Thissel Brook bridge	2028	Summer
Replace Webster Ledge bridge	2029	Summer

Administrative Activities	Calendar Year	Season
Make CFI data public	2025	Spring
Develop Survey 123 project	2025	Summer
Acoustic sampling for northern long ear bat	2025	Summer
Secure timber harvest contract	2025, as needed	Spring
Secure road maintenance contract	2025, as needed	Spring
Draft Frost Pond Forest plan	2026	Winter
Create covertype map	2027	Winter
Update enhanced forest inventory (EFI)	2027	Winter
Create harvest history database	2027	Spring
Create forest inventory database	2027	Summer
CFI analysis	2033	Fall
Update Riparian Management Zones (RMZ’s)	Annually	Spring
Update Management Unit feature class	Annually	Spring
Update harvest history	Annually	Spring
Investigate purchase of equipment		
Explore additional housing in north and south		

Geographic Information Systems

The SFMA utilizes Geographic Information Systems (GIS) in all aspects of management. In 2024, the SFMA begun the process of migrating from QGIS to ESRI's ArcGIS Pro. This move will greatly increase operational efficiency and SFMA GIS analysis capabilities.

Steps taken to improve the SFMA GIS begun with repairing the SFMA management unit feature layer by removing all overlaps and sliver polygons, updating the riparian management zones and wetlands based on new GPS and remote sensing data to ensure we meet our RMZ standards, and bringing our harvest history up to date. In addition, we have deployed an online project where field crews can collect data using Field Maps.

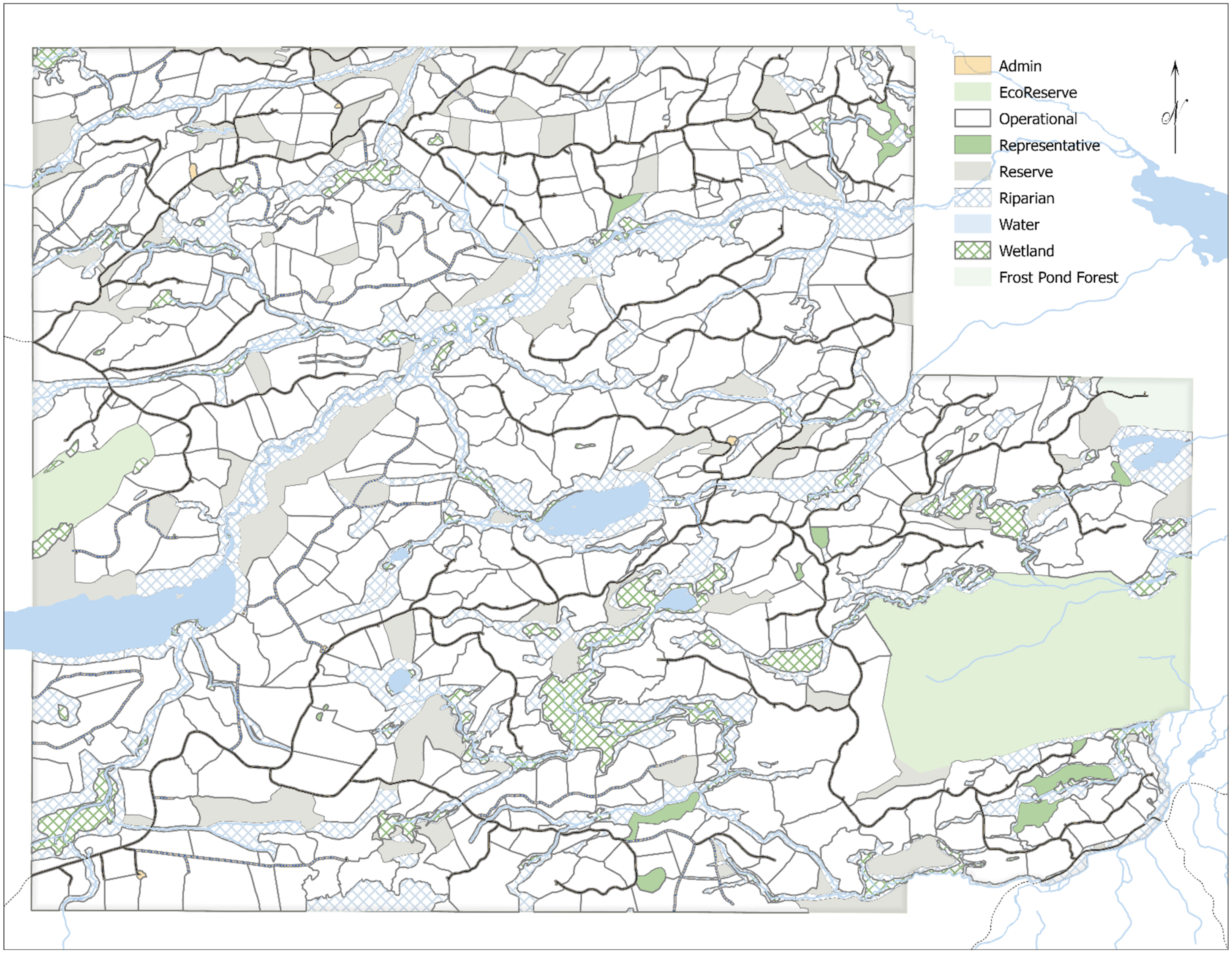
Additional steps to improve our GIS during the next ten years will include:

- Map rare tree and plant associations and incorporate into the unique areas
- Create a detailed covertype map
- Develop and implement a Survey 123 project
- Update the Enhanced Forest Inventory
- Continue to improve our RMZ mapping

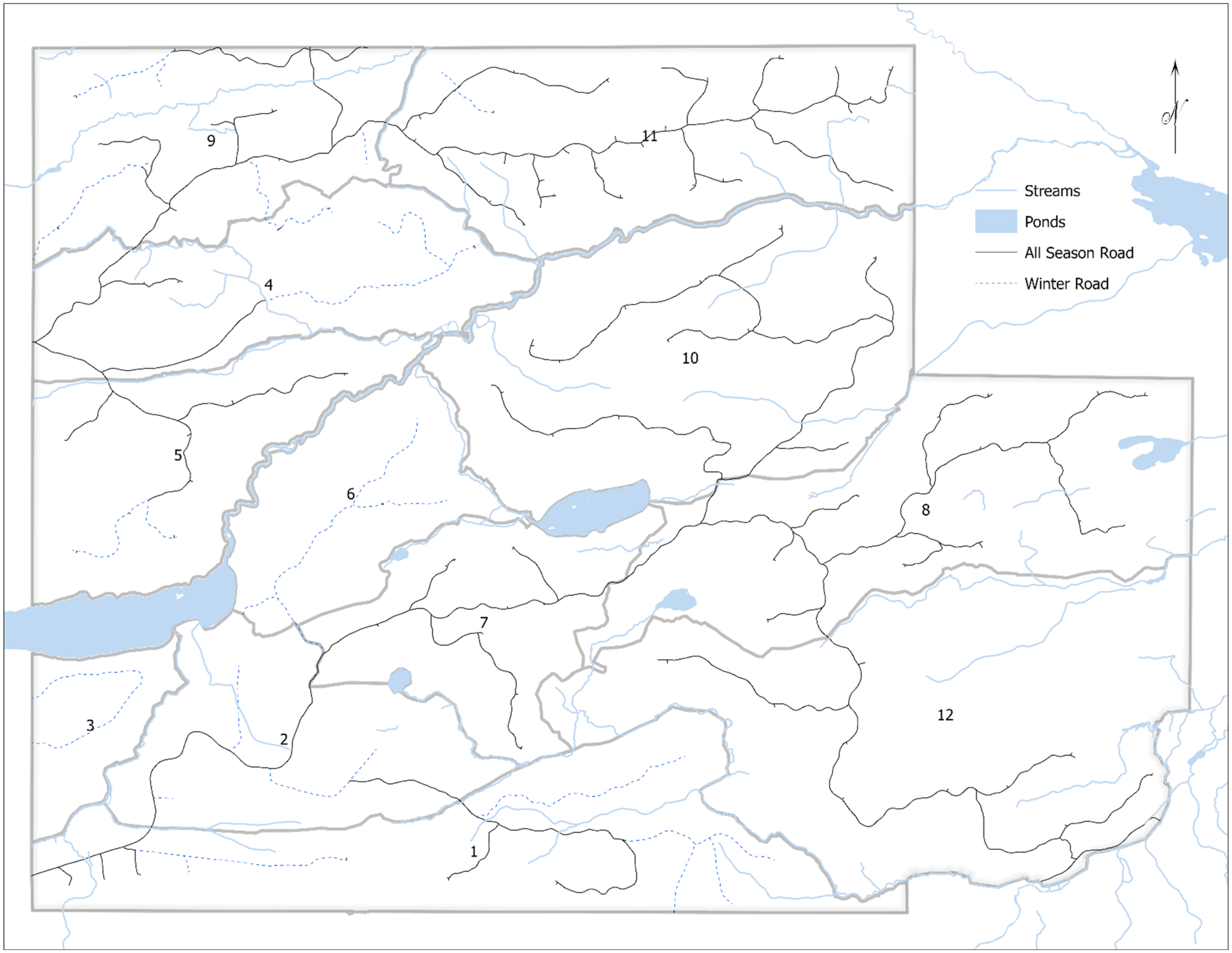
Maps Of the SFMA

The following maps detail the management unit classes, compartments, habitats identified by Inland Fisheries and Wildlife, and recreational infrastructure in the SFMA. Also included is a LiDAR derived hillside map detailing the terrain in the SFMA.

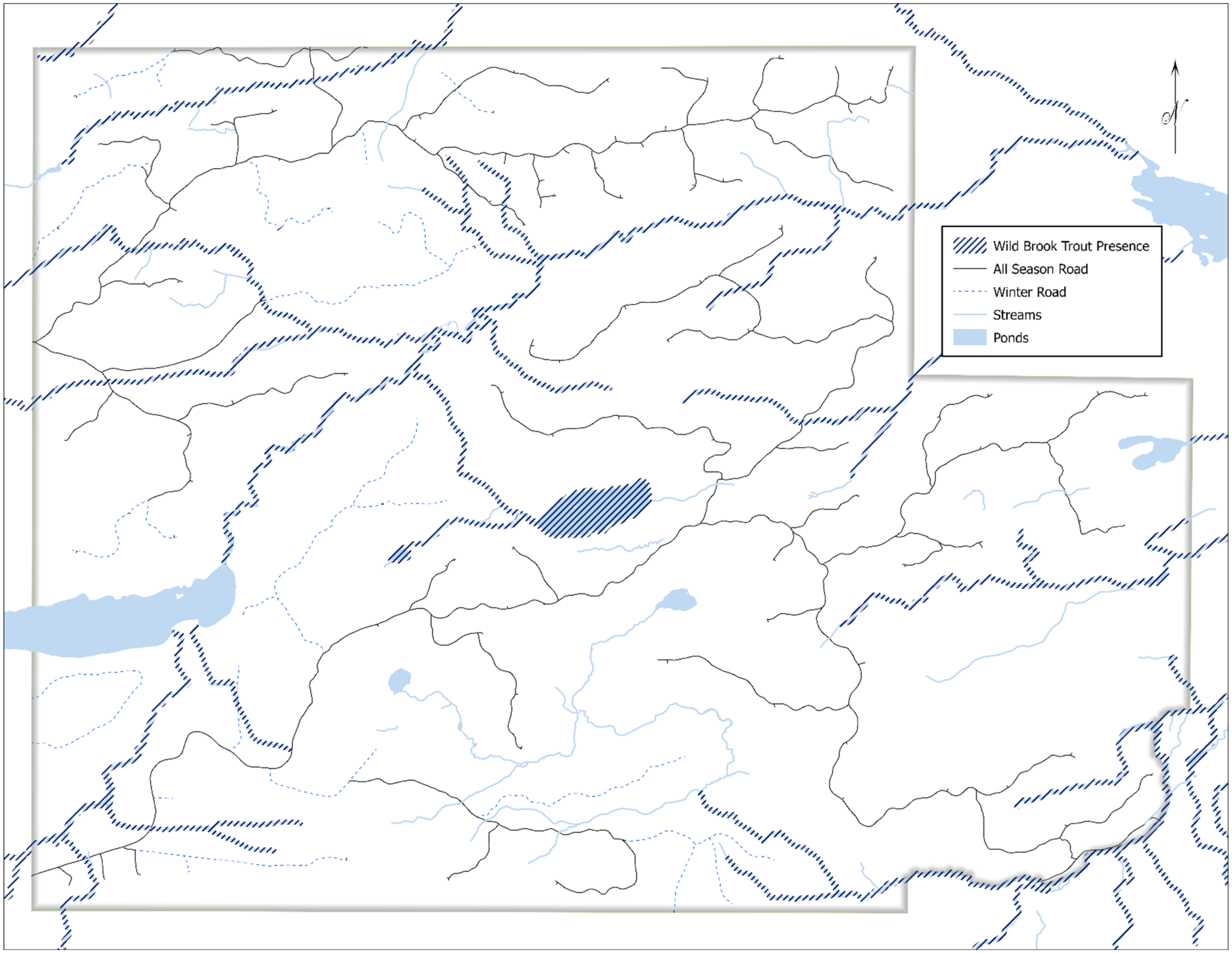
Management Units



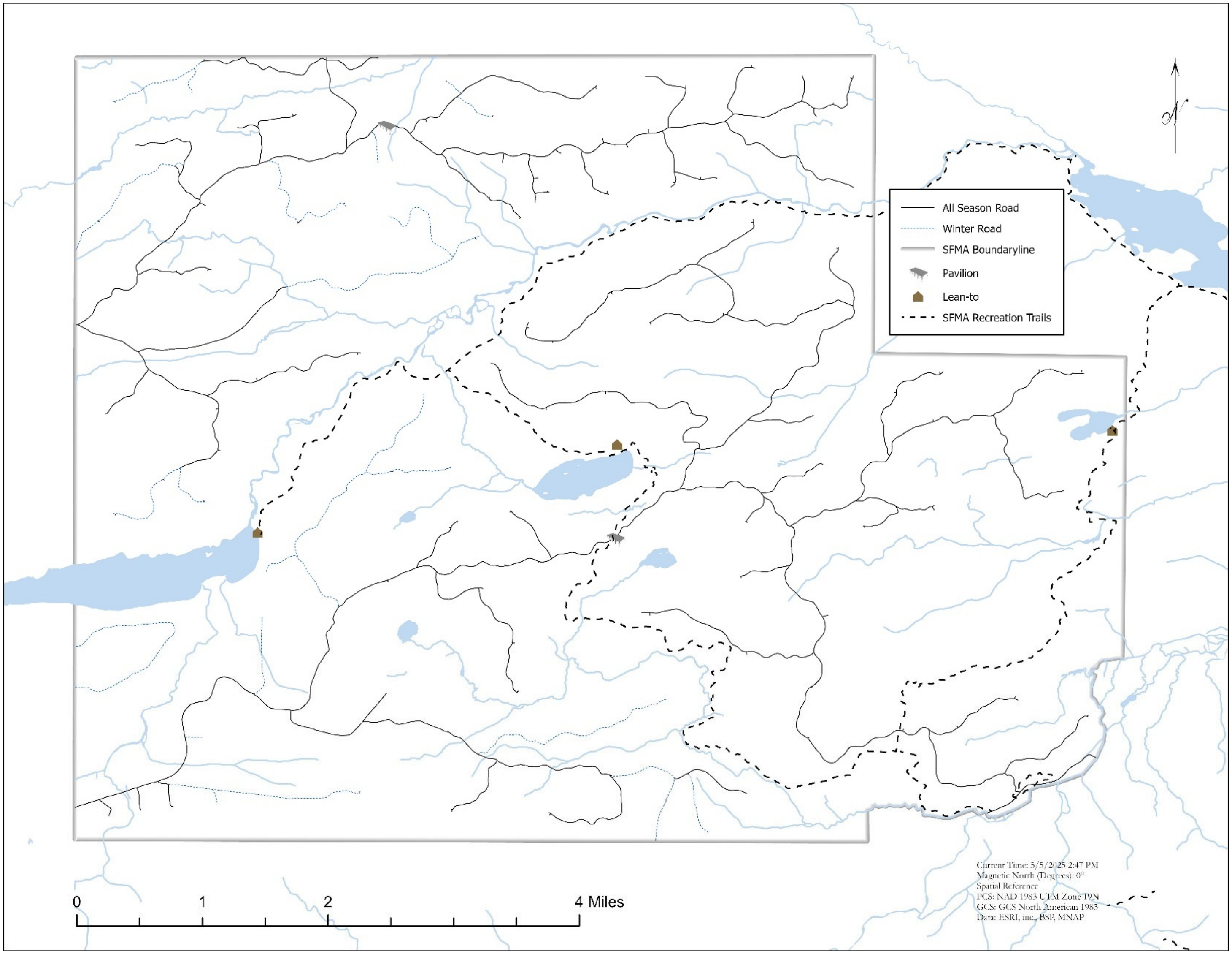
Compartments



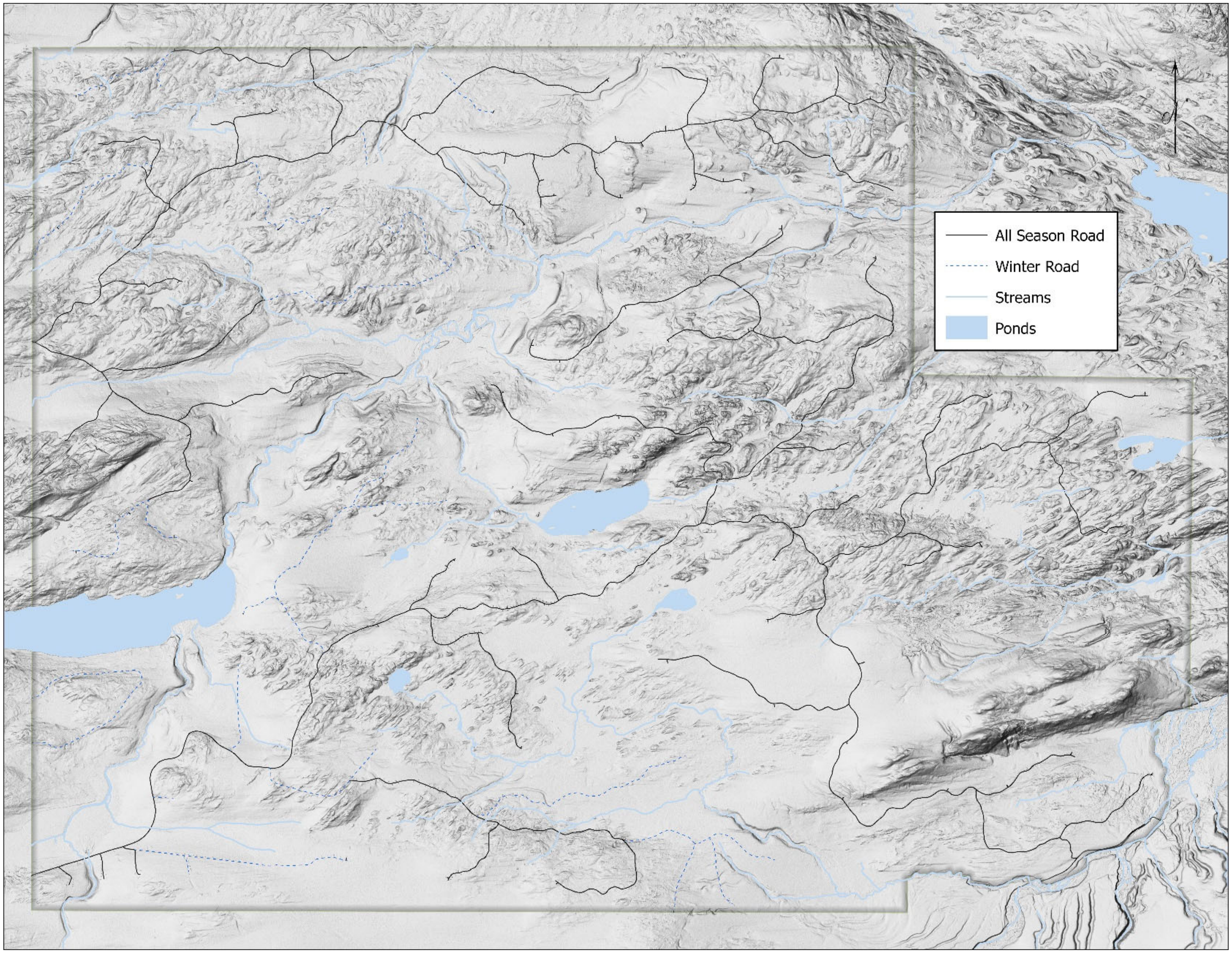
Habitats Identified by Inland Fisheries and Wildlife



Recreational Infrastructure



Hillshade Map



Forest Health Risks

Invasive plants and insect pests

Several species of concern to the health of the SFMA's health are described below. Additional plants, insects, and other taxa (e.g., fungi, non-insect invertebrates, mammals) may also pose significant threats to the SFMA.

Common reed (*Phragmites australis*)

Common reed is an invasive plant with a non-native strain that can grow aggressively and outcompete native vegetation in wetlands, shorelines, and other wetland habitats.[2] Three instances of common reed have been found in the SFMA. These sites should be addressed using an Integrated Pest Management approach in the next 10 years.

Spongy moth *(Lymantria dispar)*

Spongy moth (formerly named gypsy moth) is an invasive, non-native insect species that can cause significant defoliation and damage to trees and forests. Native to Europe and Asia, spongy moths were introduced to North America in the 1800's and have become a major pest.[3] While there are no known infestations in the SFMA currently, they pose a risk to our ecosystem and operations, and outbreaks have occurred in the SFMA in the recent past.

Emerald ash borer (*Agrilus planipennis*)

The emerald ash borer (EAB) is an invasive beetle species that poses a significant threat to all species of ash trees. Originating in Asia, EAB was first observed in North America in southeast Michigan in 2002. Since then, it has spread rapidly causing extensive damage to ash populations in the upper Midwest and northeast.[4] It was first observed in Maine in Aroostook and York counties in 2018 and has been spreading steadily since. We fully expect that it will eventually reach the SFMA. Limited control methods are available, but they are temporary and expensive, and most not feasible at large scales. Therefore, the SFMA will work to maintain overall forest health and biodiversity and continue to supply firewood to the Park, which supports a prohibition of firewood from outside of the Park. Additionally, large stands of ash in the SFMA will be mapped for potential seed saving and treatments that may become available.

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[2] Maine Department of Agriculture, Conservation & Forestry. (2019). *Common reed*. Maine Natural Areas Program, Invasive Plants, Common Reed. https://www.maine.gov/dacf/mnap/features/invasive_plants/phragmites.htm.
[3] Maine Department of Agriculture, Conservation & Forestry. (2021). *Lymantria dispar* (formerly gypsy moth) https://www.maine.gov/dacf/mfs/forest_health/documents/lymantria_dispar.pdf.
[4] Vermont Forest Health. (2021, April). *Ash management guidance for Forest Managers - Vermont*. vtforest.com. https://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Forest_Health/Library/Ash%20Management%20Guidance%20for%20Forest%20Managers.pdf

In the case of an infestation in the SFMA, any "lingering" ash—those individuals that survive EAB damage—should be identified, monitored and protected from other impacts.

Hemlock wooly adelgid (*Adelges tsugae)*

The hemlock woolly adelgid (HWA) is a small aphid-like insect that feeds *Tsuga* species including eastern hemlock, or *Tsuga canadensis.* It was introduced from Asia in the 1950s and has spread rapidly in North America. The eggs and crawlers are readily dispersed by wind, birds, deer and other mammals, including people, from March through July.[5] HWA has been confirmed in southern Maine and much of the southern quarter of the state is under quarantine. No known outbreaks have been detected in northern Maine, but the adelgid is spreading rapidly, and may be a concern in the coming 10 years. The most likely mode of transport into the SFMA will be recreational users in June and July. While there are methods to control HWA on ornamental trees, there is no effective control once an outbreak occurs in the industrial forests of Maine. Eastern hemlock is not a dominant species in the SFMA, and the SFMA is far north of the current range of HWA, which minimizes the current risk to the SFMA. Monitoring for outbreaks is recommended. No pre salvage harvest of hemlock is currently recommended.

Beech leaf disease

Beech leaf disease causes the decline and eventual mortality of *Fagus* species, including *Fagus grandifolia*, or American beech.[6] It was first recorded in Maine in 2021 in Lincolnville, and has since spread rapidly. It has been recorded as far north as Medway in 2023. There is currently little information on the disease and how to control it.

Spruce budworm (*Choristoneura fumiferana*)

Spruce budworm is a native insect that periodically undergoes population outbreaks, causing extensive defoliation of spruce and fir trees. Effective management of spruce budworm in forestry involves a combination of proactive measures to mitigate its impact and maintain forest health.[7] Below are key strategies that the SFMA is taking to mitigate the risks of spruce budworm.

- **Monitoring and Early Detection:**
    - Regularly monitor forest stands for signs of budworm infestation, such as defoliation, egg masses, and caterpillars.

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[5] Maine Department of Agriculture, Conservation & Forestry. (2010). *Adelges tsugae* (Annand) https://www.maine.gov/dacf/mfs/forest_health/insects/hemlock_woolly_adelgid_fact_sheet.htm
[6] USDA. (2022, March). Pest Alert Beech Leaf Disease. https://www.maine.gov/dacf/mfs/forest_health/downloads/US-Forest-Service-Pest-Alert-Beech-Leaf-Disease.pdf
[7] Maine Department of Agriculture, Conservation & Forestry. (2014). Spruce budworm in Maine. https://www.maine.gov/dacf/mfs/forest_health/insects/spruce_budworm_2014.htm.

- Utilize pheromone traps to monitor adult moth populations and assess potential outbreak conditions.

- **Silvicultural Practices:**
  - Promote forest diversity and resilience by managing for mixed species stands
  - Favor red spruce and white pine, which are less susceptible to budworm, over balsam fir, the preferred host of spruce budworm. Our silvicultural approach tends to remove developing fir in favor of spruce and pine in intermediate treatments, leaving a small percentage of the fir to reach mature stages of development
  - Create a mosaic of stand structures and compositions to promote and maintain diverse populations of bird species and other natural pest controls
  - Maintain a road system that allows managers to monitor, treat and salvage stands

- **Treatment.**
  - Apply approved insecticides, such as *Bacillus thuringiensis var. kurstaki* (Btk) or spinosad to manage outbreaks

Climate Change

Climate change increases uncertainty about future forest conditions. A changing climate will likely affect tree growth rates, mortality, disturbance patterns, distribution of tree species after disturbances, and regeneration success. Models suggest that we will experience shifts in the ranges of trees and other plants, animals, and pests. More frequent extreme weather events will lead to altered disturbance regimes and will necessitate adjustments in forest operations and planning. Decreased snow may result in increased abundance of ungulates such as white-tailed deer, necessitating adjustments in regeneration strategies. Management aimed at addressing these uncertainties must change over time with the best available science. The Northern Institute of Applied Climate Science (NIACS) provides the following adaptation strategies relevant to the SFMA.[8] Steps that the SFMA has or plans to take that align with these strategies are listed in italics.

Retention:

- Safeguard old-growth forests through reserve designation or preservation

[8] Swanston, Christopher W.; Janowiak, Maria K.; Brandt, Leslie A.; Butler, Patricia R.; Handler, Stephen D.; Shannon, P. Danielle; Derby Lewis, Abigail; Hall, Kimberly; Fahey, Robert T.; Scott, Lydia; Kerber, Angela; Miesbauer, Jason W.; Darling, Lindsay; Parker, Linda; St. Pierre, Matt. 2016. Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd ed. Gen. Tech. Rep. NRS-GTR-87-2. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 161 p. https://doi.org/10.2737/NRS-GTR-87-2

- *Ecological reserves and Frost Pond Forest*

- Maintain designated reserve areas
  - *Ecological reserves, unique areas, benchmark reserves*
- Preserve riparian corridors to link core regions and habitats
  - *Riparian Management Zones and the RMZ policy*
- Protect robust, mature trees during forest operations
  - *Retention harvesting, trail layout, timber marking, and legacy tree management*
- Retain survivors of disturbances, pests, or diseases
  - *See Legacies under Structural and Biological Diversity. Also refer to EAB management under Forest Health Assessment*
- Sustain unique, uncommon species
  - *See Legacies under Structural and Biological Diversity*
- Manage substantial woody debris with a focus on diversity
  - *Long rotations and morticulture. See Allowable Cut under Forest Product Sustainability. Also refer to Legacies under Structural and Biological Diversity*

Silviculture Approach:

- Apply silvicultural systems to regenerate native species, mimicking natural disturbances
  - *SFMA silviculture primarily focuses on mimicking natural disturbances. Also refer to the Allowable Cut under Forest Product Sustainability*
- Enrichment planting of preferred native species in human-altered areas
  - *Planting white pine and red spruce in areas where these species were lost due to human activity. Refer to Timber Management under Forest Product Sustainability*
- Facilitate regeneration using scarification or other methods
  - *Refer to Timber Management under Forest Product Sustainability*
- Maintain age diversity within forest types
  - *Refer to Timber Management under Forest Product Sustainability*

- Establish resilient species on sites vulnerable to heat and drought
    - *Enrichment planting of pine and oak. Retention of all oak until oak becomes a significant species in the SFMA. Refer to Timber Management under Forest Product Sustainability*
- Remove declining individuals
    - *Marking guidelines. Refer to Timber Management under Forest Product Sustainability*
- Use herbicide or mechanical thinning post-disturbance to speed site recovery
    - *Herbicide policy. Refer to Timber Management under Forest Product Sustainability*
- Thin crowded, stressed trees to reduce competition for resources
    - *Intermediate treatments including crop tree release, pre-commercial thinning, and commercial thinning. Refer to Timber Management under Forest Product Sustainability*

Wildfire

Since timber in the SFMA is both ecologically and economically valuable, a significant loss of timber due to fire would be detrimental. Thus, SFMA practices fire suppression in all wildfire events. For more information, refer to the Baxter State Park fire plan.

Forest Regeneration Failure

Shade-tolerant shrubs and small trees such as hobblebush (*Viburnum lantanoides*), striped maple (*Acer pensylvanicum*), and American beech (*Fagus grandifolia*) often grow densely under forest canopies, limiting the amount of sunlight that reaches the forest floor. This can prevent the growth of desirable tree seedlings. Moose over-browsing can cause extensive damage and even death to young trees, which similarly affects forest regeneration.[9] While we have little control over moose browse, we can control regeneration through silviculture and the treatment of competing vegetation. Areas that will benefit from the treatment of competing vegetation will be identified and some will be treated in the next ten years using both mechanical and chemical methods. The SFMA will use an Integrated Pest Management (IPM) approach encourage the regeneration of desirable timber species in areas challenged by existing regeneration failure.

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[9] Nyland, R. D., Bashant, A. L., Bohn, K. K., & Verostek, J. M. (2006). Interference to hardwood regeneration in northeastern North America: Controlling effects of American beech, striped maple, and hobblebush. *Northern Journal of Applied Forestry*, *23*(2), 122–132. https://doi.org/10.1093/njaf/23.2.122.

Protecting and Monitoring Natural Resources

Water Quality and Soils

Impacts to soil occur on any harvest operation. However, negative impacts can be minimized through appropriate planning and attention to site conditions. Key practices aimed at protecting soil productivity over the next 10 years include:

- Plan and locate skid trails to avoid potential problem areas. Restrict harvesting equipment to designated skid trails
- Operate in the appropriate season for the soil conditions
- Note areas where soil and drainage are particularly suitable for operations in wet weather conditions and operate in those areas when needed
- Utilize Geographic Information Systems (GIS) to identify potentially sensitive soils
- Inspect skid trails during harvest inspections with increased vigilance in high-risk areas
- Document trail conditions
- Document sequence of events leading to poor trail conditions and avoid operating after such sequences in the future. Create and implement a mitigation plan for trails in poor condition
- Maintain regular communications with the harvest contractors and their equipment operators
- Educate and monitor contractors in SFMA standards and implement appropriate Best Management Practices (BMPs)
- Close out trails with appropriate BMPs

Riparian Management Zones

Designated riparian management zones (RMZ’s) are regarded as "semi-protected" areas, where limited activities may be allowed if they contribute to the enhancement of water quality, wildlife habitat, and forest structure.

The overall goals guiding the management of these riparian zones encompass essential aspects such as water quality protection, wildlife habitat conservation and enhancement, and safeguarding plant communities and rare plant populations. To effectively achieve these goals, the SFMA adheres to a set of comprehensive management guidelines applicable to various water bodies, including streams, wetlands, ponds, lakes, and vernal pools.

Key principles of RMZs in the SFMA are:

- Avoid sedimentation of water bodies or disturbance of stream banks, shorelines, and soil within wetlands
- Minimize roads within mapped RMZs and next to water bodies and minimize road stream crossings
- Minimize skid trails within RMZs
- Implement Maine's water quality Best Management Practices (BMPs)
- Consider outcome-based options in exceptional cases where deviation from guidelines is necessary to improve the overall unit integrity or fulfill non-revenue-based objectives. Such deviations require a comprehensive plan drafted by a licensed forester and reviewed by a wildlife biologist or other expert for approval

For water bodies with mapped RMZs, specific management guidelines are applied to inner and outer management zones:

- Inner Management Zone (within 75 feet of the water body): maintain shade on watercourses, prevent cleared openings, and retain large trees
- Outer Management Zone (from 75 feet to the outer edge of the mapped RMZ): Maintain canopy cover, retain a well-distributed overstory, and plan canopy openings carefully

There are additional goals for lakes and ponds larger than 10 acres, such as maintaining a minimum number of super-canopy white pines per mile of shoreland for raptor habitat.

Wireless Sensor Network

Temperature probes are deployed to track water temperatures in streams from May to October and continuously monitor air and ground temperatures year-round. The main goal is to observe long-term changes in water, soil, and air temperature, influenced by factors like silvicultural practices, ecological shifts, and climate patterns. The water temperature data are sent to the Northeast Stream Temperature Database and used to model trout brook habitat in the region. This monitoring will continue through the planning period.

To view these data, refer to https://db.ecosheds.org/viewer

Wildlife

Management in the SFMA will continue to promote a diversity of wildlife habitats in all management actions. Examples of current practices include:

- Maintaining a diversity of tree and other plant species

- Maintaining or increasing spatial heterogeneity
- Morticulture
- Mapping of indicator and rare species
- Water temperature monitoring
- Maintaining significant mature softwood stands in the reserves and riparian zones
- Road layout that avoids stream crossings whenever possible
- Protecting vernal pools

Over the next 10 years, steps to improve habitat will also include:

- Improve fish passage in crossings where the stream is under $2ft^2$ in cross sectional area (as measured from the high-water mark) by increasing existing culvert sizes to manage at least a 25-year storm
- Improve fish passage in crossings where the stream greater than $2ft^2$ in cross sectional area (as measured from the high-water mark), by replacing existing culverts with bridges, arches, or box culverts designed to manage at least a 100-year storm
- Begin replacing culverts that have developed plunge pools
- Implement a retention policy intended to create old forest structure in areas needing added structure
- Consider treating landings as small patches of open or early successional habitat by seeding with native grasses and forbs post-harvest

Vernal Pools:

Several vernal pools have been identified, mapped, and protected in the SFMA. Special guidelines are in place for significant vernal pools, with the aim of preserving their habitat and the surrounding forest. Significant vernal pools, or those whose status is unknown, are managed as follows:

Vernal Pool Depression

- Identify and flag pool boundary and record location with GPS
- No equipment entry
- Do not disturb the pool or its bank with equipment, logging debris, or sediment

Within 100': Vernal Pool Protection Zone

- Harvest in frozen or dry condition, no rutting
- Maintain abundant coarse woody material
- Maintain a well-distributed average of 75% canopy cover

Within 400': Amphibian Life Zone

- Maintain an average of 50% canopy cover of trees >20ft in height
- Openings should be less than 1 acre (43,560 ft^2)
- Harvest in frozen or dry conditions
- Maintain or augment abundant large coarse woody material

Minor vernal pools are treated as significant vernal pools unless evidence indicates that use is minimal or infrequent.

Habitats Identified by the Department of Inland Fisheries and Wildlife

High priority native brook trout habitat:

- Hudson Pond
- Thissell Bog
- Multiple streams including:
    - Murphy Brook
    - Thissell Brook
    - Hudson Brook
    - North Branch Brayley Brook
    - South Branch Brayley Brook
    - Hinckley Brook
    - Boody Brook
    - Wadleigh Brook
    - Martin Brook
    - Webster Stream, and other unnamed streams.

See Habitat map in the maps section.

Ponds that meet the state's classification of great ponds and have at least a 250-foot buffer:

- Frost Pond
- Webster Lake
- Blunder Bog

- Lost Pond

Coastal rivers that have a 250-foot buffer:

- Webster Stream
- Trout Brook

No significant vernal pools, wildlife wetlands, shellfish areas, shorebird habitats, or presence of Atlantic salmon are recorded by IFW within the SFMA.

Wildlife Monitoring

A single day Canada lynx survey is performed each winter, as weather conditions and logistics allow. The results are sent to the Maine Department of Inland Fisheries and Wildlife. These surveys will continue through the next planning period, contingent on IFWs continued acceptance of the survey data results.

Endangered Species

On November 29, 2022, the U.S. Fish and Wildlife Service reclassified the northern long-eared bat (*Myotis septentrionalis)* as Endangered under the Endangered Species Act. In the summer of 2024, two acoustic monitoring sites were established. As of January 2025, there are no known occurrences of northern long-eared bat within the SFMA. The SFMA will perform additional acoustic monitoring and if northern long-eared bats are detected, a habitat management plan should be developed to manage any risk to this species or its habitat that may occur due to forest management activities.

Structural and Biological Forest Diversity

Biological Legacies

Biological legacies are the organisms, biological structures or biological patterns that remain following a disturbance such as a timber harvest. They create continuity between a pre disturbance site and a post disturbance site. When legacies are retained, the recovery period after a disturbance is reduced, and biological and structural diversity are higher when compared to a harvest where legacies are not retained to live out their lifecycle.[10]

Biological legacies are a key component in the SFMA's forest management. The retention of legacy trees and the encouragement of old forest characteristics are employed to maintain or improve structural and biological diversity while reducing the recovery time post-harvest. We manage for legacies as follows:

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[10] Palik, B. J., D'Amato, A. W., Franklin, J. F., & Johnson, K. N. (2021). *Ecological silviculture: Foundations and applications*. Waveland Press, Inc.

To provide beneficial wildlife habitat in timber harvest areas:

- All snags and cavity trees should remain standing unless they pose a danger to harvest operators or the public
- Maintain approximately 3 large stems $acre^{-1}$ as permanent legacy trees

In sites where old forest characteristics are desired or course woody debris is lacking:

- Maintain 12 large stems $acre^{-1}$ to live out their lifespan. Priority will be placed on long-lived species such as cedar, hemlock, maple, yellow birch, pine, spruce, beech, and oak. Such legacy trees should be identified, mapped, and painted before harvest
- Fell 1-2 canopy trees $acre^{-1}$ at each entry and retain them on site

Rare, Unusual, or culturally significant Forest Type Delineation

Management should strive to map regionally rare, unusual, or culturally significant forest types. Examples include:

- Northern white cedar woodlands
- Balsam poplar floodplain forest
- Brown ash swamp
- Silver maple floodplain forest

Forest Product Sustainability

Forest Inventory

Continuous Forest Inventory

In 1995, a systematic grid of 116 continuous forest inventory (CFI) points, each located a 1/5th of an acre plot, was established across the SFMA. These points, known as Permanent Sample Points (PSPs), are remeasured every 10 years (currently on an ongoing cycle, where about 10% of plots are measured each year).

CFI provides management with a reasonable representation of the processes and trends within the population (trees). It is important to note, however, that CFI is not designed to provide unbiased representations of what is present in the SFMA.[11]

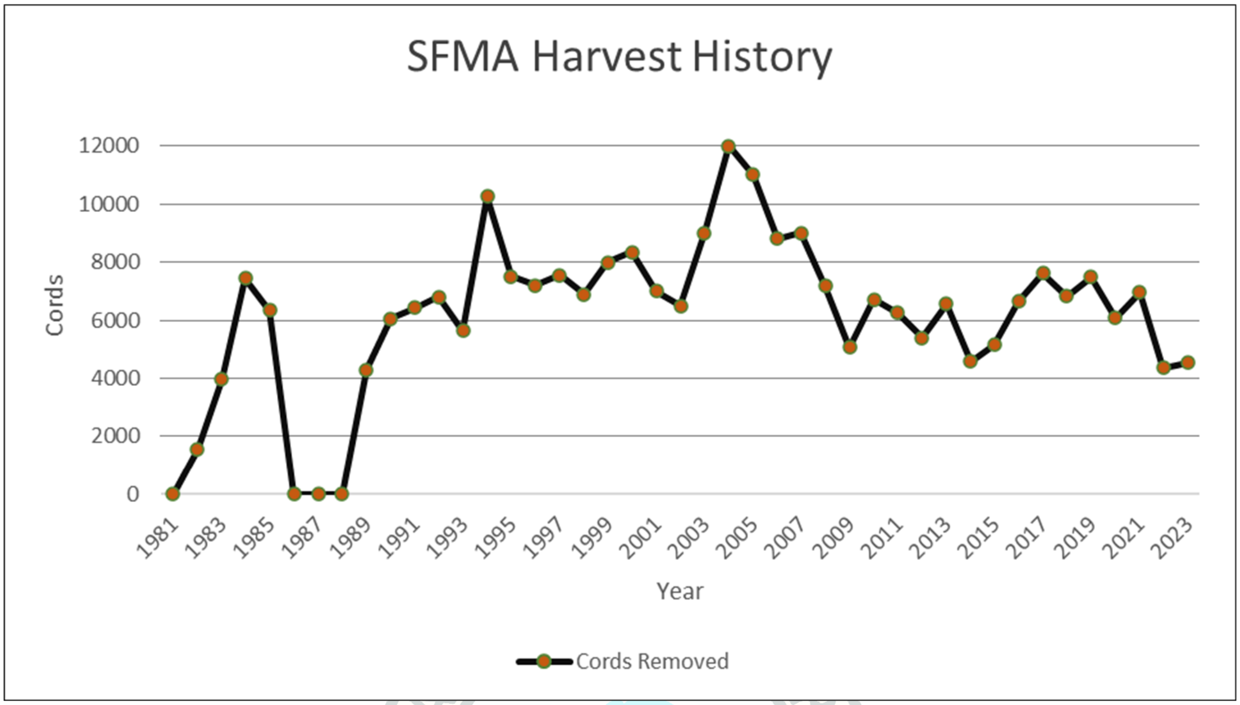
The PSPs in the SFMA are not protected from harvesting, and harvest activities are conducted without any bias around them. We measure the diameter at 4.5 feet (DBH), total tree height, crown ratio, and the condition and merchantability of each tree over 4.5 inches DBH within these plots. Additionally, we measure regeneration within nested 1/100th acre sub-plots. Finally, on three 30-meter transects, we measure coarse woody material.

CFI provides data on growth and mortality, which is then used to develop growth and yield models that guide our harvest rates. Separate traditional inventories are performed on a stand-by-stand basis to quantify population characteristics.

The SFMA established additional CFI points in Boody Bog, the 2013 tornado damage area, and Frost Pond Forest, which utilize different sampling protocols than the rest of the SFMA. These CFI points will not be repeated by SFMA staff in the next decade. However, we would welcome students to remeasure and analyze these CFI points as research projects.

[11] Iles, K. (2014). *A sampler of inventory topics: A practical discussion for resource samplers, concentrating on forest inventory techniques*. Kim Iles & Associates.

SFMA Harvest History



In 2010, SFMA models established an AAC of 5,605 cords every year for 50-70 years. After that, the harvest rates would increase to match the increased productivity due to active management. The net growth of the SFMA was estimated to be 6,300 cords year^{-1}. Current CFI analysis shows that the growth rate in the operational units is significantly higher than the 2010 estimate. Recent modeling indicates that net growth was approximately 8,000 cords year^{-1} in 2010. The same modeling indicates that net growth has since increased to over 9,000 cords year^{-1}.

Over the past decade, an average of 6,151 cords were harvested annually. Although this exceeds the intended AAC of 5,605 cords year^{-1}, it is still well below the net growth in the SFMA, making it sustainable. The average removal rate over the last 41 years was 6,353 cords year^{-1}. From the mid 90's to mid-2000's, the SFMA occasionally harvested above net growth. This was intentionally performed to capture the imminent mortality and remove low-quality, unhealthy trees. This harvesting improved the health and quality of the forest in the SFMA.

The objective set in 2010 was to increase the SFMA's stocking, over time, to approximately 25 cords acre^{-1} in the operational units. This required a harvest rate that is lower than the growth rate, achieved either by reducing the harvest, increasing the growth rate, or both. The target of 5,605 cords acre^{-1} year^{-1} removal, along with increased growth rates in managed stands has resulted in an increase in stocking to almost 27 cords acre^{-1}. An average standing volume of 27 cords acre^{-1} should be maintained and the following AAC calculations will work toward this goal.

Active management will likely further improve yields within the SFMA, making it possible to increase the removal rate while remaining sustainable. Within the coming decade, newly available Enhanced Forest Inventory (EFI) data, the fourth round of CFI, and intensified on-the-ground inventory will provide data that will allow us to further evaluate the timber removal rate and its effects on the growth and yield within the SFMA.

CFI Analysis:

CFI data collected between 2012 and 2021 were analyzed by Dr. Robert S. Seymour. Volumes were calculated using Honer's (1967) volume equation.

Stocking in the operational units in the SFMA is currently just under 27 cords acre^{-1}. Of this:

- 12 cords acre^{-1} are spruce/fir
- 6 cords acre^{-1} are tolerant hardwoods
- 4 cords acre^{-1} are intolerant hardwoods
- 3 cords acre^{-1} are pine/hemlock
- 2 cords acre^{-1} are wet site species

Stocking in the riparian units in SFMA is currently 32 cords acre^{-1}. Stocking in the reserve units in SFMA is currently 36 cords acre^{-1}.

Within the operational units, accretion is approximately 0.68 cords acre^{-1} year^{-1}. Ingrowth is approximately 0.14 cords acre^{-1} year^{-1}. Mortality is approximately 0.27 cords acre^{-1} year^{-1}. Therefore, net growth (accretion plus ingrowth minus mortality) in the operational units is approximately 0.54 cords acre^{-1} year^{-1}. This is up from 0.48 cords acre^{-1} year^{-1} as measured in the last CFI cycle, likely a result of active management. It is important to note that while net growth has increased, so has mortality. Capturing this mortality is one avenue that we could take to increase net growth. Therefore, the increase in mortality should be investigated.

Net growth in the riparian areas is 0.28 cords acre^{-1} year^{-1}. Net growth in the reserves is 0.46 cords acre^{-1} year^{-1}. Net growth in both the riparian units and the reserve units has dropped from 0.32 cords acre^{-1} year^{-1} and 0.50 cords acre^{-1} year^{-1}, respectively, since the last analysis.

Harvesting over the last decade was 93% of growth for spruce/fir, and 132% of growth for wet site species such as cedar. In contrast, harvesting was only 13% of growth for pine/hemlock, 19% for northern hardwoods, and 23% for intolerant hardwoods. While the harvest rate was only 0.33 cords acre^{-1} year^{-1}, which is well below growth rates for the previous decade, the harvest was not balanced. To ensure a more balanced removal of species groups, this management plan sets target volume removals for each species group in the allowable cut for the coming decade (see Annual Allowable Cut section below).

Standing Volume and Value in the SFMA

The SFMA contains approximately 788,837 cords of trees greater than 4.5” in diameter at breast height (4.5’). Of this, 492,957 cords are in the managed units, 144,605 cords are in riparian units, 77,543 cords are in the Benchmarks, and 73,730 cords are in reserves. This amounts to a net value (the value after the cost of cutting, yarding, hauling to markets, and toll has been removed) of over 23 million dollars in standing timber, in current dollars. At our current growth rate, the SFMA has the potential to grow an additional $440,996.00 of net value per year. Management aims to increase both the average standing volume and the net growth rate in the SFMA.

Annual Allowable Cut

The SFMA operates under an Annual Allowable Cut (AAC). An AAC is the maximum volume of timber that can be cut over a certain area of forest in a specified period, or AAC year. The SFMA AAC year begins on June 1st and runs through the end of May. The purpose of an AAC is to ensure that the harvest levels remain sustainable. There are different methods used to calculate an AAC, ranging from simple arithmetic to complex computer models. Some models are based on area, some on volume, and some are a combination of both. Currently, we use a method that considers both area and volume.

By using our knowledge of Maine's natural background disturbance rate combined with 28 years of Continuous Forest Inventory data, we can allocate areas for harvesting and estimate the volume retained and removed in each area during a given period. Through this method, we can ensure sustainable management and a stable timber supply.

The AAC for the next 10 years is as follows:

- A maximum volume of 7,098 cords year^{-1}
- Strive to limit regeneration harvests to 183 acres year^{-1}
- Strive to harvest a maximum of 2,800 cords of spruce/fir may be removed annually. Spruce will be favored for retention
- A maximum of 20 cords of cedar should be removed in annually
- Strive to harvest approximately 25% of the annual harvest should be tolerant hardwood
- Strive to harvest at least 300 cords of intolerant hardwood should be removed annually
- Approximately 10% of the annual harvest should be pine/hemlock

Markets and specific silvicultural needs may necessitate a deviation from these targets. As an example, hardwood pulp, aspen, and hemlock markets are generally poor in our area. This limits our silvicultural options in stands containing a significant percentage of these trees. In a year where hardwood pulp markets are favorable, it would be prudent to treat additional stands with a significant hardwood pulp component. These harvests would allocate space for better formed, more vigorous trees, thereby improving the overall quality of the stand. Therefore, a deviation in the overall AAC will be allowed. However, the overall average removal rate for the next 10 years should be within 10% the AAC outlined in this plan. Management will strive for an even flow of timber and ensure that the average over 10 years to fall within these targets. At the time of this writing, spruce budworm is on the rise in Maine. Salvage from spruce budworm damage should not be limited to 2,800 cords per year. If management sees fit to increase the volume removed in a specific year, they will notify the BSP Authority and the SFMA Advisory. To review how the AAC has been calculated, refer to Appendix B.

Timber Management

Summary

A substantial proportion of the SFMA's forest is recently regenerated and up to 40 years old or over 100 years old. While moving toward a more age balanced forest we also aim to improve the quality and potential of existing growing stock, capture imminent mortality, continue developing a mix of age classes by releasing established regeneration and establishing additional regeneration, and maintain or slightly increase current stocking levels.

To achieve our timber management goals, each management unit (or block) undergoes an assessment that informs a tailored silvicultural plan. The silvicultural plan is developed based on factors including overstory species mix, structure, regeneration status, competition, operational feasibility, neighboring units, wildlife impact, hydrology, and soils. This action plan is recorded in a permanent record known as a Block Narrative.

The silvicultural plan may include any combination of treatments including, but not limited to, pre-commercial thinning, planting, scarification, herbicide treatment, crop tree release, commercial thinning, and regeneration harvests.

Non-Commercial Treatments

Pre-Commercial Thinning (PCT)

Pre-commercial thinning is the removal of trees prior to merchantability with the intention of allocating resources to the remaining trees. PCT greatly increases the growth rate and quality of the retained trees. It also allows management to manipulate the species composition and quality of the trees in the stand. Furthermore, it reduces the rotation length, allowing for commercial entries decades before stands that have not been thinned. However, PCT will not necessarily maximize net present value when compared to untreated stands.[12] Nonetheless, we believe that the improved stand composition and individual tree quality, along with the shorter rotation and improved operational efficiency warrant the investment in PCT. Many stands in the SFMA would

[12] Wagle, Bishnu H. Mr., "Long-term Influence of Commercial Thinning on Spruce-Fir Forests" (2023). Electronic Theses and Dissertations. 3870. https://digitalcommons.library.umaine.edu/etd/3870

benefit from pre-commercial thinning and in the summer of 2023, the first large-scale pre-commercial thinning effort took place, treating approximately 200 acres. An additional 100 acres were treated in 2024. Our goal is to treat at least 1,000 additional acres of young spruce/fir over the next ten years. We will also evaluate how many additional acres would benefit from PCT and perform a cost benefit analysis. Therefore, PCT efforts may increase beyond what is detailed in this plan.

Planting

To date, the SFMA has relied almost exclusively on natural regeneration. Over the next 10 years, enrichment planting may be used to enhance the composition and structure of a forest by strategically planting additional trees or species into existing stands. The goal of enrichment planting is to increase diversity, improve overall health and productivity, and promote a more resilient forest ecosystem.[13] This technique may be applied in stands that have undergone human-induced disturbances, leading to a lack of tree species that are well-suited to the site or as a climate-adaptive practice.

Herbicides

Herbicides may be used to effectively control undesirable native and invasive plant species. Silvicultural systems utilized in the SFMA aim to promote desirable regeneration and thus avoid the need for herbicide treatment to successfully establish stands. However, occasionally herbicide treatment is warranted to control competition to successfully regenerate diverse and merchantable stands. [14] During the next ten years, the SFMA will work to identify and use herbicides to treat areas that are failing to regenerate.

Other Timber Stand Improvement (TSI)

The SFMA should increase the use of Timber Stand Improvement such as crop tree release, weeding, and cleaning. The goal is to identify and apply TSI treatments on approximately 50 acres year^{-1}.

Commercial Treatments

Winter operations will be performed primarily in compartments 1, 2, 3, 6, 9, and 11.

Summer operations will be performed primarily in compartments 7, 8, 10, 11, 12.

[13] Mina M, Messier C, Duveneck MJ, Fortin MJ, Aquilué N. Managing for the unexpected: Building resilient forest landscapes to cope with global change. Glob Chang Biol. 2022 Jul;28(14):4323-4341. doi: 10.1111/gcb.16197. Epub 2022 Apr 25. PMID: 35429213; PMCID: PMC9541346.

[14] Nyland, R. D., Bashant, A. L., Bohn, K. K., & Verostek, J. M. (2006). Interference to hardwood regeneration in northeastern North America: Controlling effects of American beech, striped maple, and hobblebush. *Northern Journal of Applied Forestry*, *23*(2), 122–132. https://doi.org/10.1093/njaf/23.2.122

Over the next 10 years, we aim to treat approximately 6,120 acres. Of this, approximately 1,200 acres will be regeneration harvests and around 5,000 acres will be tending treatments.

Many SFMA management units, particularly those established in the 1980s, are ready for commercial thinning. Thinning is generally performed to improve the growth rate and quality of the trees in the residual stand and may increase net growth in a stand through capturing mortality. However, it can also be used to increase spatial variability and speed the development of habitat and biological diversity in young stands.[15] During the next ten years, management units in compartments 1, 2, and 7 will be treated to increase spatial heterogeneity and improve growth rates.

Harvest Site Preparation

To ensure the silvicultural plan is successful, harvest areas are prepared as follows:

Timber Marking

The SFMA will increase its tree-marking efforts over the coming decade. Marking is a process where forest managers identify and mark which individual trees to remove and which trees to leave. This allows for increased control over the size, health, and form of the remaining trees in the stand.

Low-quality or unhealthy trees are prioritized for removal. This includes trees that are at an elevated risk of dying, those that are highly defective, and those with poor form. However, some may be retained as legacy or wildlife trees. The crown position and species composition of the residual stand are also considered, along with market conditions.

The goal of marking is to control light levels and the overall health of the stand by removing and/or preserving specific individuals. After the harvest, the stand should be noticeably improved from a forest health standpoint. All these decisions are made quickly on the ground, and tree marking greatly affects the outcome of a harvest operation by improving operator efficiency and promoting sustainable forestry management practices.

Layout

All harvest sites in the SFMA will be laid out on the ground with ribbon. In addition, trails will be laid out in some harvest sites if it is deemed necessary to reduce the impact of machinery on both the trees and soils and/or improve the efficiency of the operator.

[15] Palik, B. J., D'Amato, A. W., Franklin, J. F., & Johnson, K. N. (2021). *Ecological silviculture: Foundations and applications*. Waveland Press, Inc.

Scientific Forest Management Area Administration

Short-Term Planning

During the next 10 years, short-term planning will be improved in the SFMA. This will involve the development of a three-year plan and corresponding annual plans that are updated monthly.

Three-Year Plan

The Operations Plan will encompass a comprehensive three-year plan, formulated with a focus on specific areas and stands. This three-year plan is intended to align with volume targets established through inventory assessments and modeling with removals. Flexibility is a key feature of this plan, enabling adaptive responses to evolving weather conditions, stand status, and market dynamics.

Annual Plan

The annual plan will provide a breakdown of specific volumes, prescriptions, and designated harvest areas. This will include maps and financial projections.

Finances

10-year Revenue

Based on CFI and AAC, the timber value from the periodic harvest, before maintenance expenses, can be estimated as follows:

At 7,098cd yr^{-1}, with an average net of \$35cd^{-1}

- $248,430.00 annually

Timber revenue over the 10-year period, adjusting up 3% $year^{-1}$:

- $2,847,971.54

This value does not account for fixed maintenance expenses.

Maintenance Expenses

Estimated maintenance expenses, including pre-commercial silvicultural treatments for the next 10 years (adjusted for 3% inflation):

Annual Expenses

- $218,537.00

Maintenance expenses over the 10-year period, adjusting up 3% year^{-1}:

- $2,505,281.79

SFMA and Baxter State Park

The SFMA aims to be self-funded and not place an undue burden on the Park. However, since the SFMA shares the Parks recreational and preservation goals (though not wilderness preservation), much of the overhead for the SFMA is paid by the Park (e.g., SFMA staff salaries, trail and building maintenance costs). Since the SFMA has been actively managed by the Park, it has consistently provided some annual revenue to the Park to aid in its management. Recently, about 3% of the Park operating budget comes from the SFMA. However, inflation and poor markets have impacted revenue in the SFMA. Going forward, steps must be taken to maximize revenue while minimizing expenses.

In addition to direct fund transfers, a significant percentage of the wood used in construction and maintenance within the Park comes from the SFMA. These materials are used in the construction of approximately 4 lean-tos, 150 to 200 pieces of 8' bog bridging and sills, and 2-to-4-foot bridges year^{-1}. Furthermore, all of Baxter State Park's firewood comes from the SFMA. Finally, wood for special projects, such as the Daicey Pond Cabin rehabilitation comes from the SFMA. The annual product value and savings the SFMA provides to Baxter State Park is estimated below.

Average SFMA product value (not realized): $47,015.00 annually

- Softwood sawlog: $12,640.00
- 250 cords of firewood: $34,375.00

Average BSP product savings (not purchased): $62,277.00 annually

- Sawlogs: at an average wholesale price of $0.45/bdft would cost $17,277.00 annually
- Firewood: at an average of $180.00/cord would cost $45,000.00 annually

Timber Markets

SFMA staff negotiate with mills and forecast delivered volumes for each seasonal harvest. In 2022 and 2023 SFMA wood buyers included:

- Daaquam: Spruce and fir sawlogs
- D&G: Spruce, fir, and pine sawlogs
- Pleasant River Lumber: Spruce and fir sawlogs and studwood

- Ward Clapboard: Red spruce clapboard logs
- Bourgeois guitar: Red spruce tonewood
- Lumbra Hardwoods: Hardwood sawlogs
- Columbia Forest Products: Veneer logs
- Lie-Nielsen Toolworks: Hop hornbeam sawlogs
- Sappi Paper: Hardwood pulp
- Hardwood Products: Hardwood sawlogs
- Gardner Chip: Hardwood pulp
- Treeline: Hemlock
- Ruff Cutters: Firewood and softwood sawlogs

Due to the changing nature of wood markets, this list is constantly evolving.

Contractors

Harvest:

The SFMA is currently in contract negotiations with Acadian Timber as of March 2025. A new contract is expected in May 2025.

We also contract with Brent Chadbourne to provide cable skidder/chainsaw harvesting.

Over the next 10 years, we will aim to bring other harvest contractors into the SFMA to diversify our workforce and consider other ways to maximize the stability and continuity of harvest operations.

Other Forestry Services

Horizon Forestry Services provides pre-commercial thinning services. In the coming 10 years we may seek additional services from Horizon Forestry or similar contractors including planting and other silvicultural treatments.

Equipment

The SFMA will consider the purchase of equipment to ensure our silvicultural goals are met efficiently. This will include equipment to perform TSI, herbicide treatments, harvesting, trucking, and plowing.

Timber Security

Beginning in 2024, the SFMA shall adopt a timber security policy that includes the following components:

Ticket and Loader Book Policy

- **Distribution of Ticket Books**

Ticket books will be provided to contractors at the commencement of the harvest year. All ticket numbers are recorded in the office.

- **Documentation for Wood Loads**

Every load of wood from the landing to the mill must be accompanied by a completed and signed ticket. In cases of split loads, a ticket for each product within the load is mandatory, as are accompanying separate weight scale slips.

- **Ticket Book Usage**

Ticket books are to be filled out exclusively on the landing and should not be in transit with the wood, except in the case of self-loading trucks.

- **Load Identification**

Each load is to have “BSP” (Baxter State Park), and the Management Unit Number painted on the back before leaving the woods.

- **Ticket Submission**

Tickets with a legible mill weight scale for the wood that is trucked are sent to the Baxter State Park office on a weekly basis.

- **Submission of Empty and Voided Tickets**

Empty ticket books, as well as voided and damaged tickets, are submitted to the Baxter State Park office on a weekly basis.

- **Return of Unused Tickets**

Unused tickets and books are to be returned within two weeks following the completion of the year's trucking.

- **Loader Books Distribution**

Loader books will be provided to contractors prior to the commencement of the harvest year.

- **Data Entry and Verification**

All necessary ticket and load information must be recorded in the Loader Sheet prior to each load leaving from the landing. These sheets must be signed by the loader operator before being sent to the Baxter State Park Office.

- **Spot Check Procedure**

A licensed forester will conduct random spot checks on loader books and trip tickets to ensure the proper documentation of loads. The duplicate ticket and loader book will be signed by the forester during these spot checks.

Demonstration and Scientific Knowledge

Demonstration & Supporting Research

Percival Baxter emphasized that one of the primary objectives of the SFMA is to showcase scientific approach to forest management. To achieve this, SFMA management aims to meticulously plan and execute every aspect of forest management, maintaining detailed records for each action. Furthermore, the SFMA collaborates with researchers to advance forest management science and is a member of the Cooperative Forestry Research Unit. It's important to note that SFMA will never be sold, and all management activities will follow the same philosophy. This approach will result in long-term monitoring and records that are unparalleled in the industry. These records include comprehensive silvicultural plans, CFI, and other essential data. They are highly valuable as they allow us to track the impact of human activities on forests over longer timespans than at most other managed sites. As we contend with climate change, this approach will only become more important. Although they currently still only document a relatively short timeframe in the life of a forest, these records will grow over time, and their significance will only increase.

Over the next 10 years, increased efforts should be made in the following areas:

- Work to develop a long-term research project by partnering with the Cooperative Forestry Research Unit

- Construct interpretive signage describing silvicultural treatments along the Wadleigh Mountain Road and Brayley Brook Road, and maintain the existing Forestry Interpretive Trail along the Park Tote Road

- Make the SFMA CFI data publicly available

- Begin developing workshops for advanced silviculture and operations in sensitive sites

SFMA staff will also continue to provide tours of the SFMA to Park staff and other interested groups and will seek opportunities to demonstrate our operations and share knowledge with colleagues in the forestry industry.

The SFMA is situated in the traditional territories of the Wabanaki Nations. We hope that the SFMA's science-driven management will benefit from learning and collaboration with Wabanaki Nations in the future.

Staff Training

To ensure management aligns with the most up to date science, staff must continue training in addition to the minimum required to maintain Maine foresters' licenses. Examples of training include:

- New England Society of American Foresters meetings
- New England Council of Forest Engineering meetings
- Cooperative Forest Research Unit Field Workshops
- Maine Forest Service Workshops
- Maine Agricultural Trade Show Herbicide training
- Advanced coursework in silviculture, biometrics, and forest operations

Public Access and Aesthetics

Recreational Opportunities

Recreation is a vital part of SFMA management planning. In the next decade, SFMA will continue to maintain road access to enable various recreational activities including hunting, fishing, trapping, hiking, paddling, mountain biking and camping. SFMA staff will collaborate with other Park staff to ensure that recreational trails and facilities are well-maintained and accessible.

Current recreational opportunities in the SFMA include:

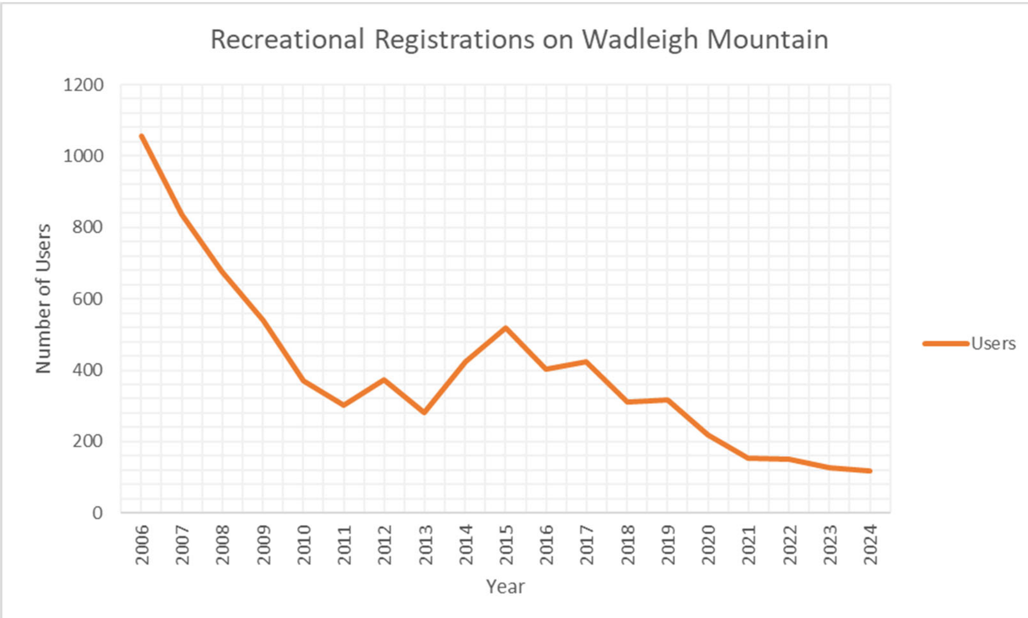
- 29 miles of hiking trails
- 3 camp sites on three ponds, including Webster Lake, Frost Pond, and Hudson Pond

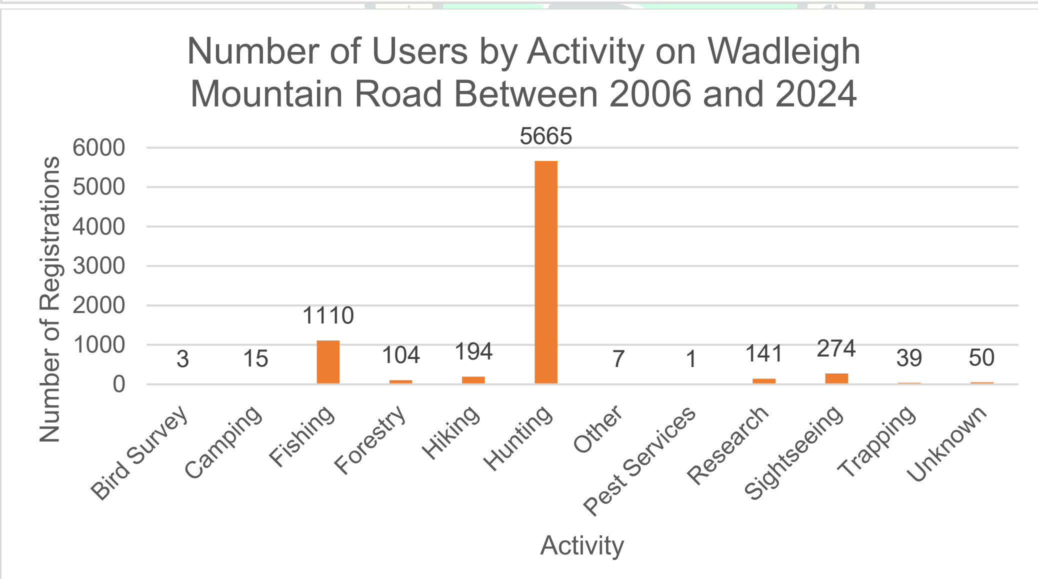
According to SFMA records, recreational use has declined steadily in this part of the Park since 2006. This trend seems to be driven largely by reduced hunter and angler use. We currently do not have sufficient data to explain this trend.

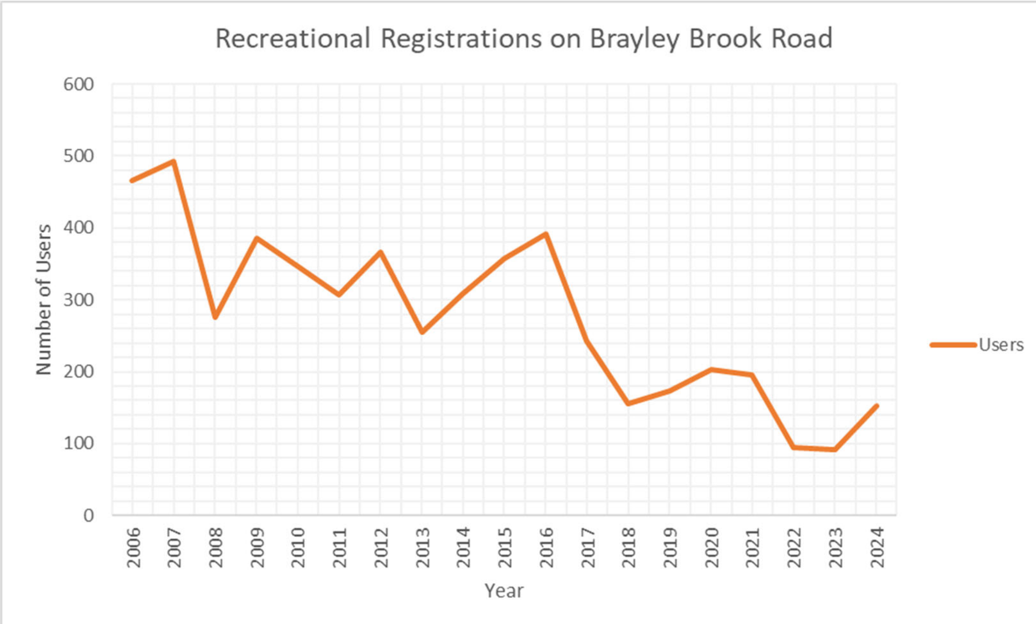
Hiking and camping use increased in 2020, 2021, and 2022 and has remained slightly elevated. This aligns with the trends we have seen parkwide.

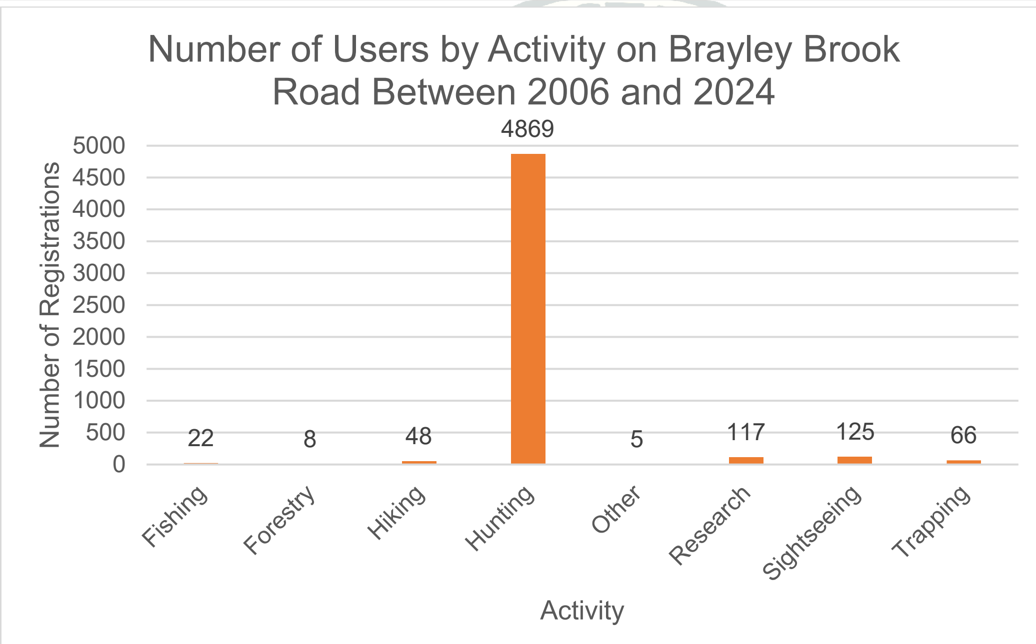
Over the next 10 years we will continue to monitor these trends and consider options that may increase or improve recreational opportunities in the SFMA.

Gate Registration Data

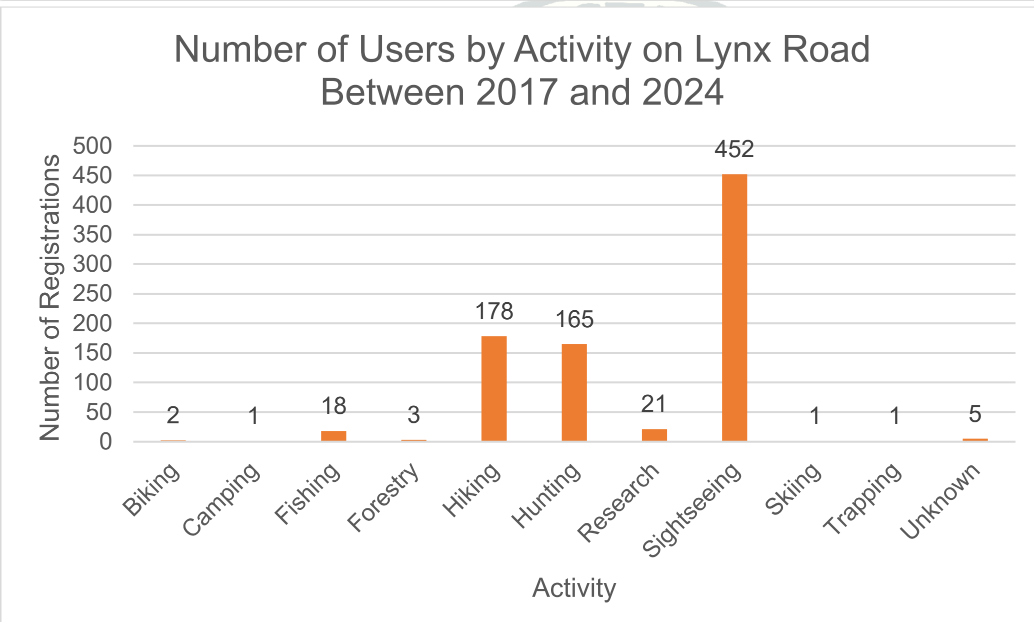




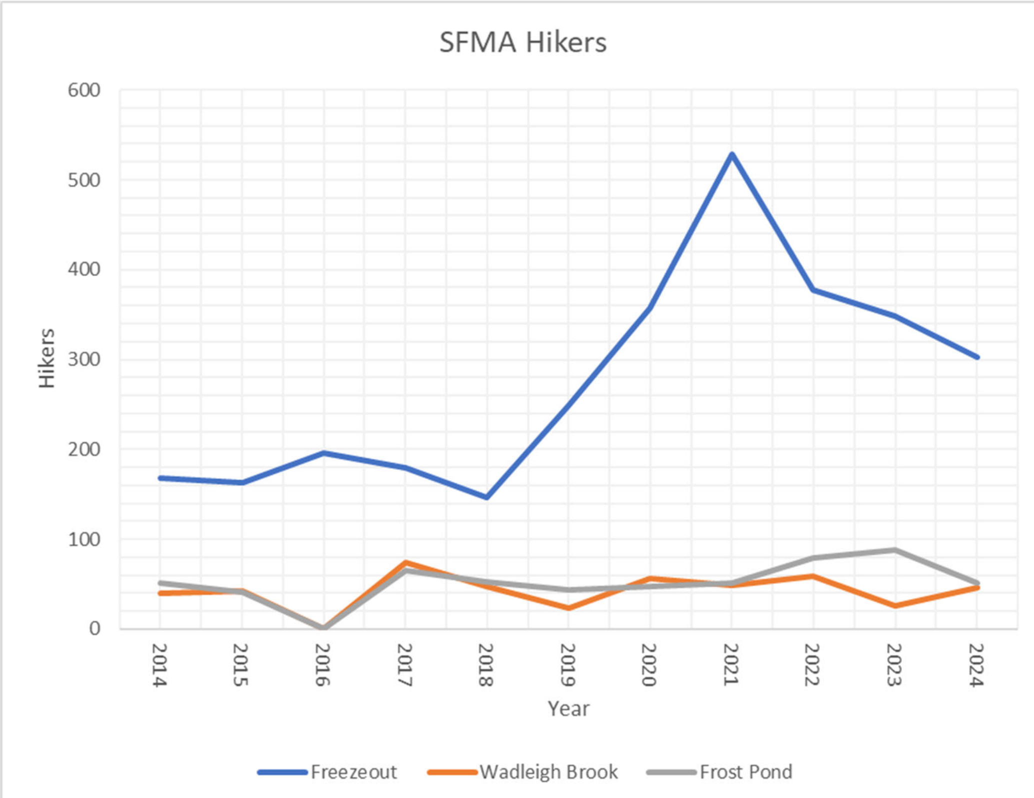

Recreational Registrations on Brayley Brook Road
Number of Users
600
500
400
300
200
100
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
Users


Number of Users by Activity on Brayley Brook Road Between 2006 and 2024
Number of Registrations
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
22
8
48
4869
5
117
125
66
Fishing
Forestry
Hiking
Hunting
Other
Research
Sightseeing
Trapping
Activity

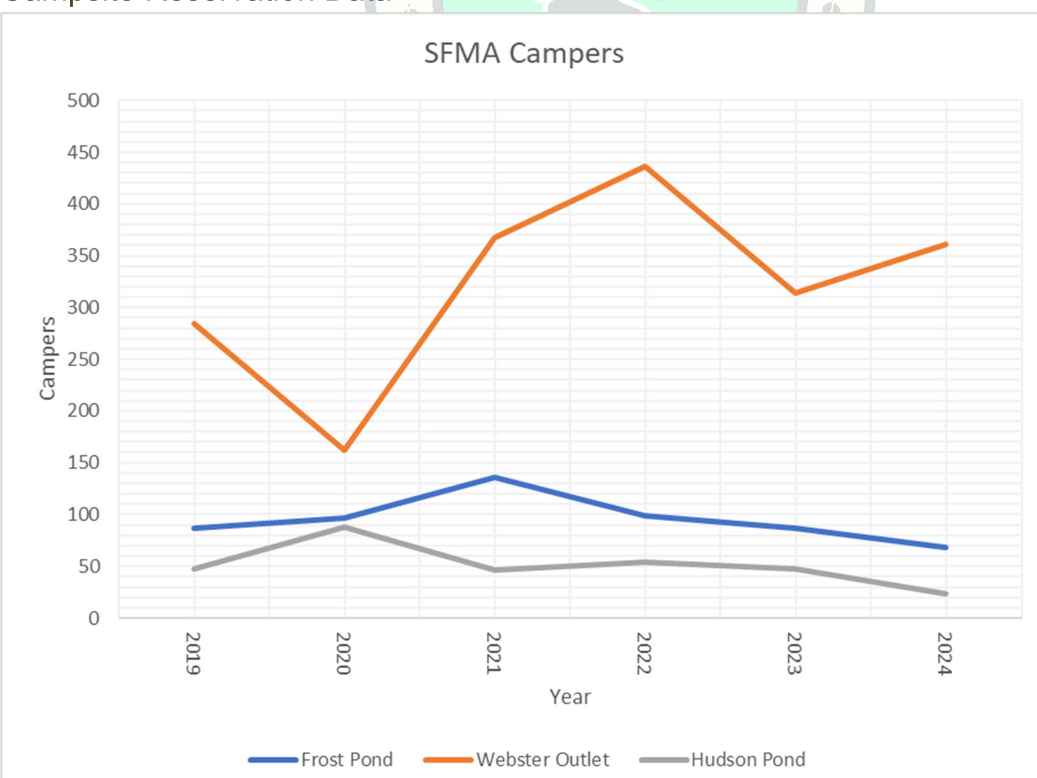

Recreational Registrations on Lynx Road
180
160
140
120
100
80
60
40
20
0
Number of Users
2017
2018
2019
2020
2021
2022
2023
2024
Year
Users


Number of Users by Activity on Lynx Road
Between 2017 and 2024
500
450
400
350
300
250
200
150
100
50
0
Number of Registrations
2
1
18
3
178
165
21
452
1
1
5
Biking
Camping
Fishing
Forestry
Hiking
Hunting
Research
Sightseeing
Skiing
Trapping
Unknown
Activity

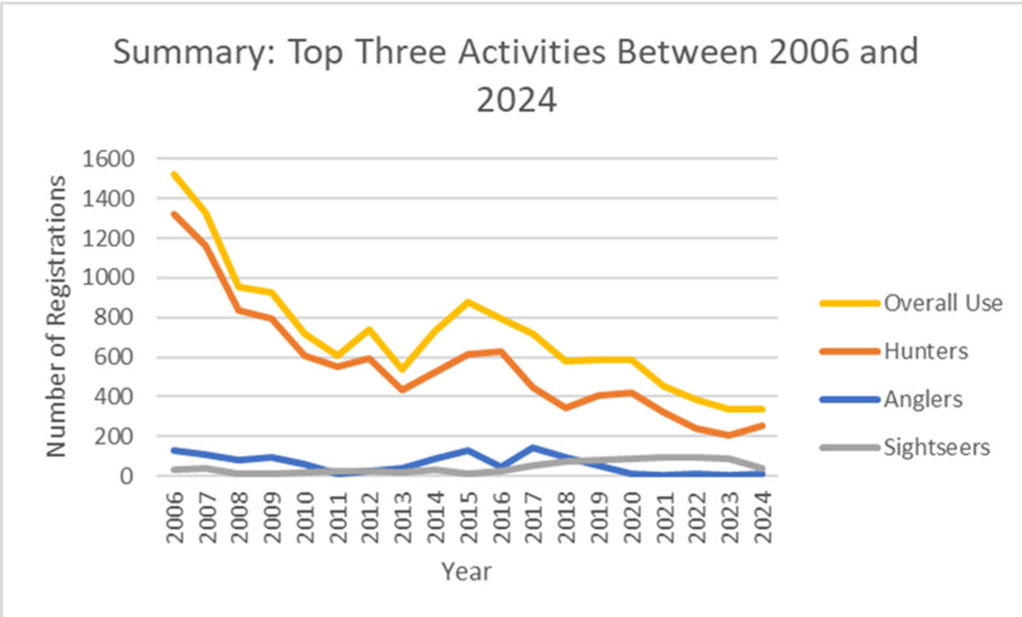
Trail Registration Data



Campsite Reservation Data



Summary



Aesthetic Quality

Aesthetic quality is managed at both the forest and local scales.

At the forest scale we aim to retain the aesthetic appeal of forested habitats and individual trees.

- Develop and maintain a mosaic of age classes and forest structures
- Utilize uneven aged silviculture where appropriate
- Retain significant legacies
- Utilize long rotations, often exceeding 100 years

At the local scale we aim to minimize the visual impacts of work areas and infrastructure.

- Yards and Skid Trails
    - Operate in appropriate weather conditions to avoid yard/trail degradation
    - Sort and pile wood products neatly and safely
    - Avoid cutting large landings and use one or two well-maintained skid trails to access landings when they are necessary
    - Revegetate using best-known methods

- Where needed, start remedial site work immediately upon completion, and clean woody debris from yards
- Remove equipment and any temporary infrastructure promptly

- Roads
  - Curves in the road reduce visual penetration by avoiding long, straight sections of road
  - Shape areas of exposed soil and use appropriate stabilization methods
  - Minimize damage to roads by operating in appropriate conditions
  - Remove maintenance debris (e.g., from old bridges and culverts) and dispose of properly

Infrastructure Projects

Buildings

The SFMA does not currently have enough housing in either the north or south end camps to support harvest contractors, staff, interns, and the occasional researchers. Over the next ten years, options should be explored to increase the housing available to crews and staff to ensure forest operations are well supported. In addition, the following maintenance will be performed with the support of Park maintenance staff:

- Replace the single wall fuel tank at the North End Camp
- Replace the pavilion roofs at Halfway Brook and Blunder Bog
- Insulate the large camp at Hemlock Camps
- Replace the shed roofs at Hemlock Camps
- Replace the roof at Webster Camp
- Paint all the camps

Road Construction and Maintenance

Construction

The SFMA will consider constructing a road that will create better access to wood markets north of the Park.

Road Maintenance

The following schedule is recommended over the next 10 years:

- **Mowing:** Main haul roads are mowed on a 5-year cycle (7 miles/year). Spur roads are mowed or opened as needed.
- **Brushing:** Annual roadside brushing of 1 mile.
- **Ditching:** Approximately 0.5 mile of ditching annually
- **Grading:** Grade roads as needed to allow for efficient trucking and to protect water quality.
- **Road Surfacing:** 200 feet of spot graveling annually.
- **Culverts:** Regular maintenance and replacement of about 10 culverts/year, as needed. Stream culverts are sized at 3.5 times the cross-sectional area. In the case where a culvert would exceed 3 feet in diameter, it will be replaced with a box culvert or bridge designed to pass the flow of a 100-year storm at a minimum. All cross drains should be 18" in diameter or larger, if possible.
- **Bridges:** Inspect bridges throughout the SFMA's road system every other year. Upgrades for Hudson Pond and Hinckley Brook bridges began in 2023. The North Branch of Murphy Brook bridge was replaced in 2024. The Halfway Brook bridge was rebuilt in 2024 as well. Thissell Brook crossing will be evaluated for replacement in the future.

Gravel

Gravel resources are limited in the SFMA. Three active ledge pits are available for road management. Additional resources should be located and developed over the next 10 years.

Boundary Line Maintenance

The Thirty-two miles of SFMA boundary line are maintained on a ten-year cycle. Therefore, 8 miles will be brushed, blazed, and painted every 3 years. Three and six tenths (3.6) miles of this line have not been refreshed in decades. It is an internal line between T6R10 and Trout Brook. Evidence will be challenging to locate and even though this line is not shared with an adjacent landowner, it should be located and refreshed in the next 10 years as we will be harvesting near the line in the next planning period.

Appendix

Appendix A: Rotation and Desired Future Condition

The biological rotation age, or the rotation age that maximizes the mean annual increment (MAI), of the SFMA was estimated to be approximately 80 years. In other words, maximum sustainable volume yield over multiple rotations is achieved at a rotation of approximately 80 years. The financial rotation age, which maximizes financial returns and is generally much shorter than the biological rotation age, of the SFMA will not been considered since it would not yield the ecological or social benefits desired by SFMA management. In the 1990's, an extended rotation age was adopted by SFMA managers. An extended rotation sacrifices financial returns and volume yield for ecological and social benefits. The 1998 Forest Management Plan called for an extended rotation of 140 years. This decision represents the SFMA's commitment to managing for long term ecological goals such as old forest structure and the biodiversity that comes along with it. This is not to say that management on the ground will necessarily follow a 140-year rotation. A forest is made up of many individual stands, and the individual site and species being managed will dictate the silvicultural plan. For example, a stand managed for aspen may have a 50-year rotation, while a stand managed for sugar maple may have a rotation of 150 years or more. Additionally, managers in the SFMA designate significant legacy trees to actively create old forest structure.

In 2012, SFMA management set a goal of keeping approximately 2/3 of the operational units in the SFMA under even aged management. The remaining 1/3 would be managed utilizing classical uneven aged methods. Of the even aged area, approximately ½ was to be managed under a uniform shelterwood system, with the remainder using various other even aged methods. The increasing use of irregular shelterwood systems has blurred the lines between even aged management and uneven aged management. In fact, what we consider even aged management generally contains enough legacy trees and future crop trees that it is hard to say a stand is ever fully replaced. Additionally, significantly more than 1/3 of the SFMA is moving to uneven aged management, albeit not necessarily classical uneven aged management.

Traditional forest management often aims to achieve a balanced forest. In a balanced forest, each age class occupies the same proportion of the forested area. The goal is to produce a sustained supply of timber. This is a major part of what is known as the normal forest concept. The normal forest concept was one of the significant steps toward sustainable forest management in western culture. It is not without its limitations, however. First, it is much easier to implement in even aged plantations since you know the age of the trees in each stand. In naturally regenerated, multiage stands, it becomes much more complicated. In these cases, tree size, which is much easier to measure than tree age, is most often used as a surrogate for age. Every forester knows that tree size and tree age are not linearly correlated. Many factors determine how fast or large a tree grows, including site quality, species, genetics, past management, and even luck. Additionally, the normal forest concept assumes equal increment, or growth, across the forest. This is never the case. Soils, aspect, and elevation, among many other factors, affect growth. Finally, it assumes ideal stocking. Market challenges, accessibility, and natural factors such as fire, spruce budworm, and wind events can result in stands that are either overstocked or understocked in any point in time. In short, biological systems are complicated. However, the normal forest concept, and the calculations used to attempt to balance a forest, do provide a useful benchmark for managers. While a truly balanced forest is not the goal of the SFMA, and likely could never be achieved anyway, management should strive to bring the SFMA closer to a balanced state over time.

The following calculations are used to calculate normal growing stock, of the volume of growing stock in a theoretically balanced, normal forest. These numbers provide insight and help guide management and are used in future calculations. Note that the numbers below have been rounded, and therefore may not calculate exactly as shown.

Normal growing stock in the SFMA is determined as follows.

In a theoretically balanced forest with a 140-year rotation and a 10-year growing period, you would have fourteen 1,310-acre age classes.

$$\frac{140\ years}{10 - year\ period} = 14\ periods$$

$$\frac{18{,}346\ acres}{14\ periods} = 1{,}310\ acres\ period^{-1}$$

With a 0.54 cords $acre^{-1}$ $year^{-1}$ growth rate, each period would grow approximately 5.4 cords $acre^{-1}$ over 10 years:

$$0.54\ cords\ acre^{-1}\ year^{-1} * 10\ years = 5.4\ cords\ acre^{-1}$$

Therefore, a 1,310-acre age class would grow 7,074 cords $period^{-1}$:

$$1{,}310\ acres * 5.4\ cords\ acre^{-1} = 7{,}074\ cords$$

A summation formula is used to determine the theoretical volume of a fully regulated forest without thinning:

$$Gr = (V_n + V_{2n} + V_{3n} \ldots + V_{r-n} + \frac{V_r}{2})$$

Where:
G_r=Total volume of growing stock on r acres
V_n= Calculated volume at n period, or 7,074 cords/ period
r= Period length in years and total number of acres

1990 marks the end of period 1 (assuming the 140-year rotation began in 1980 along with active management in the SFMA). If we break the SFMA up into 14, ten-year periods, we will regenerate 1,310 acres period^{-1}. Therefore, we would have 14 age classes made up of 1,310 acres each. We can use this information, along with net growth derived from our CFI to provide an estimate of volume, by age class, for a theoretically balanced SFMA. The following table shows the theoretical stocking for each period:

Period	Year	Growth/ac/period (cords)	Acres to regenerate /period	Total Cords
1	1990	5	1310	7076
2	2000	11	1310	14153
3	2010	16	1310	21229
4	2020	22	1310	28305
5	2030	27	1310	35382
6	2040	32	1310	42458
7	2050	38	1310	49534
8	2060	43	1310	56611
9	2070	49	1310	63687
10	2080	54	1310	70763
11	2090	59	1310	77839
12	2100	65	1310	84916
13	2110	70	1310	91992
14	2120	76	1310	99068

Using the equation $Gr = (V_n + V_{2n} + V_{3n} \ldots + V_{r-n} + \frac{V_r}{2})$, we get:

$Gr = (7076 + 14153 + 21229 \ldots\ldots + 70763 + \frac{70763}{2})$ = 693,479 cords

When we divide total cords by operational acres, we get 37.8 cords acre^{-1}.

$$\frac{693{,}479\ cd}{18{,}346\ ac} = 37.8\ cd\ ac^{-1}$$

70 cords acre^{-1} in the 130-, and 140-year periods is very optimistic. Based on inventory data from multiple stands in the SFMA, we can assume that is unlikely. Generally, standing volume in the SFMA ceases to significantly increase at approximately 50 cords acre^{-1}. It is important to remember that this is an idealized situation that would likely be impossible to recreate in the SFMA. Furthermore, it does not incorporate any thinning or uneven aged stand management. However, it provides a useful benchmark for future calculations.

Appendix B: AAC Calculations

In a truly balanced forest, you could harvest timber at the calculated net growth rate. The SFMA is far from balanced. Therefore, one must dig deeper. The following sections provide additional information on how the AAC in the SFMA was determined.

Volume Based AAC

In volume control, determination of the AAC is approached through the increment and the volume and distribution of the growing stock. There are many formulas used to determine the harvest rate using volume methods. Some only consider the volume of growing stock. Others only the increment. And some consider both volume and increment. Neither volume nor increment alone is sufficient to establish volume control, and the combined approach is best. The Austrian Formula, or Austrian Volume Equation, combines the increment with the current and desired growing stock, allowing for a means to adjust the growing stock up or down over an adjustment period. The increment and standing volume are derived from our CFI. The desired volume (normal stocking) is determined using the summation equation previously described. The Austrian Formula provides a direct route to increase or decrease the standing volume in a forest over time and is generally considered particularly applicable to uneven-aged forests. The following is calculated using this equation. Current stocking in the operational units is approximately 27 cords acre^{-1}. On a 140-year rotation, normal stocking in the SFMA is calculated to be approximately 37.8 cords acre^{-1}. Therefore, the goal is to increase stocking, over time, from 27 cords acre^{-1} to 37.8 cords acre^{-1}. A net growth rate of 0.54 cords acre^{-1} year^{-1} is used in the following calculations.

$$Calculated\ Net\ Growth = 18{,}346ac * 0.54\ cd\ ac^{-1}\ yr^{-1} = 9{,}907\ cd\ yr^{-1}$$

Austrian Volume Equation

AAC= I + $\frac{Ga-Gr}{r}$

Where:
I= Net growth
Ga= Current stocking
Gr= Desired stocking
r= Adjustment period

$$AAC = 9{,}907\ cd\ yr^{-1} + \frac{491{,}489\ cd - 693{,}479\ cd}{100\ yrs} = 7{,}887\ cd\ yr^{-1}$$

Based on historical harvest layout, approximately 10% of the area within the Operational Units in the SFMA is not suitable for harvest. Therefore, the volume is reduced by 10%.

$$Adjusted\ AAC = 7{,}887\ cd\ yr^{-1} * 0.9 = 7098\ cd\ yr^{-1}$$

Area Allocation AAC

The Austrian Formula does not consider area or cutting schedule. Therefore, it is not designed to bring about a desirable age class distribution by area. In other words, the calculated volume says nothing about how much should come from what age class and where it should come from. To bring about our desired forest structure, area and age classes must be considered.

The following calculation follows the procedure used to determine the allowable cut in the 1998 SFMA management plan. It is area based and incorporates estimated removals to set a AAC volume. It includes a final removal, which implies that it is most appropriate for even aged, and area based uneven aged management. Also, it assumes a balanced forest. Nonetheless, since it considers both area and volume simultaneously, it ensures sustainability from both the area and volume standpoint.

To determine the allowable cut based on area, we calculate the area regenerated and the area that will receive intermediate treatments over a given period and estimate the volume that will be extracted from each.

The SFMA contains 18,346 operable acres available for management. To determine the number of acres to regenerate each year we divide the operable acres by the rotation length. The same is done to determine the area that will receive intermediate treatments in the 60, 80, 100, and 120-year age classes.

Area-Based Regeneration Harvests:

$$\frac{18{,}346ac}{140yr\ rotation} = 131\ ac\ yr^{-1}$$

$$19cds\ ac^{-1} * 131ac\ yr^{-1} = 2{,}489cd\ yr^{-1}$$

*A 6-cord acre^{-1} reduction was incorporated into the final harvest volume to account for legacy trees.

Area-Based Intermediate Treatments:

$$Acres\ per\ year = \frac{18{,}346ac}{20yr\ period} = 917\ ac\ yr^{-1}$$

$$20\ year\ age\ classes = \frac{917\ ac\ yr^{-1}}{7\ twenty\ yr\ periods\ in\ a\ 140\ yr\ rotation} = 131ac$$

$$917ac\ yr^{-1} - 131\ ac\ final\ harvest = 786\ ac\ yr^{-1}$$

$$131ac\ in\ a\ 20yr\ class\ *\ 2\ age\ classes\ for\ the\ 20\ \&\ 40yr\ classes = 262\ ac\ of\ non-merchantable\ ac\ yr^{-1}$$

$$Intermediate\ treatments = 786ac - 262ac = 524\ ac\ yr^{-1}$$

$$Growth = 0.54cd\ ac^{-1} * 20yr = 10.8\ cd\ ac^{-1}\ yr^{-1}$$

$$524\ ac\ yr^{-1} * 10.8\ cd\ ac^{-1} = 5{,}659\ cd\ yr^{-1}$$

$$\underline{Total\ Harvest\ Area = 131\ ac\ yr^{-1} + 524\ ac\ yr^{-1} = 655\ ac\ yr^{-1}}$$

$$\underline{Approximate\ Volume = 2{,}489\ cd\ yr^{-1} + 5{,}659\ cd\ yr^{-1} = 8{,}046\ cd\ yr^{-1}}$$

Based on historical harvest layout, approximately 10% of the area within the Operational Units in the SFMA is not suitable for harvest. Therefore, the area and volume are reduced by 10%.

$$\underline{Adjusted\ AAC\ Regeneration\ Area = 131ac * .9 = 118\ ac}$$

$$\underline{Adjusted\ AAC\ Intermediate\ Treatment\ Area = 524\ ac * 0.9 = 472\ ac}$$

$$\underline{Adjusted\ AAC\ Volume = 8{,}046\ cd\ yr^{-1} * 0.9 = 7{,}241\ cd\ yr^{-1}}$$

Long Term Sustained Yield

The volume-based and area-based calculated AAC can also be compared to the Long-Term Sustained Yield (LTSY). The LTSY is calculated by dividing the volume by the age of local stands and multiplying it by the operable area and then by the final removal percentage. The increment for several benchmark reserves with known establishment dates were averaged. These stands hold approximately 50 cords acre^{-1} at age 100. Twenty percent of the volume is set aside as legacy trees and to account for inaccessible areas.

$$LTSY = \frac{50cd}{100yr} * 18{,}346ac * 0.8 = 7{,}095\ cd\ yr^{-1}$$

Species Limits

To ensure harvests are proportionally applied to all species groups, the SFMA will strive to meet the following conditions on annual harvest volumes for the next 10 years.

- Approximately 44% of the stocking in the SFMA is spruce/fir. This accounts for approximately 55% of net growth of the SFMA. Over the next 10 years, the SFMA will limit harvesting of spruce/fir to 75% of the net growth of spruce in the Operational Units in the SFMA. Therefore, the spruce/fir volume removed will be limited to approximately 2,800 cords year^{-1}.

- Wet site species such as cedar, black spruce, and brown ash account for approximately 8% of the stocking in the SFMA and only 2% of the growth. Wet site species were harvested well above growth over the last decade. Cedar was the primary wet species harvested. Due to the slow growth and difficulty establishing cedar regeneration, the SFMA will limit the removal of cedar to a maximum of 20 cords year^{-1}. Cedar outside of trails will be marked to cut, and records made at the time of marking. Additionally, growth and stocking of cedar in the SFMA should be further investigated in the coming decade.

**Brown ash is a culturally important species that is at imminent risk of loss from the state due to the invasive emerald ash borer. As such, any stands of brown ash will be mapped and given separate consideration*

- Approximately 21% of the stocking in the SFMA is tolerant hardwood. This accounts for approximately 28% of net growth of the SFMA. Over the next 10 years, the SFMA will strive to harvest tolerant hardwood in proportion to its contribution to net growth. Therefore, the tolerant hardwood volume removed should be at approximately 25% of the annual harvest. It is important to note that the AAC already incorporates retention and a reduced operable area, so this is still well below net growth for tolerant hardwood in the SFMA.

- Approximately 16% of the stocking in the SFMA is intolerant hardwood. Much of this is senescing aspen in fire origin stands. To capture mortality and regenerate aspen in select locations for biodiversity, the SFMA will strive to harvest at net growth levels for intolerant hardwood. Intolerant hardwood accounts for approximately 4% of net growth of the SFMA. Therefore, the goal is to harvest approximately 300 cords year^{-1}.

- Pine/Hemlock accounts for approximately 10% of the stocking and 11% of the net growth in the SFMA. Over the next 10 years, the SFMA will aim to remove pine/hemlock in proportion to its contribution to net growth. Therefore, the pine/hemlock volume removed should be at approximately 10% of the annual harvest. It is important to note that the AAC already incorporates retention and a reduced operable area, so this is still well below net growth for pine/hemlock in the SFMA.

Summary

Continuous forest inventory provides insight into the processes occurring in a forest, such as growth and mortality rates. It does not, however, provide an unbiased picture of what is in the forest. While the CFI shows that there is an average of 27 cords acre^{-1}, this assumes an unbiased representation of the management area. Without a more intensive inventory, we cannot be certain that this is the case. Additionally, these calculations work best in a relatively balanced forest, and SFMA is not balanced. Therefore, erring on the side of caution is prudent, and the AAC is set significantly below growth. A cap on certain species groups based on their growth rates will also be implemented. Finally, regeneration harvests are limited to approximately 1 percent of the operational land base year^{-1}, unless specific silvicultural conditions dictate otherwise.

The volume-based AAC calculation suggests a removal rate of 7,887 cords year^{-1}. The adjusted volume based AAC is 7098 cords year^{-1}. The Area-Allocation calculation shows that 131 acres should be regenerated every year, and that an additional 524 acres should receive intermediate treatments annually. The yield from these treatments is estimated from actual harvest yields, current stocking, and the growth increment. After adjustment, we would regenerate and thin 118- and 472-acres year^{-1}, respectively. The volume from these harvests should sum to approximately 7,241 cords year $^{-1}$. Finally, the LTSY is calculated at 7,095 cords year^{-1}.

An average removal rate of 7,098 cords year^{-1} over the next 10 years should not be exceeded. We can then use the next round of CFI and intensified sampling to adjust the AAC in the future as needed. While we are not trying to regulate the SFMA on an area basis, management should strive to limit regeneration harvests to 1% of the operational area, or 183 acres, year^{-1}. This may prove challenging since the 140-year rotation begun in a relatively old forest where many of the trees have reached senescence. Therefore, the final silvicultural decision must be made at the stand level.

It is important to note that these calculations assume all available silvicultural options are considered. If sites do not regenerate due to competing vegetation, the calculations must be adjusted. If harvesting occurs without adequate desirable regeneration, these harvest rates cannot be maintained.

It is also important to remember that these calculations are simply a guideline to ensure sustainability. The overall goal is to develop specific stand structures and forest conditions, not harvest a specific volume. Additionally, we must consider market conditions. Therefore, some years may result in harvest volumes well below the AAC, while others may exceed it. If the 10-year average does not exceed the AAC (7,098 cords year^{-1}.) and the species limits are followed, we will be on track to meet our long-term goals. While the AAC will always be important, it should be used in conjunction with other planning tools. Over the next 10 years, data will be gathered to allow for more sophisticated modeling to aid in reaching our structural and biological goals.

Appendix C: Acknowledgements

Former Resource Manager and Former Park Director Jensen Bissell for setting the foundation that the SFMA is building on today. The 1988 and 1998 plans are to this day extremely valuable resources for current SFMA management and helped guide the author in drafting this plan.

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