Special analysis units

Introduction

The term “special analysis unit” stemmed from a need to describe geographic areas that already had management plans or guidance documents but that do not align with state forest management areas. These geographic areas all have specific sets of goals and objectives related to wildlife habitat or desired future forest conditions and are relevant to capture in the State Forest Management Plan model. By specifically incorporating these areas into the model as attributes of stands, outputs can be generated for them. They then can be used in model constraints, and specific transition proportions can be applied to help guide management activities.

It is quite common that a management plan written for a particular species, such as Kirtland’s warbler, includes specific goals for cover types such as planted and natural jack pine. Other cover types, like aspen, that fall within those focused areas can be managed according to the broader management area plan. This level of specificity allows for complementary management of both management area-level cover type and habitat goals and the more focused goals related to special analysis units.

There are five types of special analysis units across all three ecoregions of the state forest (Figure 1), all with a specific set of management goals outlined in their respective guidance document or management plans:

1. **Pigeon River Country State Forest**
    a. Guiding document: A Concept of Management for the Pigeon River Country (2007).
    b. Purpose: Protect area from overuse and overdevelopment and later provide desired future conditions of the forest.
2. **Elk Management Area**
    a. Guiding document: Michigan Elk Management Plan (2012).
    b. Purpose: Provides strategic guidance for managing elk in Michigan.
3. **Grouse Enhanced Management Site**
    a. Guiding document: Grouse Enhanced Management Plans (2014-2016).
    b. Purpose:
        i. Provide unique hunting opportunities.
        ii. Promote hunter recruitment and retention.
        iii. Expand local economies.
        iv. Provide a destination point for the traveling wing-shooter.
        v. Accelerate timber harvest opportunities (shorter rotation length on aspen).
4. **Kirtland’s Warbler Essential Habitat**
    a. Guiding documents:
        i. Kirtland’s Warbler Operational Plan (2022).
        ii. Kirtland’s Warbler Breeding Range Conservation Plan (2015).
    b. Purpose: Provides information and operational guidance to Department of Natural Resources staff, our conservation partners and the public on how the DNR will manage state-administered lands for the Kirtland’s warbler.

5. **Deer Wintering Complexes**
    a. Guiding documents: Deer Wintering Complex Plans (2016).
    b. Purpose: Provide information and strategies for managing lands to benefit deer wintering within the deer wintering complexes.

Specific goals or management strategies in each individual plan that depend on habitat management via commercial timber harvesting were selected, and an effort was made to incorporate those goals into the modeling effort of this State Forest Management Plan. Incorporating these special analysis unit goals started by establishing relevant units and spatially joining those with overlapping stands.

One of the 18 themes used in creating the SAU section of the model used the data that allowed for unique objective functions, outputs, constraints, goals, actions and transitions to be specified. These unique modeling elements, which impact the overall harvest schedule of the preferred solution, helped nest the SAU goals into the management area harvest targets, implemented each year through the compartment review process. The following sections will discuss the unique elements incorporated into the State Forest Management Plan model for each special analysis unit.

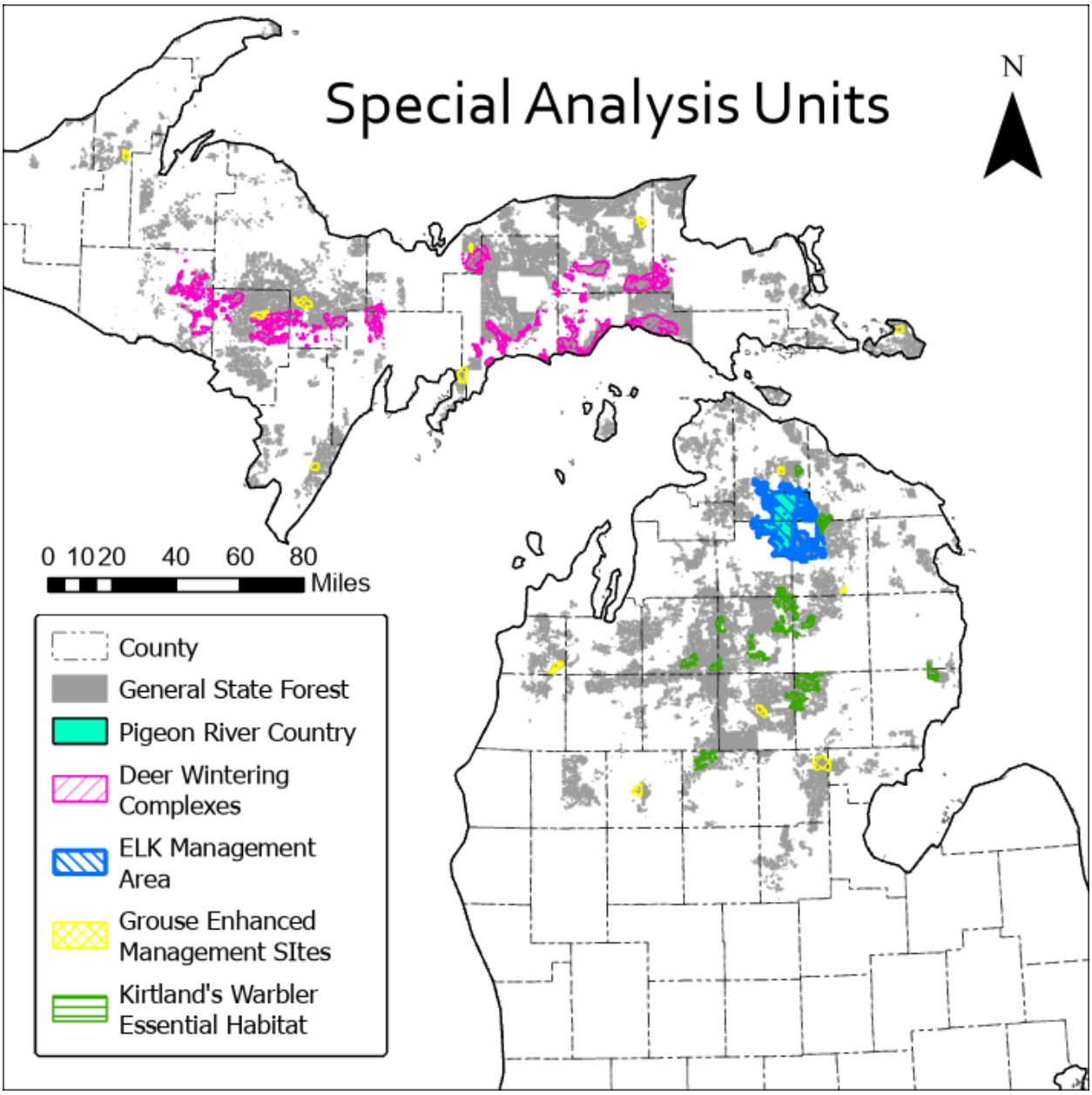

Figure 1. The five types of special analysis units across the state forest.

Pigeon River Country State Forest

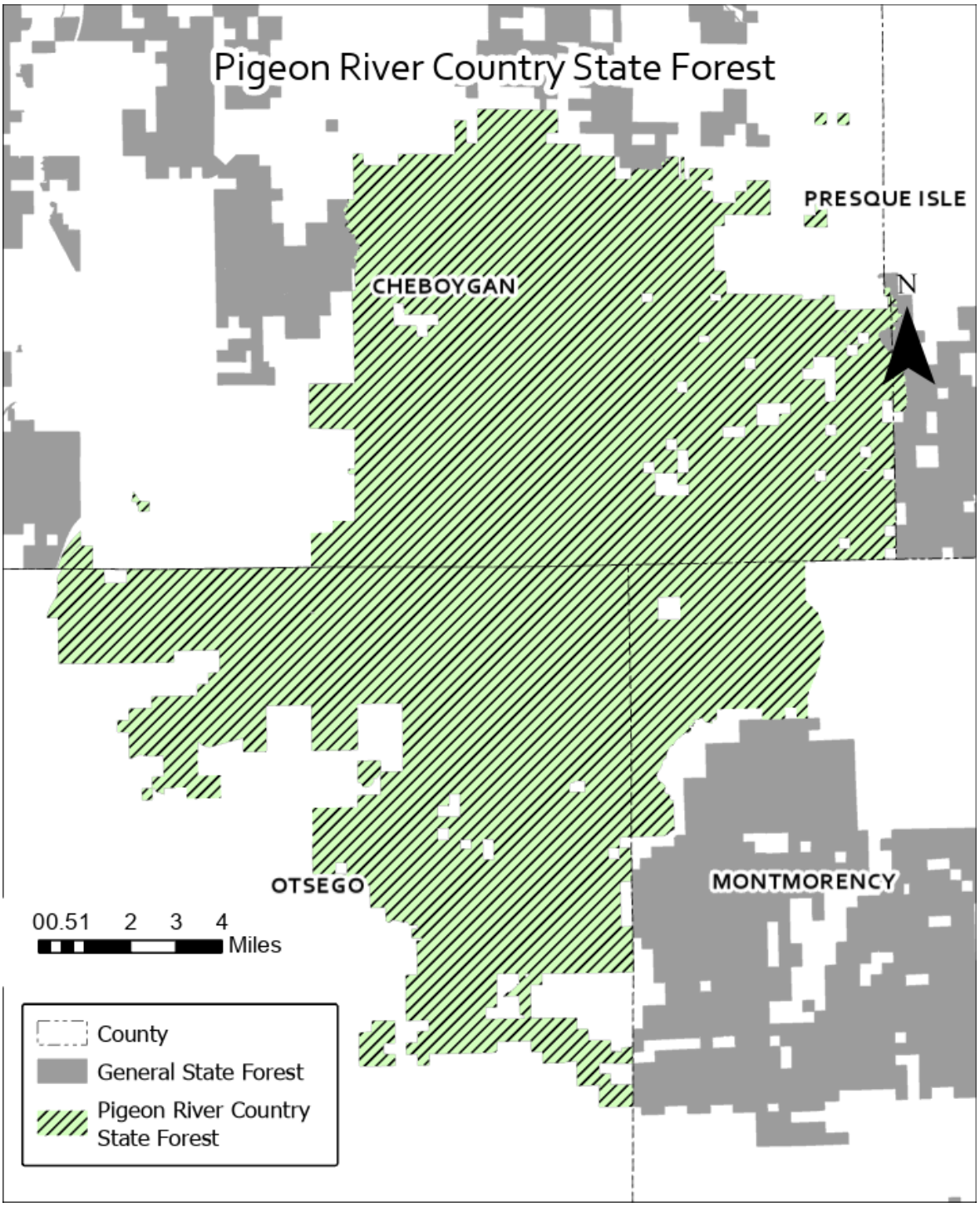

Figure 1. The Pigeon River Country State Forest Special Analysis Unit geographic boundary.

Description

The Pigeon River Country State Forest Special Analysis Unit (Figure 1), synonymous with the forest management unit, is located in Cheboygan, Montmorency and Otsego counties in the northern Lower Peninsula. This forest management unit has been recognized as a unique part of the state forest since its beginning and has several unique features that make it special. The following excerpt from the Concept of Management for the Pigeon River Country sums up its uniqueness:

> *The Pigeon River Country (PRC) is indeed a special place held in trust for the people of Michigan. There are many fascinating sides to the story of this beautiful piece of our state – its rather unusual history, the way the elk herd began, the struggle for and against oil drilling, what's happened over the past quarter-century as a result, and what we might expect to happen in years to come. It's a rich story that has developed over more than a century of land use and abuse, a story that exposes human folly which appeared at the time to be wisdom, and human wisdom most thought folly at the time. When the Concept of Management for the Pigeon River Country (Concept) was first adopted by the Michigan Department of Natural Resources (DNR) in December 1973, it represented the collective wisdom of many individuals, representing many organizations and interest groups, who all shared a common purpose – to protect the Lower Peninsula's last "Big Wild" from overuse and overdevelopment. 19th and early 20th century attitudes about treating natural resources as commodities, to exploit without restraint, had changed with the hard-won recognition that resources must be managed wisely if they are to be there for future generations.*
>
> *One purpose of this updated Concept of Management is to make sure that overuse doesn't happen. P.S. Lovejoy, a conservation leader of national stature in the first half of the 20th century, had seen firsthand too much of what had taken place here. A once pristine forest that had become a landscape denuded of trees; its rivers choked with sand and silt, a place bereft of wildlife. "It was Lovejoy who first recognized the Pigeon River Country as special. He called it 'the Big Wild'…. He led the charge to increase state holdings around the Pigeon River State Forest that started with 6,468 tax-reverted acres in 1919 and had expanded to over 19,200 by mid-1928, thanks to hunting license revenues." (Pfeifer 1974) "He viewed 'parked-up campsites', widening of county roads and other development as a 'poison' to the Pigeon River. He wanted a wild area…" (Cutler 1976) To protect its wild character from overuse, development will be more limited and people's activities will be more restricted than on most other state forest lands.*
>
> *The Pigeon River Country Advisory Council (Council) is made up of eighteen citizen members, three ex-officio members from the Department of Natural Resources, and one ex-officio member from the Department of Environmental Quality who was added to the Council in 1997. Since 1973, the Council has worked tirelessly and with great resolve to keep the management of Pigeon River Country in line with the Concept, and responsive to the wishes of people who use it and who may be affected by its use and management. During the past three decades, forest, wildlife and fisheries management practices have evolved with advances in scientific knowledge. Several large private tracts have been acquired by the state and added to the Pigeon River Country. Some state lands that had been managed by other FOREST MANAGEMENT Units have been added to the PRC. The*

area around the PRC has experienced growth, and patterns of recreational use have changed bringing new pressures to bear on the effort to protect the "Big Wild."

Special analysis unit goals

The Concept of Management has eight broad goals; the three of those with more specific objectives that could be incorporated into the State Forest Management Plan model are bolded below.

1. **Manage the elk population and elk habitat so the Pigeon River Country State Forest remains the nucleus of Michigan's elk herd.**
2. Provide needed habitat and seclusion for diverse fish and wildlife species.
3. Provide recreational opportunities for people in keeping with the wild character of the area and to provide peace and quiet through control of disruptive activities.
4. **Manage game species such as woodcock, grouse, deer and others for hunting and viewing opportunities.**
5. Protect water quality, stream habitat and manage the streams for a naturalized trout fishery, and the lakes for trout and game fish.
6. **Manage forest resources in a sustainable manner for desired future habitat conditions.**
7. Manage mineral resources in a manner consistent with existing legal requirements and these objectives
8. Protect the Pigeon River Country from overuse and overdevelopment which could destroy its wild character.

Current and desired future conditions

The first goal for managing the elk habitat is further described in the Forest Cover and Wildlife Habitat Management section, which states:

> *Adequate distribution and abundance of young, regenerating forest stands is critical to sustaining habitat for elk and many other species of wildlife requiring open or early successional habitats. Young forests are defined as being 0-9 years in age. Clear-cuts, and to a lesser extent tree and shelterwood cuts, are the three primary silvicultural methods used that result in even-age young forests. The cover types where even-age management will be applied are aspen, jack pine, low quality northern hardwoods, oak, red pine, lowland poplar, swamp conifers, paper birch, spruce-fir and white pine. Current forest analysis suggests that just over 50% of the forest is in those cover types that may be managed for early successional habitat. To maintain adequate elk habitat, managing the entire PRC for 7 to 8% in early successional age classes is the recommended objective.*

This objective was incorporated into the SFMP model by creating first an aggregate of the current equivalent cover types listed above, then an inventory area output that used the aggregate cover type and the Pigeon River Country Forest Management Unit as mask values that added up acres in the 0-9 age class. A separate set of theme-based outputs summed acres across each forest management unit and could also be used to represent this objective for the Pigeon River Country specifically. Two goal statements were then created that stated the area in the 0-9 age class of the specified cover types

should be greater than or equal to 7 percent and less than or equal to 8 percent of the total area of the Pigeon River forest management unit.

The current condition of the aspen 0-9 age class is slightly above the target at 8.2% of the Pigeon River Country. This is due to management strategies used during the last planning period (compensatory approach) that resulted in an elevated amount of regeneration and a reduction in what was the 40-49 age class. The SFMP model, also incentivized by the age class goals of each cover type in each management area, maintains the minimum requirement of 7-8%, with 7,730 acres in the 0-9 age class in each period moving forward as shown in Table 1 and Figure 2.

Table 1. Aspen 0-9 age class area and total aspen area across the Pigeon River Country State Forest Special Analysis Unit.

Model Period	Pigeon River Country (PRC) Age 0-9 Acres	Percent in 0-9 Age Class	PRC Aspen Type Acres	PRC Aspen Type Percent	Total PRC Acres
Current	9,038	8.2%	25,149	23%	**110,425**
1	7,730	7.0%	26,031	24%	**110,425**
2	7,730	7.0%	26,162	24%	**110,425**
3	7,730	7.0%	26,169	24%	**110,425**
4	7,730	7.0%	26,197	24%	**110,425**
5	7,730	7.0%	26,204	24%	**110,425**
6	7,730	7.0%	26,283	24%	**110,425**
7	7,730	7.0%	26,338	24%	**110,425**
8	7,730	7.0%	26,123	24%	**110,425**
9	7,730	7.0%	25,803	23%	**110,425**
10	7,730	7.0%	25,581	23%	**110,425**

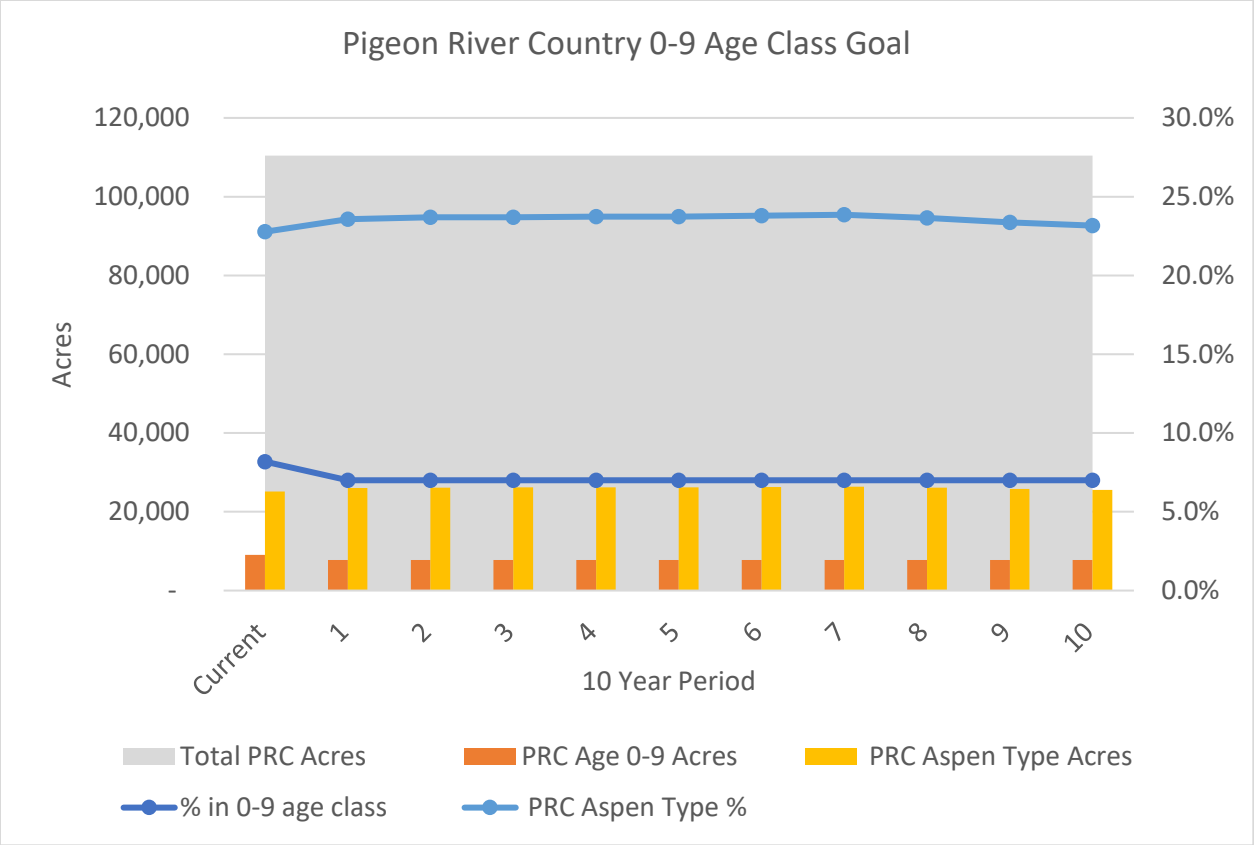

Figure 2. The 0-9 age class in the Pigeon River Country State Forest Special Analysis Unit.

The Concept of Management also states in this section that, "The objective will be to maintain at least 27 percent of the (Pigeon River Country) as aspen" as it relates to early successional stages of forest development and the benefits that stage has for many game species as stated in goal 4 above. This was incorporated into the model by generating another inventory area that adds up acres of aspen within the Pigeon River Forest Management Unit and then referencing that output in a similar goal statement that says the area of aspen in the forest should be greater than or equal to 27 percent of the total area in each period.

The goal of 27 percent aspen was created under the older "operations inventory" forest inventory system, which used a different classification system for determining cover types of stands. As stated in the Concept of Management, "Forest stands, where aspen is the principal component, **are considered** an aspen type." This system allowed stand examiners to assign a cover type to stands based on management intent rather than actual species occupancy and often resulted in more acres of the aspen cover type than estimates based on canopy species proportions. The current inventory system calculates the cover types, and the general rule is that stands must have greater than or equal to 40 percent of the canopy occupied by aspen species to be an aspen cover type (which is the lowest threshold for all species/cover types). One other consideration is that there were no upland mixed cover types in the old operations inventory system, so many stands with small components of aspen species were captured in the aspen cover type. Currently they are captured as mixed upland deciduous or upland mixed forest if there is a conifer component present. These factors have contributed to a current condition that falls below the stated goal of 27 percent, with a current value of 23 percent. The SFMP model is able to show

conversion from other cover types to aspen, which results in an increase to 24 percent, but is unable to achieve a higher proportion.

The Concept of Management also includes an objective that the amount of upland open land in the Pigeon River Country should be 6-7% of the entire area. There were no conversions from forested types to nonforested types projected in the SFMP model as a result of management discussions, so there is no movement projected related to this objective. The capability does exist, and an output was generated to track the amount of upland open lands, but the focus right now is to maintain existing open lands and prevent encroachment of tree species from converting them to a forested condition.

Increasing or maintaining mast production is also an objective in the Concept of Management, but because mast can come from a variety of species and cover types, it would be difficult to create a meaningful set of goals to inform the modeling effort. Instead, efforts to maintain or increase mast-producing components of stands will be handled through implementation as specific prescriptions are made through the compartment review process. Conversion away from oak cover types is discouraged, and maintenance of oak components at the highest level possible will continue to be the objective of such treatments.

Northern hardwood management is also discussed, and many of the objectives could be better achieved with individual prescriptions at the stand level. One objective for northern hardwood included managing a small proportion of this cover type with an even-aged stem rather than the typical uneven-aged approach. This goal coincides with the overall goals of the Wolverine Moraines and the Presque Isle Lake and Till Plains management areas and applies to the portions of those management areas that fall within the Pigeon River Country State Forest Special Analysis Unit.

The sixth goal listed above is more broadly concerned with sustainable forest management for desired future habitat conditions. This was accomplished by adding specific Pigeon River Country age class goals to each cover type managed with an even-aged system. This helps to regulate harvests and create a desirable age class distribution across the landscape to ensure an even flow of timber harvest and diverse habitat conditions. This is accomplished through the creation of specific age class outputs for each cover type, then using those outputs in an expression that specifies a proportion relative to outputs representing all available acres across the Pigeon River Country in that same cover type. The goal statements incentivize the model to achieve the desired age class distribution in each cover type as soon as possible, then maintain that distribution through strategic harvesting levels.

The age class goals for aspen in the Pigeon River Country use a base rotation age of 50 years (Figure 3; once balanced, most stands will be prescribed once they reach 50 years old as seen in Figure 4) by intending to carry about 14 percent of the available aspen acres in six age classes from 0-9 through 50-59. There is also an age class tail that will hold an additional 14 percent of the population across three older age classes in the 60-69 (8 percent), 70-79 (4 percent) and 80-89 (2 percent) age classes. Stands to be held in these additional age classes should be chosen carefully to ensure that holding these stands a little longer will not result in loss of the cover type due to diminished tree vigor and coppice regeneration capabilities. Stands located on productive sites with a high proportion of bigtooth aspen are good candidates for these age class tails.

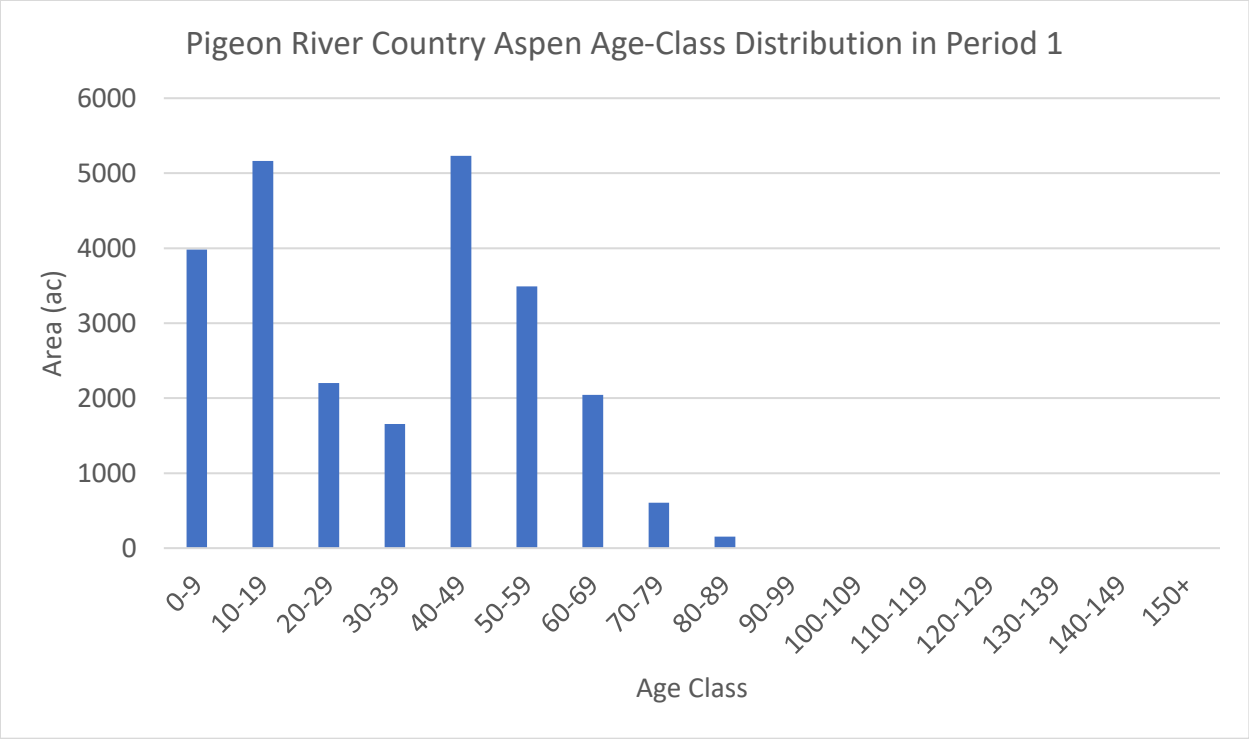

Figure 3. Aspen age class distribution after the planning period in the Pigeon River Country State Forest Special Analysis Unit.

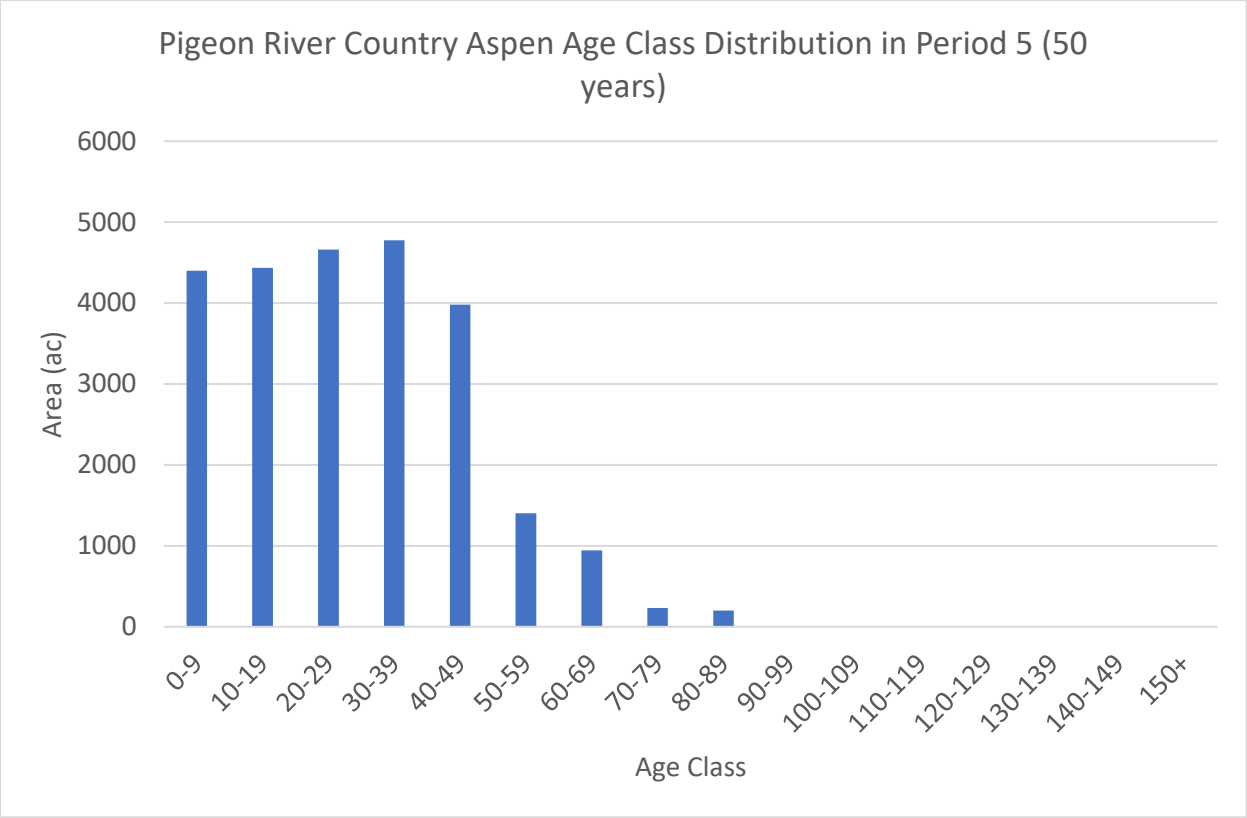

Figure 4. Aspen age class distribution in period 5 showing balanced condition.

Age class tails help provide both realistic harvesting options and beneficial habitat elements across numerous even-aged cover types. Planning for a small amount of additional area to be held beyond a single rotation age provides managers with opportunities to distribute treatments, both spatially and temporally, in landscapes that may not currently be in a desirable condition (e.g., large blocks of same age class). This practice has been in place for decades, but the planning has not accounted for it, which results in falling short of stated harvest objectives. The habitat-related objective of age class tails is to encourage more mature forest habitat elements to develop at the stand level and be present across the landscape to include lands both available and unavailable for commercial timber harvest. Mature forest habitat elements often include, but are not limited to, a higher component of living trees with cavities for small mammal and bird nesting opportunities, standing dead snags, dead and downed material for coarse woody debris, diverse vertical and horizontal structure, a more developed shrub species component, and large crowned canopy trees with raptor nesting opportunities.

Pine management encourages transitions away from plantation-style management to more natural regeneration of diverse deciduous, coniferous and mixed stands. This was represented in the SFMP model through transitions when regeneration harvest actions occur on planted red pine – the majority of those stands are projected to convert to mixed cover types and natural pine.

Management actions

The Period 1 projected harvest levels by silvicultural method provided in Table 2 will help ensure management in the Pigeon River Country aligns with the goals in the Concept of Management. Stand selection will be up to local land managers and biologists, but the overall harvest levels will help ensure

a balance of long-term sustainability and habitat creation is achieved. Salvage harvest will be conducted on stands based on field assessments and may differ from projections shown. Stands that were severely damaged in the 2025 ice storm have been factored in as well, resulting in a decrease in harvest levels to compensate for the surplus regeneration and decreased basal area.

Table 2. Projected period 1 harvests by silvicultural method for the Pigeon River Country State Forest Special Analysis Unit.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Salvage Clearcut	Salvage Thinning	Total
Northern hardwood	-	-	-	-	-	-	2,779	**2,779**
Planted red pine	171	-	1,497	-	-	-	987	**2,655**
Aspen	1,594	-	-	-	-	410	-	**2,004**
Mixed upland deciduous	1,794	-	-	-	-	-	-	**1,794**
Natural mixed pines	-	-	116	-	326	-	209	**651**
Natural white pine	-	-	114	-	210	-	89	**413**
Northern red oak	-	-	-	-	-	13	393	**406**
Natural red pine	-	-	13	-	154	-	55	**222**
Upland mixed forest	201	-	-	-	-	-	-	**201**
Upland spruce/fir	136	-	-	-	-	-	-	**136**
Natural jack pine	-	-	-	-	-	109	-	**109**
Planted mixed pine	-	-	85	-	-	-	-	**85**
Planted white pine	-	-	33	-	-	-	-	**33**
Black/red hybrid oak	31	-	-	-	-	-	-	**31**
Planted jack pine	-	-	-	-	-	22	-	**22**
Hemlock	-	1	-	-	-	-	-	**1**
Total	**3,927**	**144**	**1,859**	**-**	**689**	**2,758**	**2,165**	**11,541**

Elk Management Area

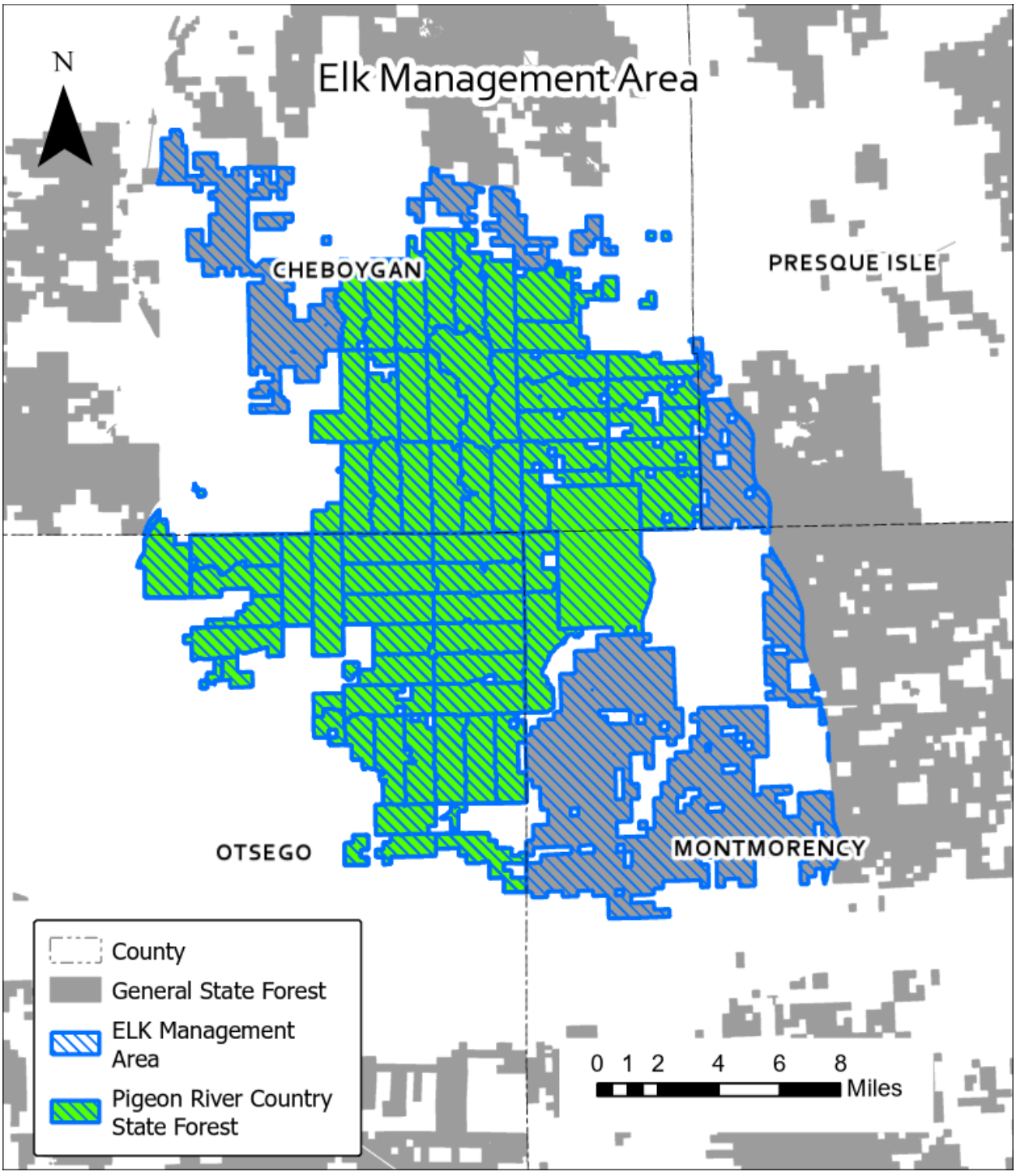

Figure 1. The Elk Management Area Special Analysis Unit geographic boundary.

Description

The purpose of the Elk Management Area Special Analysis Unit is to represent habitat goals derived from the Elk Management Plan through forest cover-type management. The overall goals and objectives are similar to those in the Pigeon River Country Concept of Management but cover a slightly larger area extending north into the Gaylord Forest Management Unit and east into Atlanta Forest Management Unit. The following is an excerpt from the Michigan Elk Management Plan:

> *"This plan provides strategic guidance for the management of elk in Michigan. This guidance will help: 1) manage for a sustainable elk population in balance with habitat; 2) use hunting as the primary method to control elk numbers, herd composition and distribution; 3) enhance public understanding of elk management in Michigan. This plan is appropriately aligned with the Wildlife Division strategic plan, "Guiding Principles and Strategies"…*

Special analysis unit goals

The following goals are represented in the Elk Management Plan:

1. Maintain 6-7% as grass and upland brush types.
2. Manage the forest to maintain the proportion of aspen at the same level (no net loss of aspen).
3. Maintain mast production by red, white, northern pin oak and beech and increase production if silviculturally appropriate.
4. Manage for mixed pine stands using natural regeneration that promotes both coniferous and deciduous species.
5. Managers must also be cognizant of the total amount of all early successional vegetation types and make efforts to provide consistent amounts over the decades.

These goals are consistent with those of the Pigeon River Country Concept of Management and are replicated throughout the SFMP model in the form of age class goals for each management area and the Pigeon River Country, specific Elk Management Area Special Analysis Unit transitions, and a specific aspen cover type constraint providing for no net loss over time.

Current and desired future conditions

The grass and upland brush types are not impacted by the SFMP model, as there are no transitions to nonforested cover types, resulting in no change over time. Small amounts of conversions are likely to occur and will be discussed locally through the compartment review process. Maintaining the current proportion of the aspen cover type was incorporated into the SFMP model by creating a specific output that sums the acreage of aspen within the Elk Management Area Special Analysis Unit, then referencing that output in a goal statement relative to the entire area covered by the Elk Management Plan. The goal statement incentivizes the SFMP model to maintain the same or a greater amount of aspen in future periods throughout the 15-period planning horizon (Figure 2).

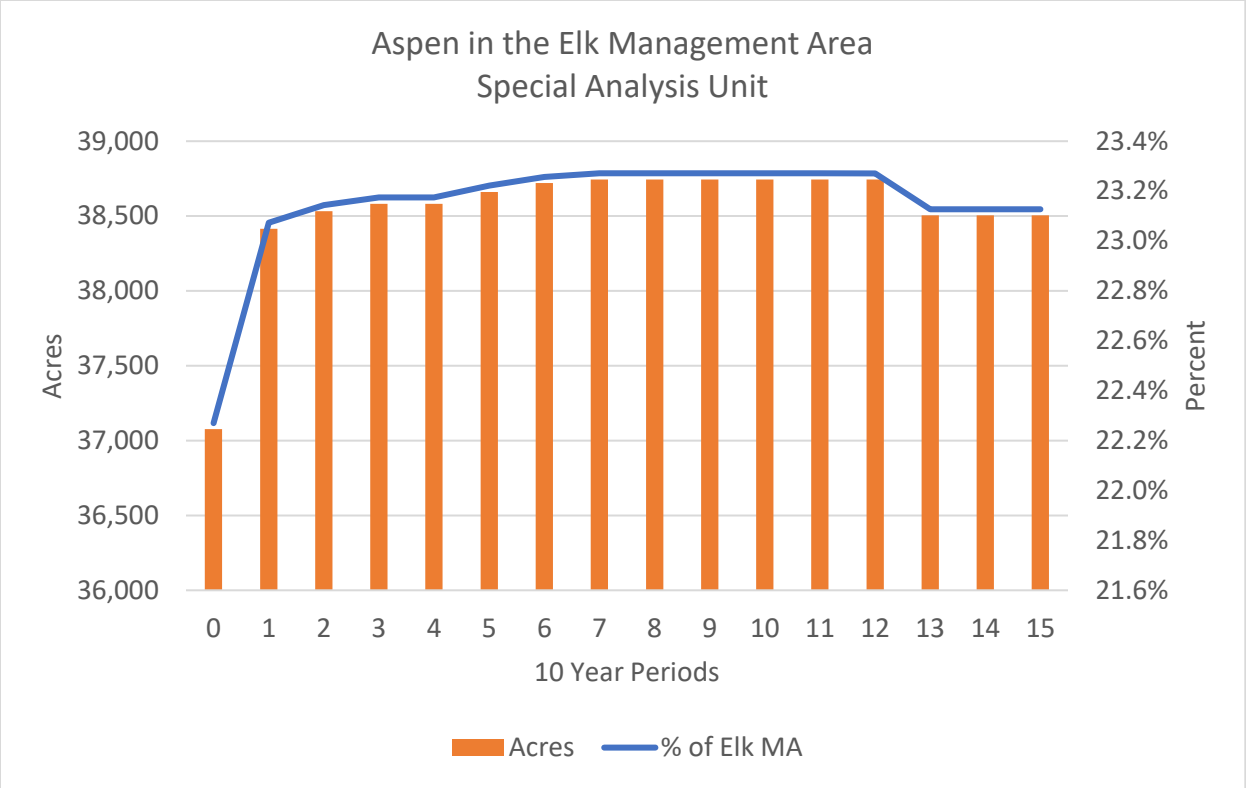

Figure 2. Aspen cover type acres in the Elk Management Area Special Analysis Unit.

The slight decrease from period 12 to period 13 is likely a result of aspen located on lands unavailable for commercial timber management senescing to more mid-or late-successional cover types.

The mast production goals in the Elk Management Plan will be challenging to achieve:

1. The loss of American beech trees, due to beech bark disease, as a component of the northern hardwoods cover type will significantly reduce in hard mast across the landscape.
2. Regeneration and recruitment of oak species at densities prior to harvest has proven to be difficult to achieve. This is likely due to a couple of key factors, including:
    a. Our resistance to replicate the rather harsh disturbance of the logging era (large-scale repeated harvests – first pine, then hardwood – and subsequent wildfires of logging slash) that occurred around 1890 to 1930, resulting in the significant oak component we see today in mature stands on dry-mesic and dry-xeric sites.
    b. Significantly more herbivory occurring on regenerating stands when compared to the time when these stands were established.

The State Forest Management Plan model indicates a decline in oak types because of these factors, while more acres of mixed upland deciduous can be expected, containing a substantial oak component. Efforts to both retain and regenerate oak will be specified in nearly all prescriptions on stands containing oak species (Figure 3).

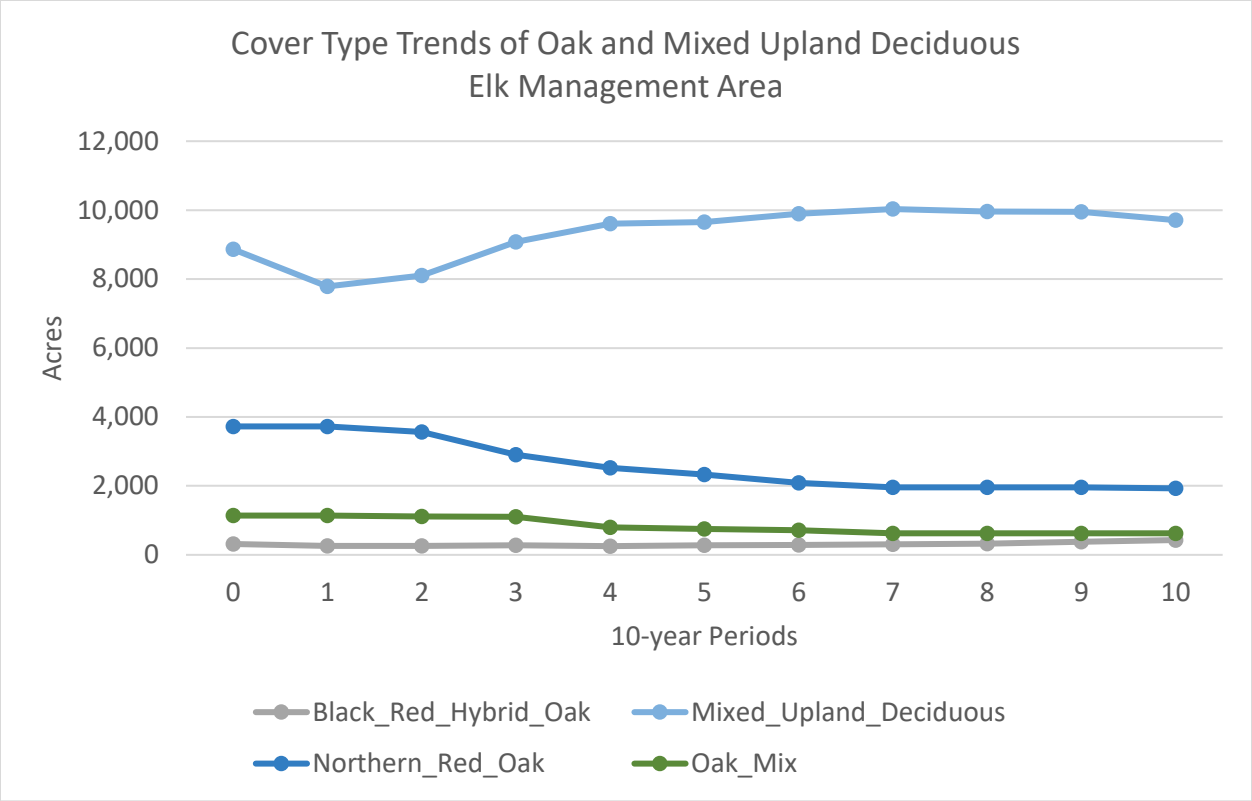

Figure 3. Trends for oak cover types in the Elk Management Area.

Pine management in the Elk Management Area encourages transitions away from plantation-style management and more natural regeneration of more diverse deciduous, coniferous and mixed stands. This was represented in the State Forest Management Plan model through transitions when regeneration harvest actions occur. The code shows the source stands being diverted to other mixed and natural cover-type targets after a regeneration harvest occurs. These transitions result in a projected decrease in the planted pine types and a subsequent increase in all three natural pine types as well as upland mixed forest, which contains a mix of both coniferous and deciduous tree species (Figure 4).

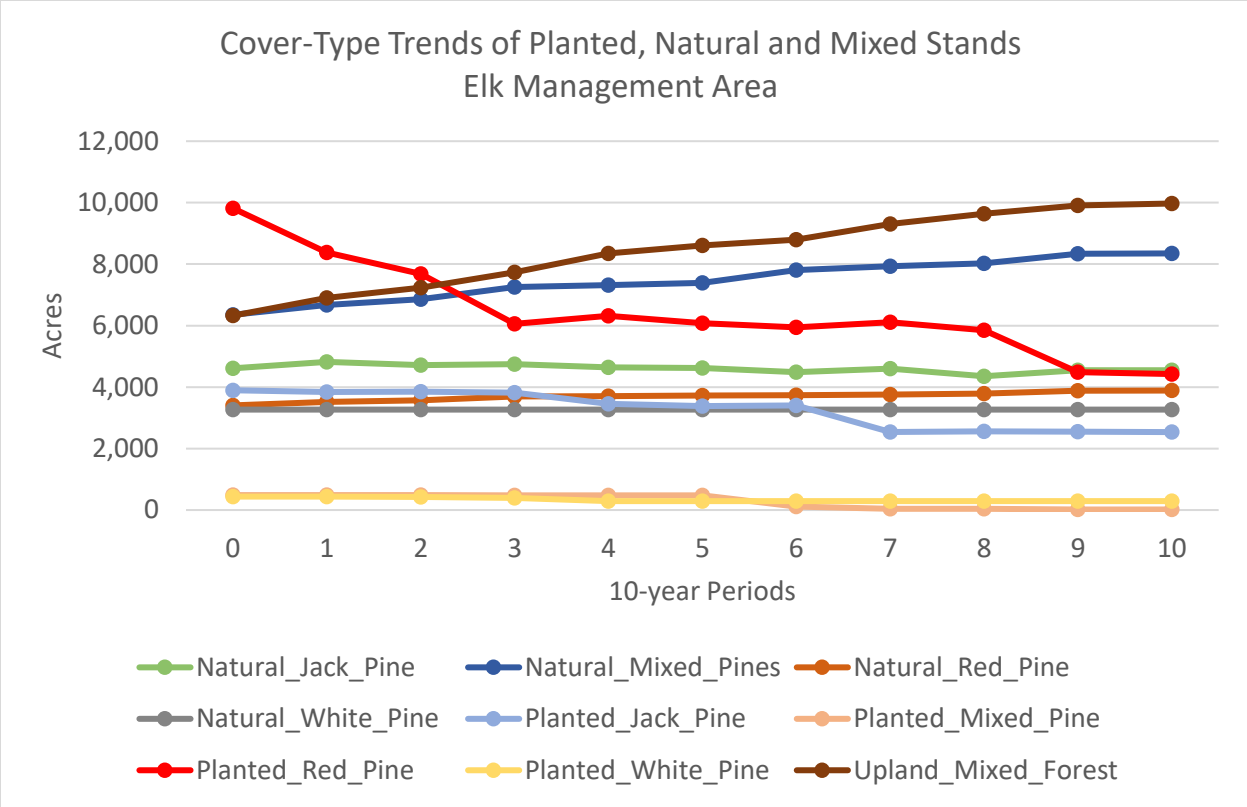

Figure 4. Cover-type trends of planted and natural pine types in the Elk Management Area.

Early successional cover types will be maintained across the Elk Management Area through specific age class goals for the Pigeon River Country Forest Management Unit and the Wolverine Moraines and Presque Isle Lake and Till Plain management areas. The resulting age class distribution of important even-aged cover types like aspen is projected to remain relatively well balanced for the Elk Management Area (Figures 5 and 6).

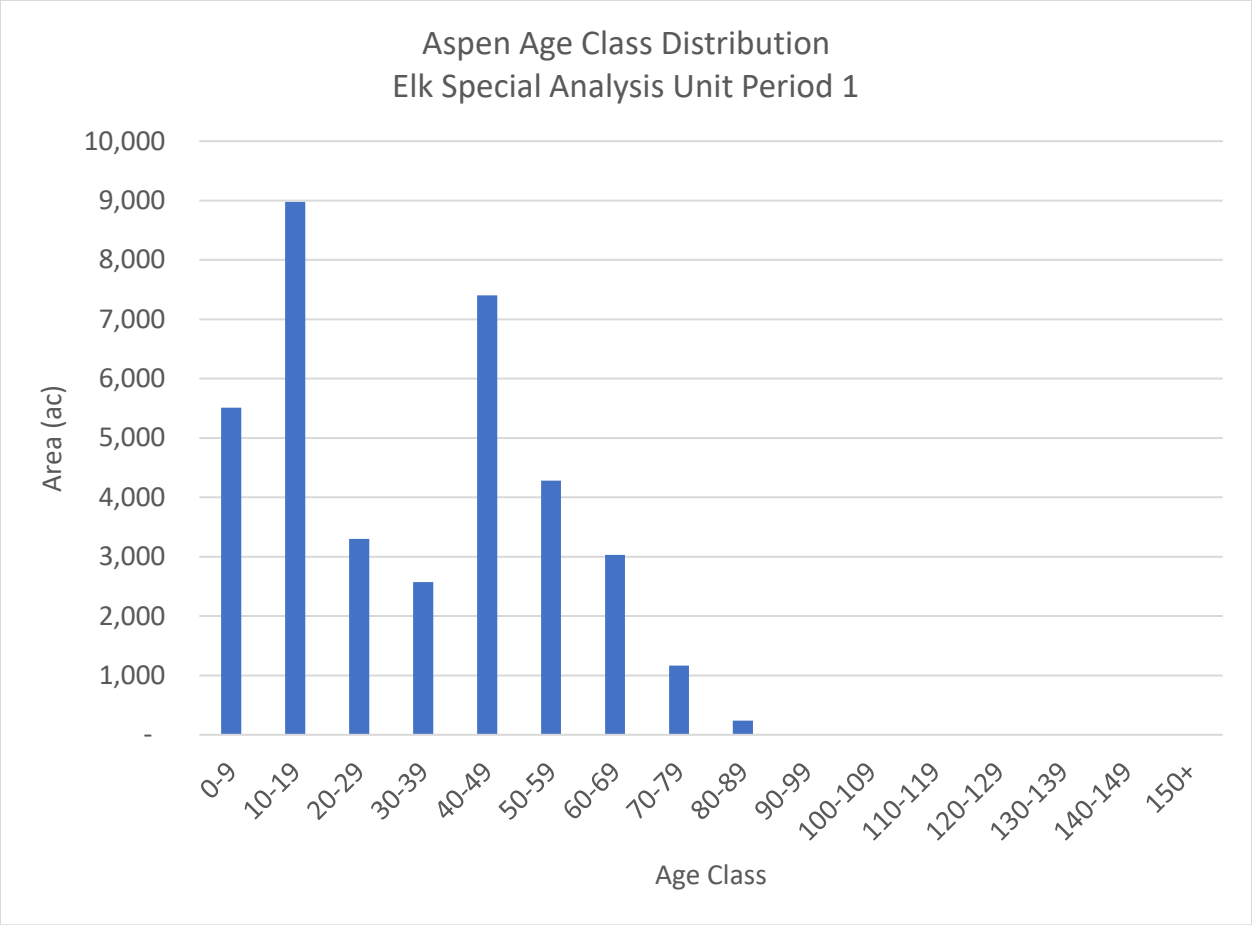

Figure 5. Aspen age class distribution in the Elk Management Area Special Analysis Unit after 10-year planning period.

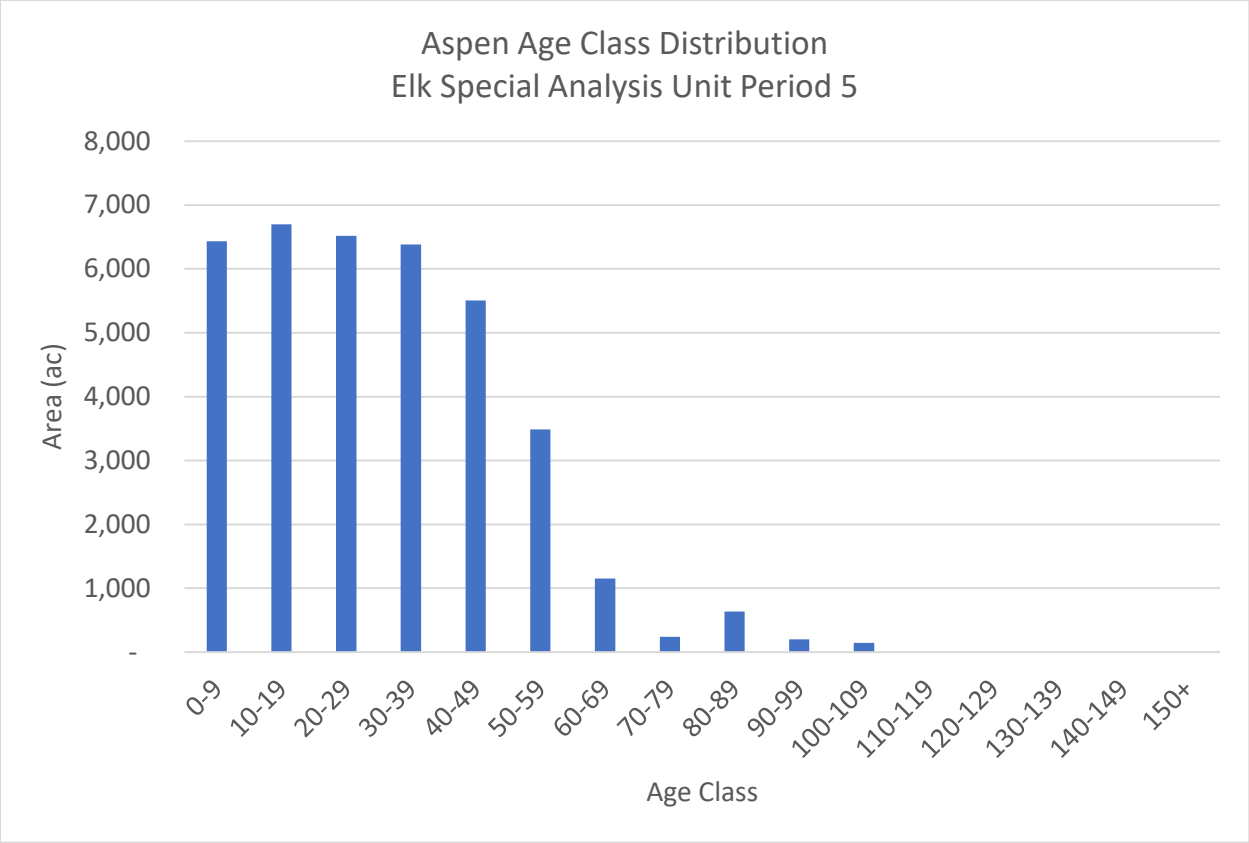

Figure 6. Aspen age class distribution in the Elk Management Area Special Analysis Unit after 50 years of management.

Management actions

The Period 1 projected harvest levels by silvicultural method provided in Table 1 will help ensure the management in the Elk Management Area aligns with the goals in the Michigan Elk Management Plan. Stand selection will be up to the local land managers and biologists, but the overall harvest levels will help ensure a balance of long-term sustainability and habitat creation is achieved.

Table 1. Harvest projections for the Elk Management Area.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Salvage Clearcut	Salvage Thinning	Total
Planted red pine	729	-	2,675	-	-	658	1,045	**5,106**
Northern hardwood	-	733	-	168	-	2,203	1,145	**4,248**
Aspen	2,507	-	-	-	-	552	-	**3,060**
Mixed upland deciduous	2,808	-	-	-	55	-	-	**2,864**
Northern red oak	89	-	-	100	-	290	493	**972**
Natural mixed pines	-	-	125	-	389	-	271	**786**
Natural white pine	-	-	114	-	217	-	89	**420**
Natural red pine	-	-	49	-	154	-	162	**365**
Lowland conifers	352	-	-	-	-	-	-	**352**

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Salvage Clearcut	Salvage Thinning	Total
Natural jack pine	63	-	-	-	-	276	-	**339**
Upland mixed forest	277	-	-	-	-	-	-	**277**
Upland spruce/fir	136	-	-	-	-	-	-	**136**
Black/red hybrid oak	125	-	-	-	11	-	-	**135**
Planted jack pine	-	-	-	-	-	112	-	**112**
Planted white pine	-	-	88	-	-	-	-	**88**
Planted mixed pine	-	-	85	-	-	-	-	**85**
Lowland aspen/balsam poplar	51	-	-	-	-	-	-	**51**
Hemlock	-	33	-	-	-	-	-	**33**
Lowland deciduous	22	-	-	-	5	-	-	**26**
Tamarack	20	-	-	-	-	-	-	**20**
Lowland spruce/fir	10	-	-	-	-	-	-	**10**
Cedar	-	-	-	5	-	-	-	**5**
Total	**7,189**	**766**	**3,136**	**273**	**830**	**4,091**	**3,204**	**19,488**

Grouse Enhanced Management Sites

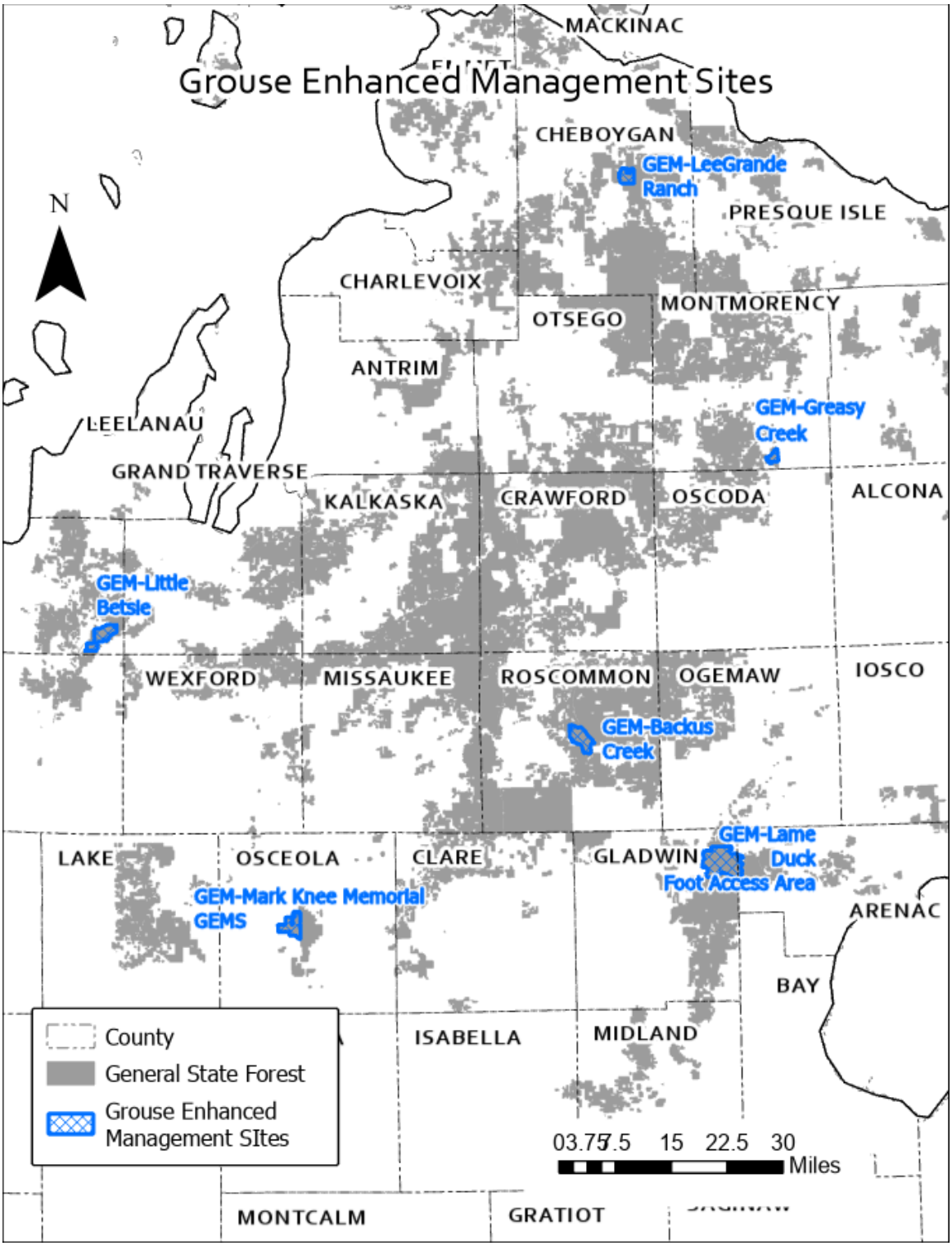

Figure 1. The geographic distribution of GEMS in the northern Lower Peninsula.

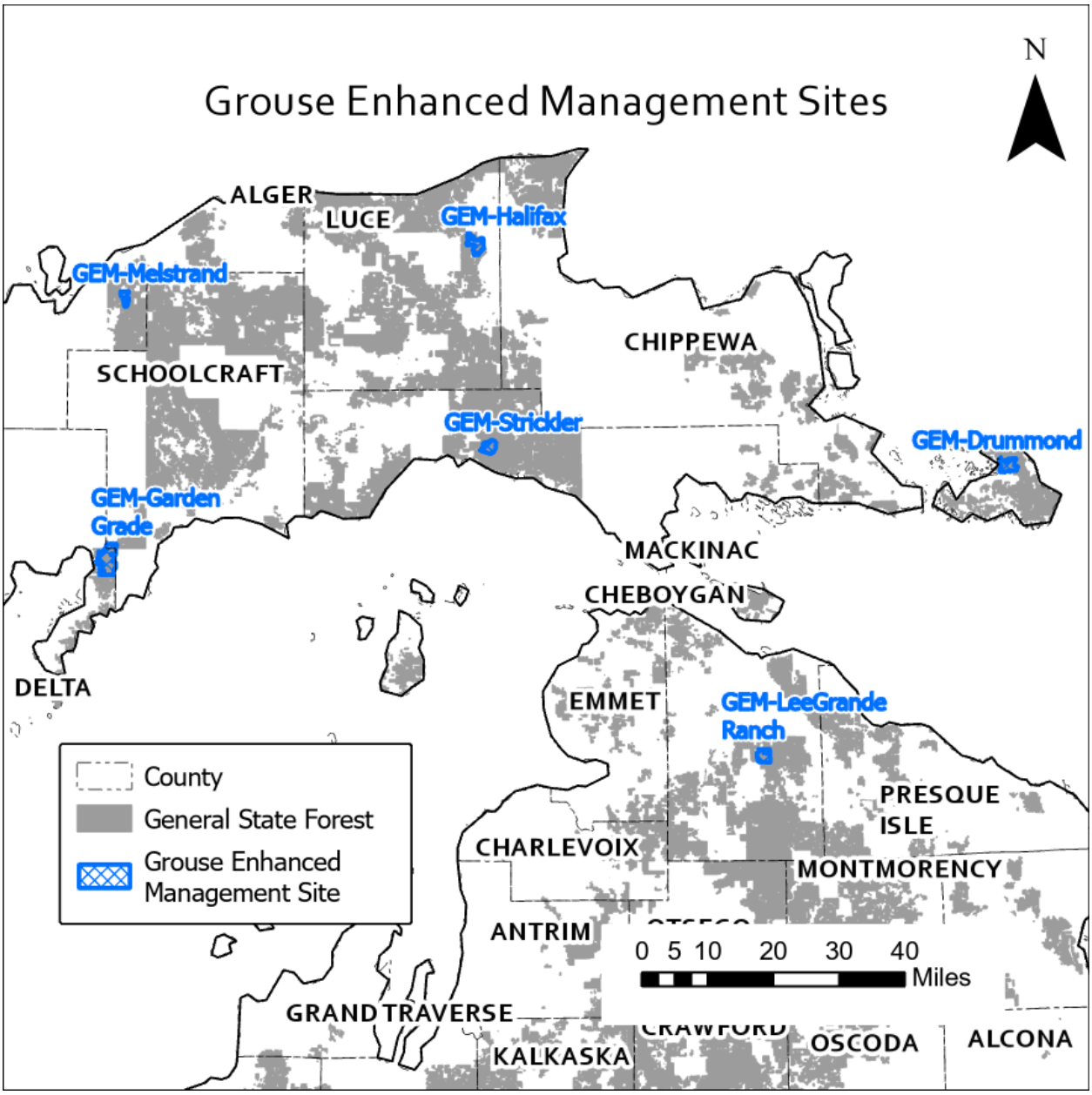

Figure 2. The geographic distribution of GEMS in the eastern Upper Peninsula.

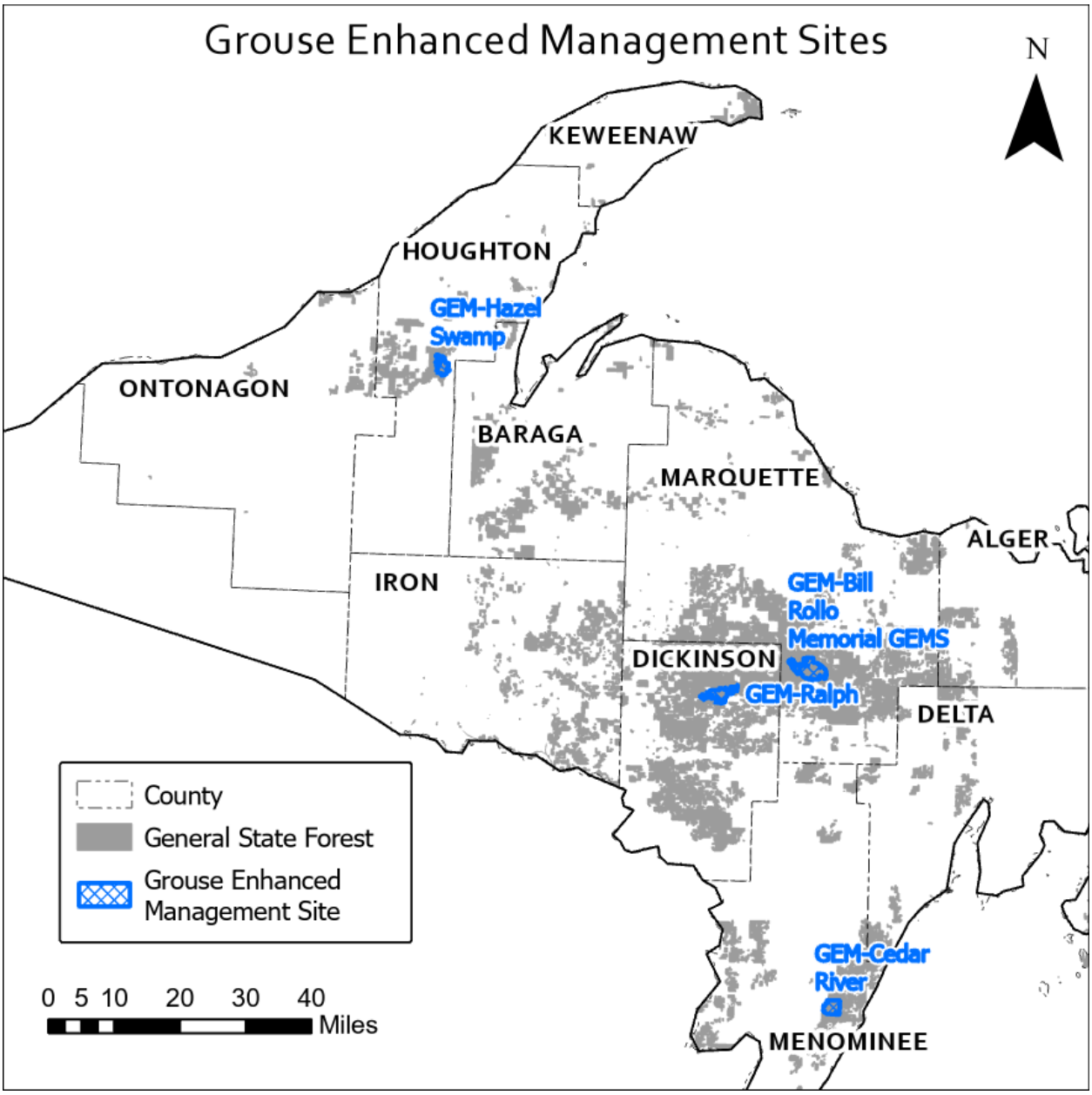

Figure 3. The geographic distribution of GEMS in the western Upper Peninsula.

Description

As part of a statewide grouse hunting improvement initiative, the Michigan DNR has created Grouse Enhanced Management System throughout the northern Lower Peninsula and the Upper Peninsula. These GEMS vary in size and configuration, but they are all intended to meet the following goals:

- Provide unique, walk-in-hunting opportunities.
- Promote hunter recruitment and retention.
- Expand local economies.
- Provide a destination for the traveling wing-shooter.
- Accelerate timber harvest opportunities.

To date, there are 15 established GEMS using intensive forest management to enhance grouse habitat and establish trail systems for walk-in hunting access. These areas are destinations for novice or traveling wing-hunters, as well as wildlife viewers and hiking enthusiasts. Though primarily for grouse, these intensively managed sites benefit other species including woodcock, turkey and white-tailed deer.

Special analysis unit goals

The primary goal of maximizing early successional habitat through accelerated timber harvests is represented in the SFMP model through a series of age class goals that incentivize the model to create and maintain an age class distribution designed with a relatively strict 40- to 50-year-old rotation age (Table 3).

Table 3. Rotation age of aspen types in GEMS across Michigan's state forest.

Grouse Enhanced Management Site	Rotation Age of Aspen Types
Backus Creek	40-49
Bill Rollo Memorial	40-49
Cedar River	40-49
Drummond	50-59
Garden Grade	40-49
Greasy Creek	40-49
Halifax	40-49
Hazel Swamp	40-49
Lame Duck	50-59
Lee Grande	40-49
Little Betsie	50-59
Mark Knee Memorial	50-59
Melstrand	40-49
Ralph	40-49
Strickler	40-49

Current and desired future conditions

Aspen stands will be harvested and regenerated shortly after they become commercially viable at a level that creates a relatively balanced condition of the aspen cover type across each site and maximizes the number of acres in the 0-9 and 10-19 age classes that are ideal for both ruffed grouse and American woodcock. The following graphs (Figures 4 through 16) represent projected future age classes and overall aspen abundance in each GEMS from the SFMP model.

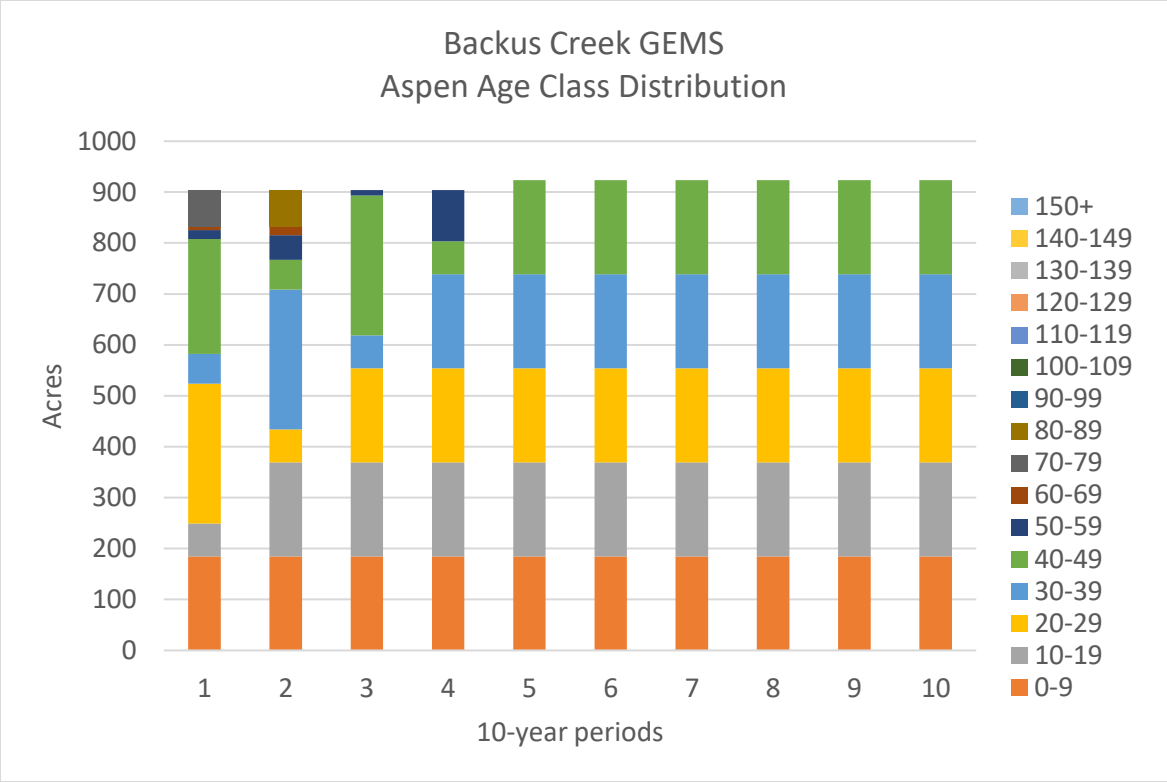

Figure 4. Projected aspen age class distribution across all 15 10-year model periods in the Backus Creek GEMS.

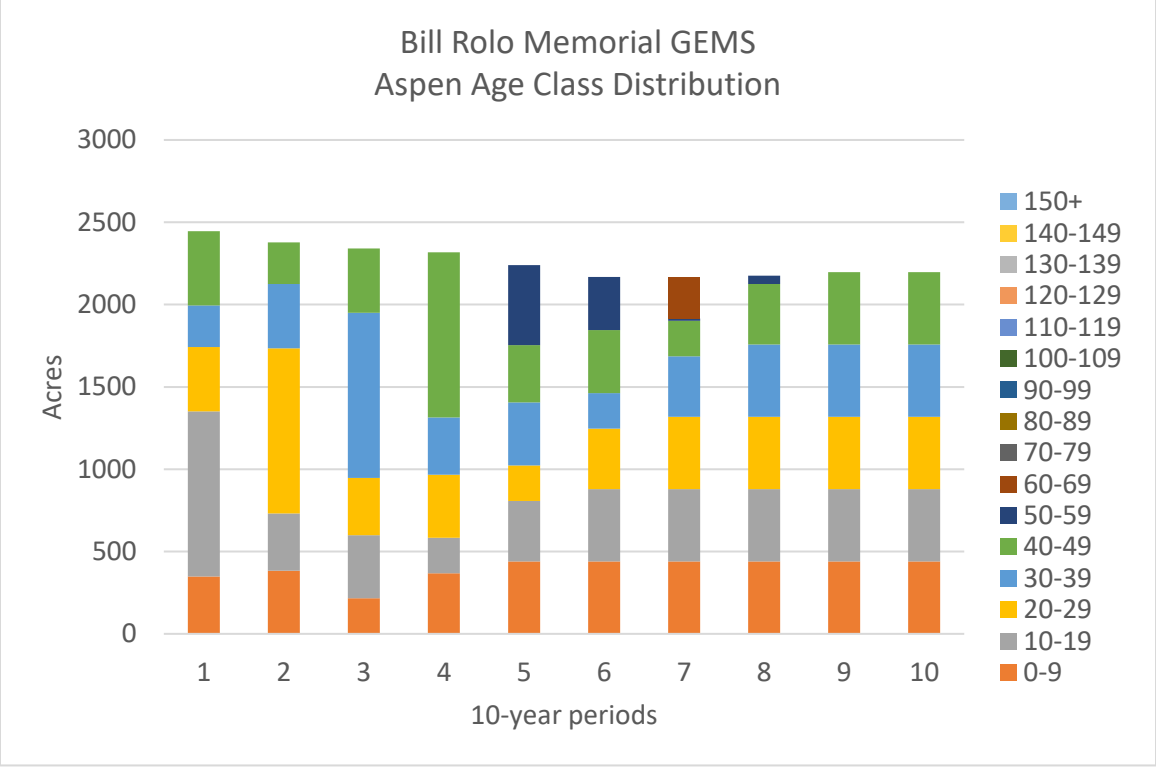

Figure 5. Projected aspen age class distribution across all 15 10-year model periods in the Bill Rolo Memorial GEMS.

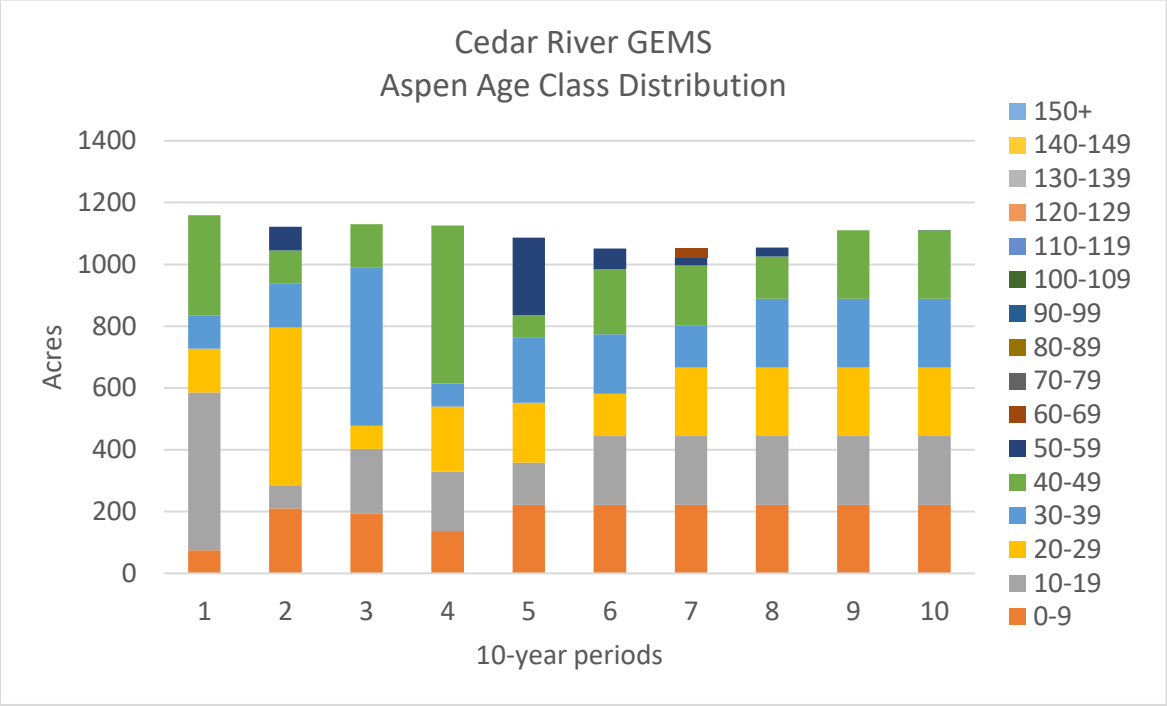

Figure 6. Projected aspen age class distribution across all 15 10-year model periods in the Cedar River GEMS.

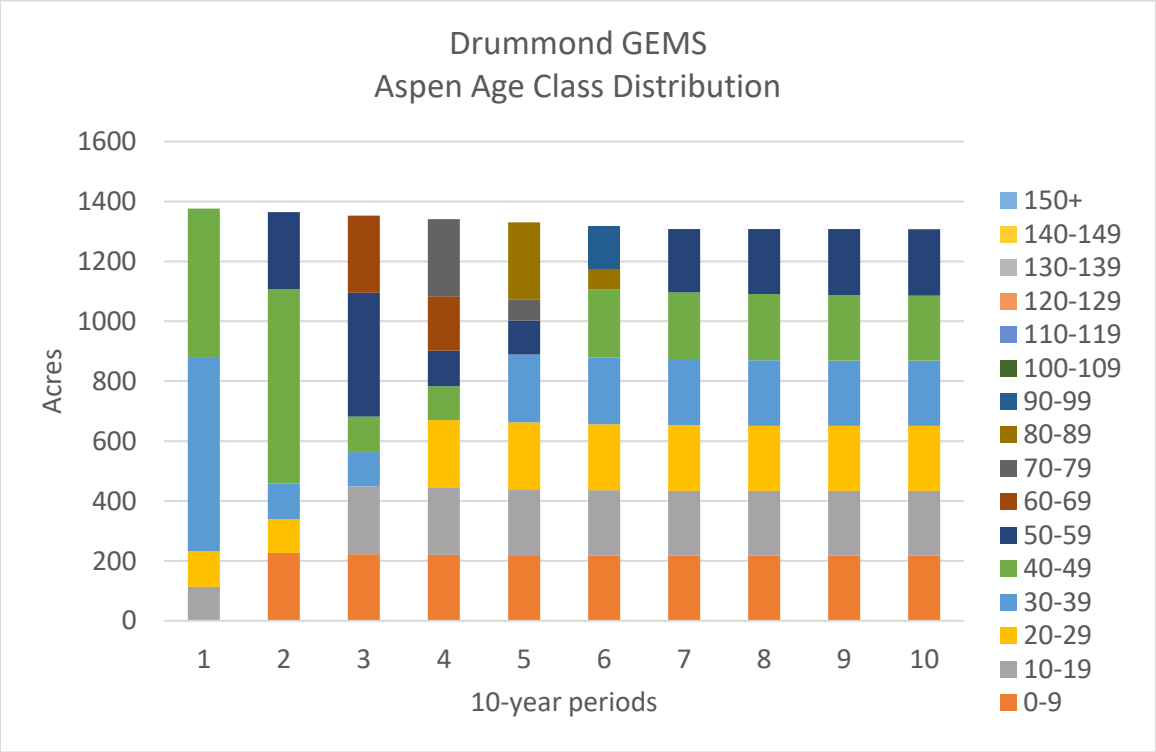

Figure 7. Projected aspen age class distribution across all 15 10-year model periods in the Drummond GEMS.

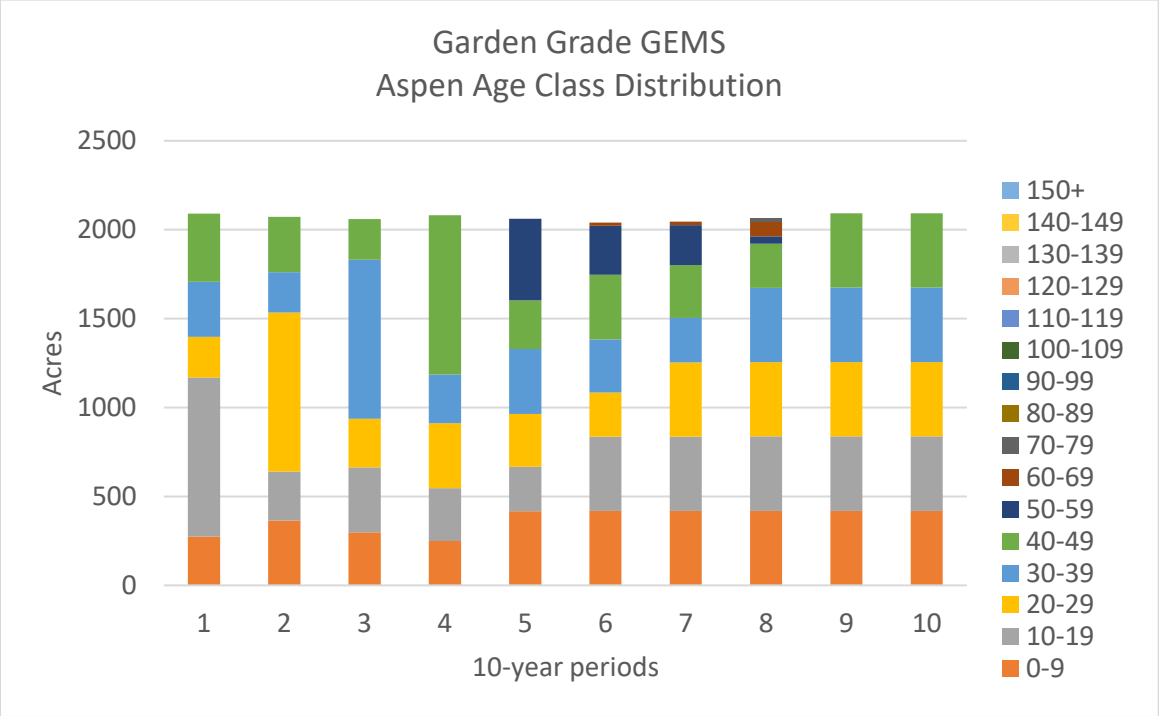

Figure 8. Projected aspen age class distribution across all 15 10-year model periods in the Garden Grade GEMS.

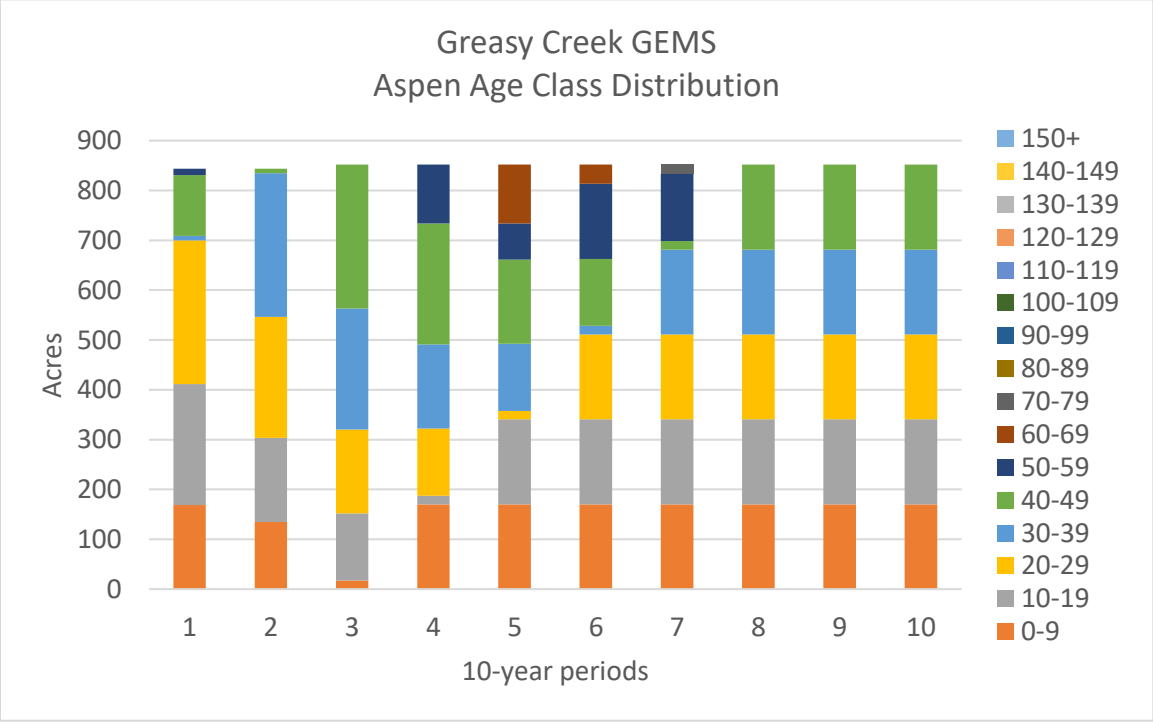

Figure 9. Projected aspen age class distribution across all 15 10-year model periods in the Greasy Creek GEMS.

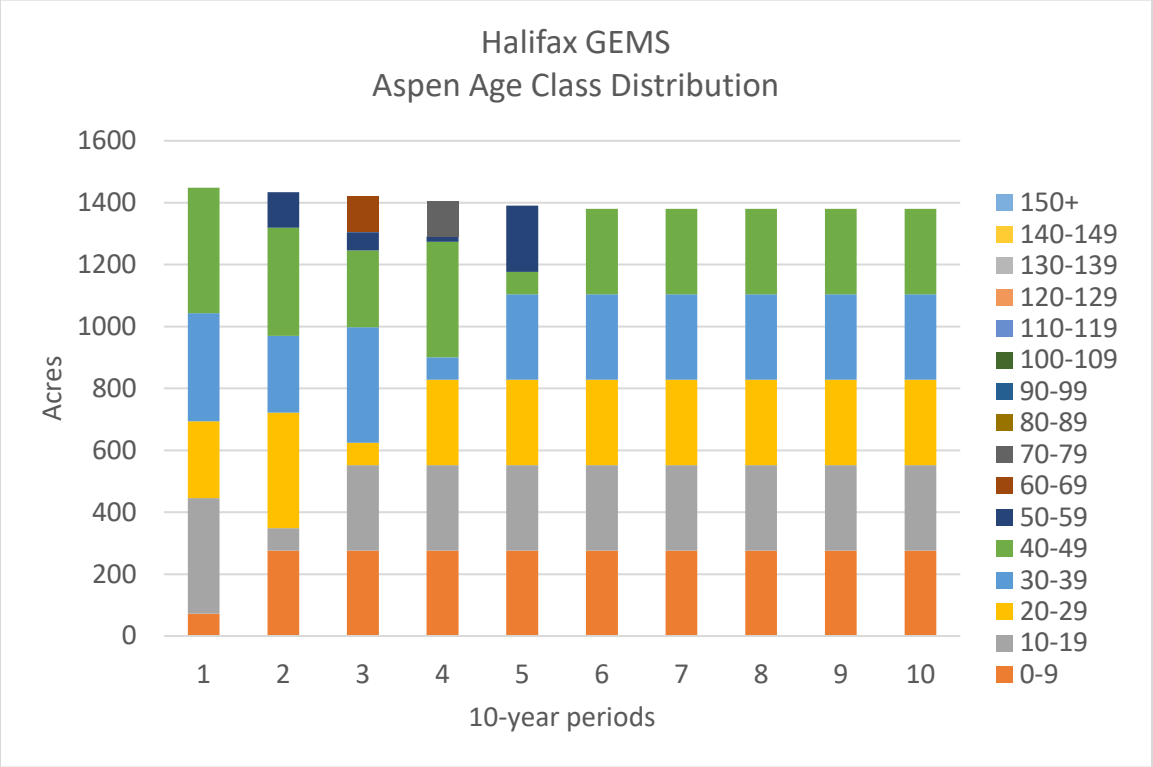

Figure 10. Projected aspen age class distribution across all 15 10-year model periods in the Halifax GEMS.

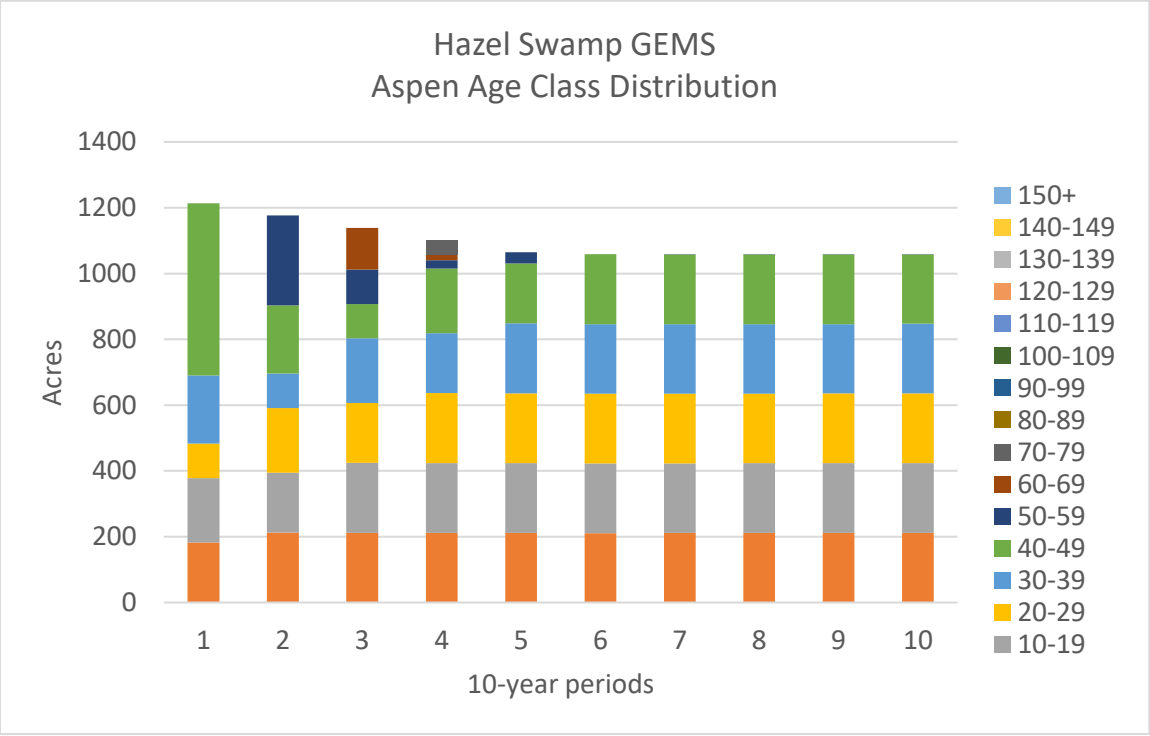

Figure 10. Projected aspen age class distribution across all 15 10-year model periods in the Hazel Swamp GEMS.

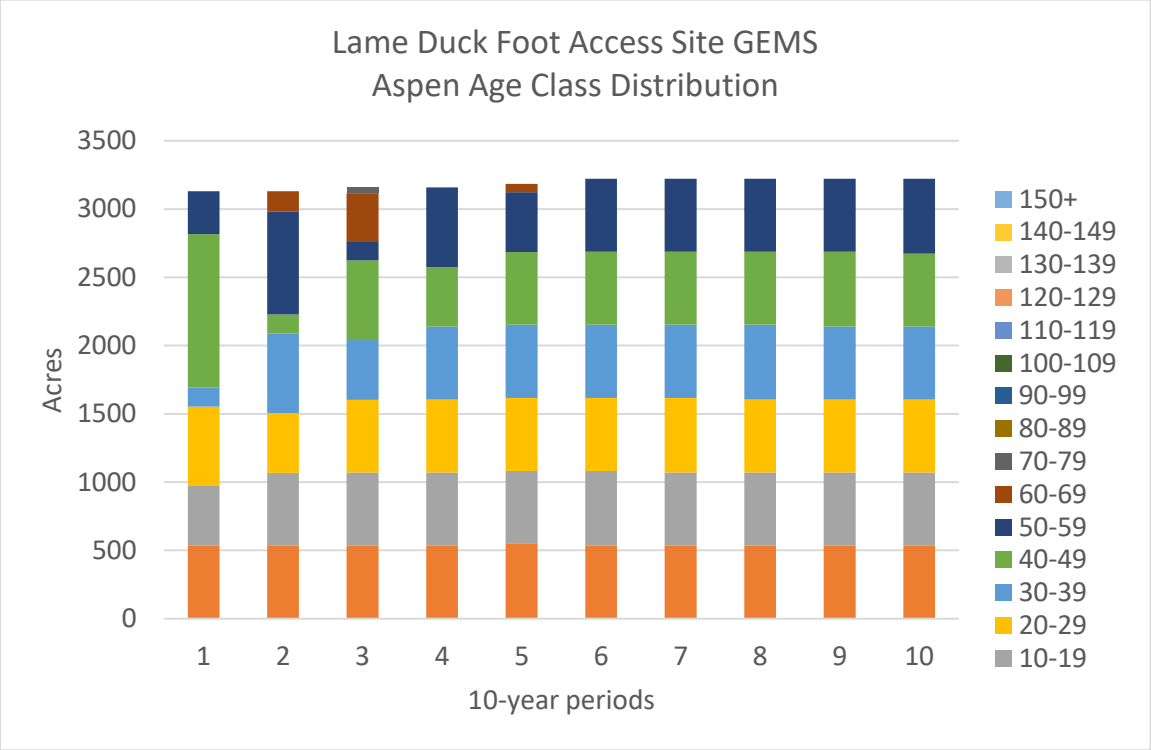

Figure 11. Projected aspen age class distribution across all 15 10-year model periods in the Lame Duck Foot Access GEMS.

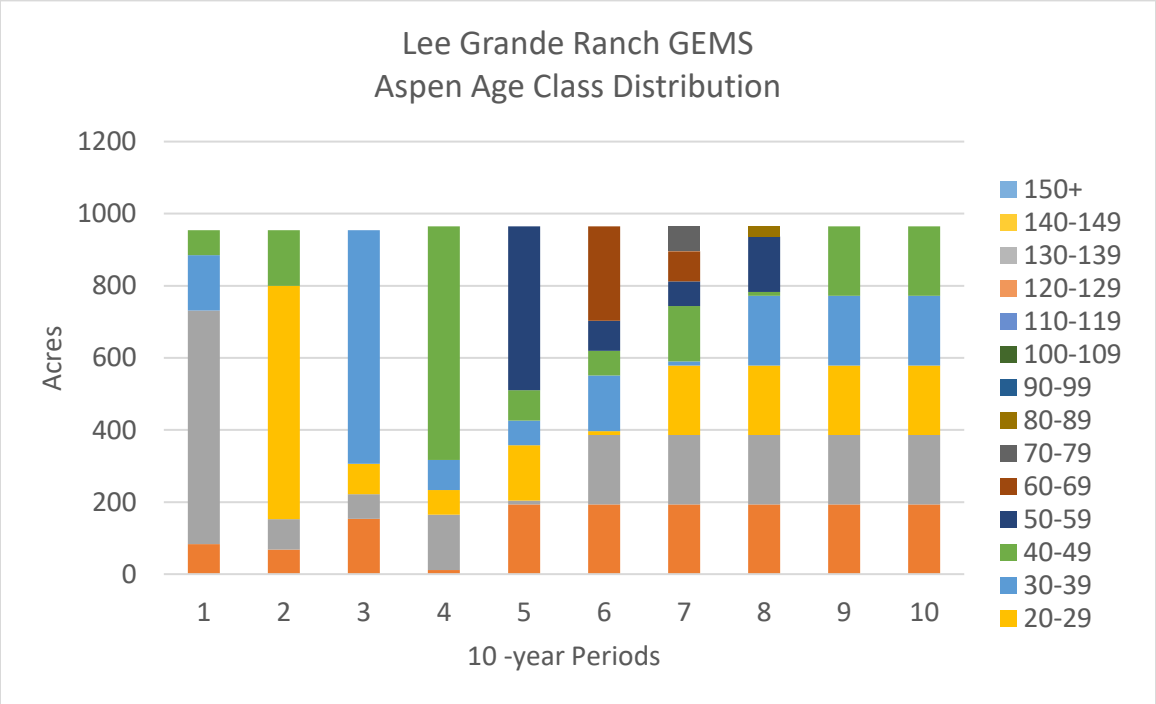

Figure 12. Projected aspen age class distribution across all 15 10-year model periods in the Lee Grande Ranch GEMS.

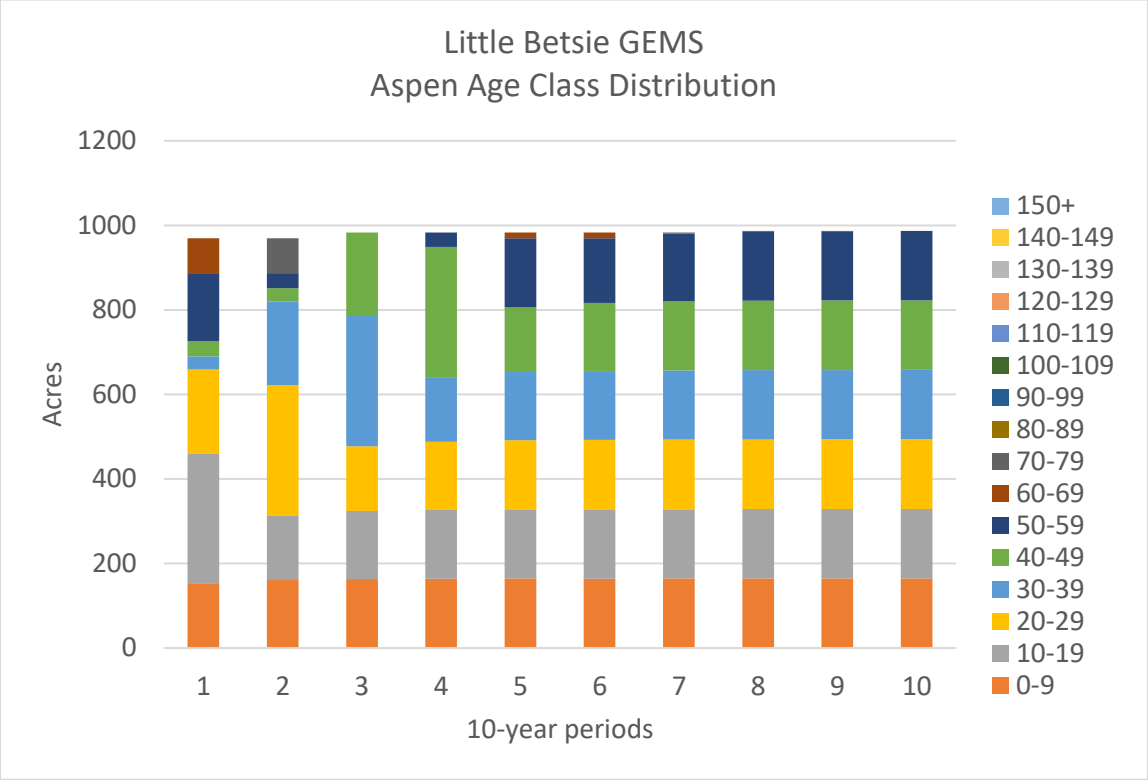

Figure 13. Projected aspen age class distribution across all 15 10-year model periods in the Little Betsie GEMS.

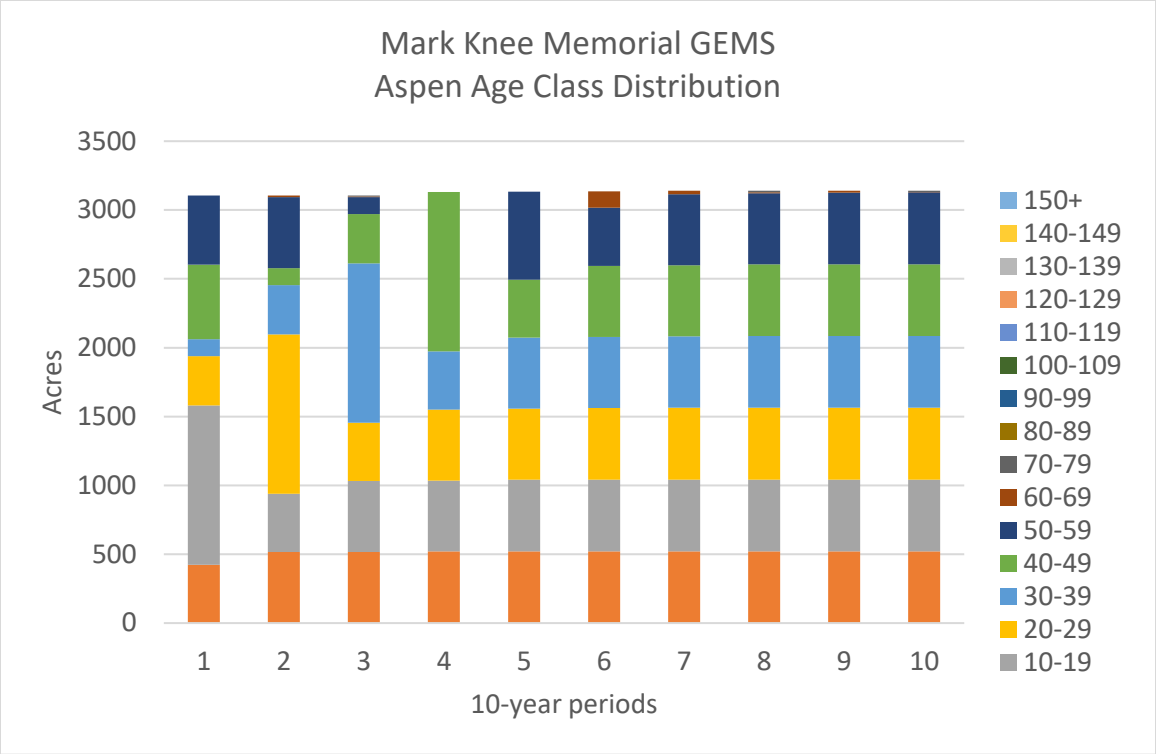

Figure 14. Projected aspen age class distribution across all 15 10-year model periods in the Mark Knee Memorial GEMS.

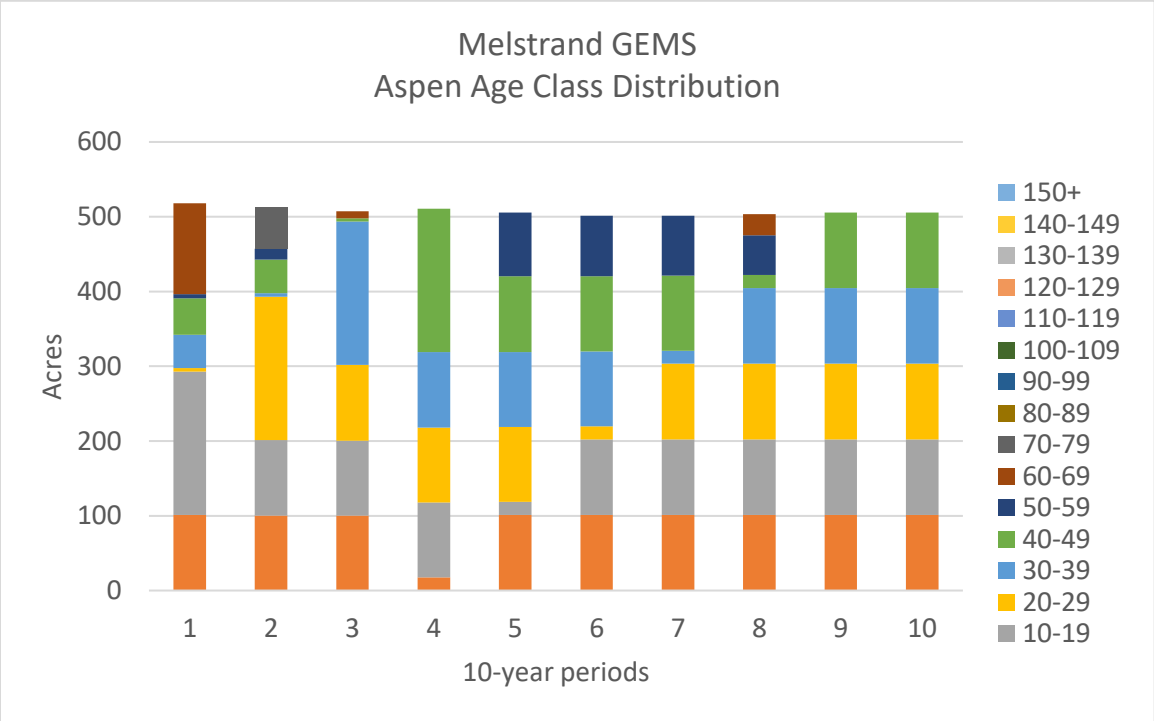

Figure 15. Projected aspen age class distribution across all 15 10-year model periods in the Melstrand GEMS.

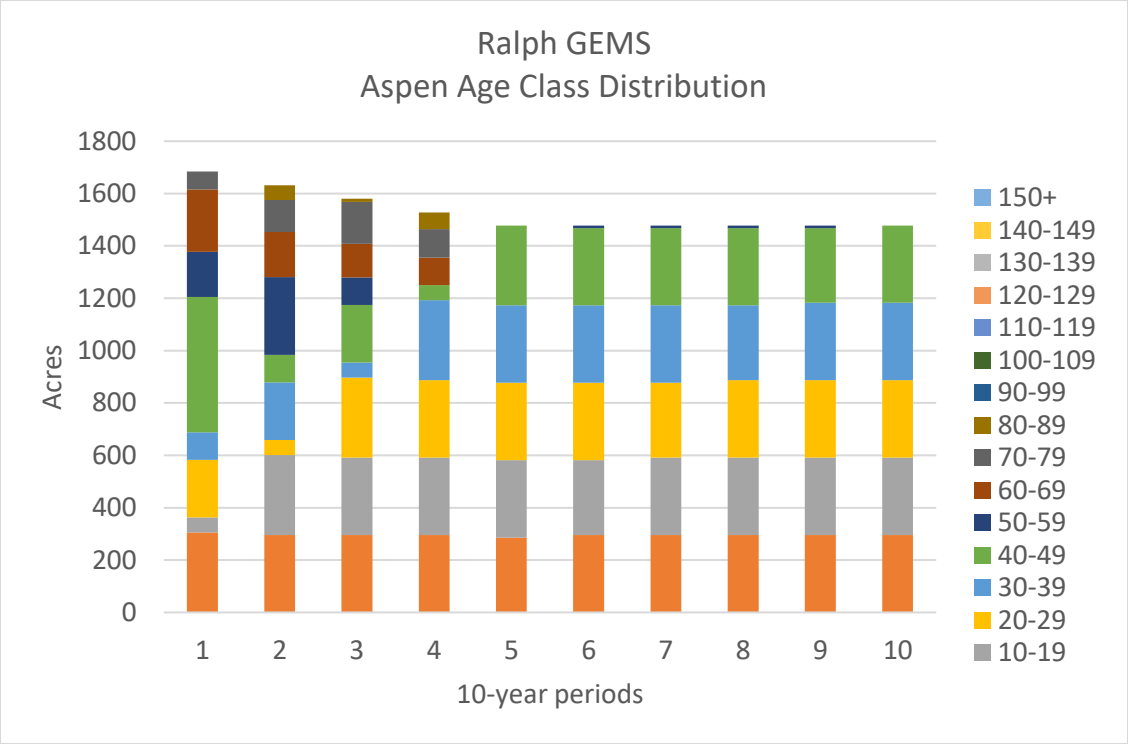

Figure 16. Projected aspen age class distribution across all 15 10-year model periods in the Ralph GEMS.

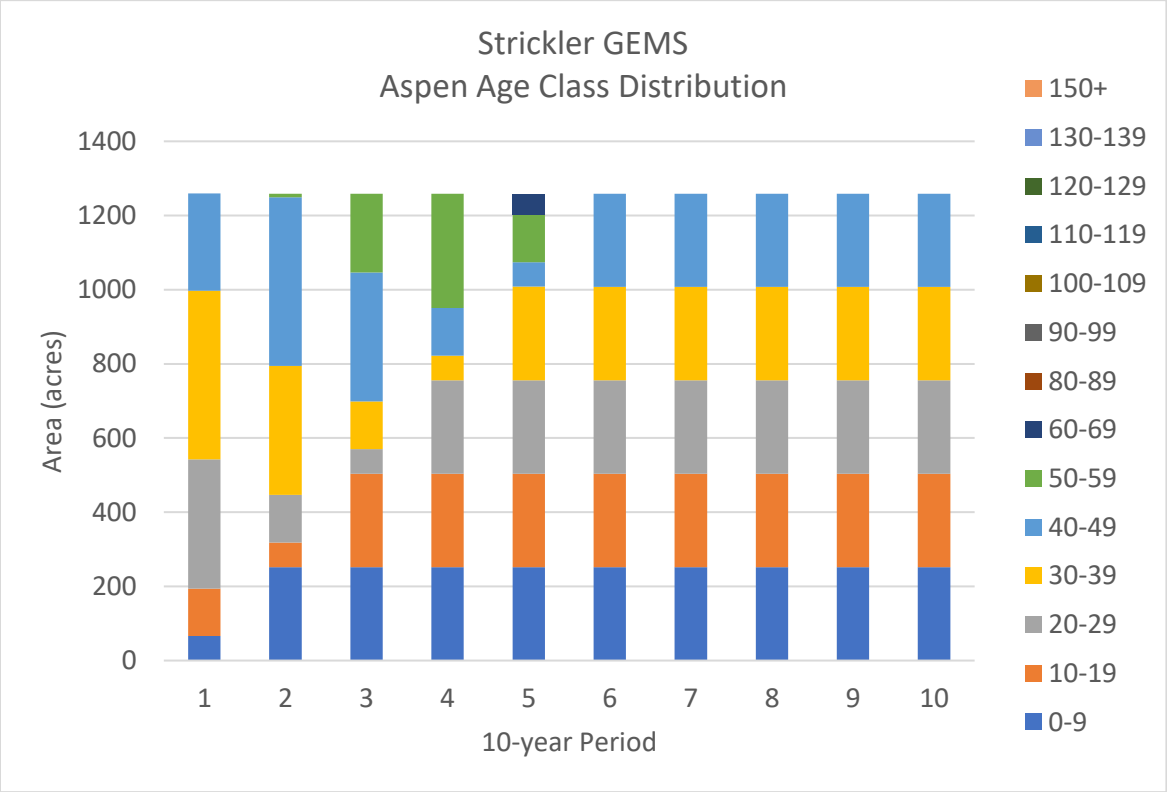

Figure 17. Projected aspen age class distribution across all 15 10-year model periods in the Strickler GEMS.

Management actions

The aspen age class distributions shown in the above graphs can be achieved over time by carefully regenerating the desired amount of aspen in each 10-year period. Projected aspen harvest levels for each GEMS for the next 10 years are shown Table 1.

Table 4. Projected 10-year aspen harvests in each GEMS site.

GEMS/Cover Type	Clearcut Acres
Backus Creek	**168**
Aspen	148
Lowland aspen/balsam poplar	20
Bill Rollo Memorial GEMS	**409**
Aspen	409
Cedar River	**87**
Aspen	87
Drummond	**38**
Lowland aspen/balsam poplar	38
Garden Grade	**287**
Aspen	287
Greasy Creek	**170**
Aspen	170
Halifax	**72**
Aspen	72
Hazel Swamp	**223**
Aspen	214
Lowland aspen/balsam poplar	8
Lame Duck Foot Access Area	**1,070**
Aspen	535
Lowland aspen/balsam poplar	535
Lee Grande Ranch	**88**
Aspen	84
Lowland aspen/balsam poplar	5
Little Betsie	**153**
Aspen	153
Mark Knee Memorial GEMS	**410**
Aspen	410
Melstrand	**111**
Aspen	111
Ralph	**397**
Aspen	358
Lowland aspen/balsam poplar	39
Strickler	**66**
Aspen	10
Lowland aspen/balsam poplar	56

GEMS/Cover Type	Clearcut Acres
Grand Total	**3,683**

Kirtland’s Warbler Essential Habitat

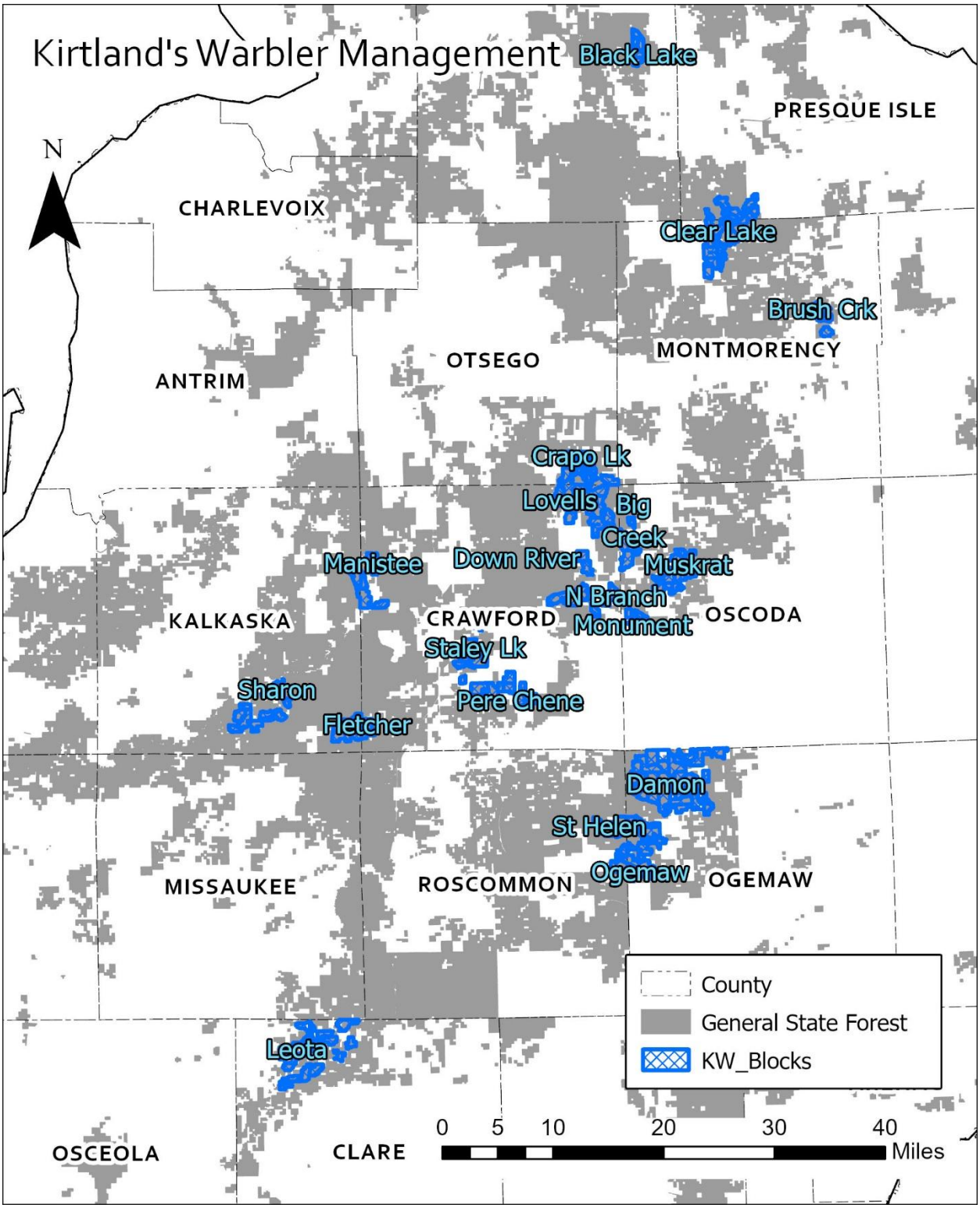

Figure 1. Kirtland’s Warbler Special Analysis Unit geographic distribution in the northern Lower Peninsula.

Description

The Kirtland's Warbler Habitat Management Special Analysis Unit (Figure 1) is comprised of 90,273 acres spread across the northern Lower Peninsula on xeric outwash plains where jack pine is commonly found growing naturally and aligns with the Kirtland's warbler essential habitat high value conservation area.

Special analysis unit goals

Typically, SAU goals are derived from habitat goals defined in a DNR species plan. When the draft of this State Forest Management Plan went out for tribal and public review in 2024, the Kirtland's warbler SAU goals reflected what is in the 2022 DNR Kirtland's warbler operational plan. Since then, in 2025, the DNR's Kirtland's warbler planning team completed a habitat program reassessment and made some notable and necessary changes, including updates to the habitat goal. This renders the operational plan outdated, and it will be revised once the revised version of the species' breeding range conservation plan is finalized and approved, anticipated by late 2026.

In the meantime, there was no opportunity to provide updated model outputs for the SAU with the new habitat goal number. Instead, data from the habitat program planning effort is provided for transparency.

The previous habitat goal for the decade was to create 15,600 acres of habitat to support 750 breeding pairs of Kirtland's warblers on state forest land in the northern Lower Peninsula, with an additional commitment to manage for 50 birds in the Upper Peninsula. After the reassessment, the goal is now 12,080 acres of habitat creation over the next decade, to support approximately 700 birds on state forest land in the northern Lower Peninsula, with the same commitment to manage for 50 birds in the U.P. The goal decrease is due to an increase in the rotation age and the difference between the total acres of essential habitat used in previous calculations versus the acres within essential habitat that can actually be managed for jack pine. The actual manageable land base is 84,573 acres once lowland, aspen and other similar cover types are removed from calculations. The decadal habitat creation goal of 12,080 acres represents what can reasonably and sustainably be achieved long-term.

Once the State Forest Management Plan is in the implementation phase, the DNR's Kirtland's warbler planning team will turn back to the SFMP model and use the opportunity to update the SAU.

Current and desired future conditions

The management framework in the 2022 DNR KW operational plan uses six age classes and is not likely to produce commercially viable jack pine stems at 50-59 years old given the average planting densities of 1,452 stems per acre. Recognition of this shortly thereafter prompted extensive analysis of the current condition and desired future condition of Kirtland's warbler essential habitat. Data from Dr. David Rothstein (Michigan State University) showing the diameter differences in jack pine suggested that the rotation age should be increased to 60 years, resulting in an age class distribution with seven age classes. Further, it was revealed that there is a current deficit in commercially viable jack pine and red pine to support harvesting and regeneration needs to create a desirable level of habitat for warbler breeding requirements. This is because the age class distribution of jack pine in essential habitat skews young; most of the acres are under 40 years old, which doesn't leave enough in the older, commercially marketable age classes to meet the habitat goal. To address this gap, the planning team identified the potential for commercial harvest in the 30-year age class for the biomass market and for mastication in

the 20-year age class as ways to supplement annual habitat creation and ensure the goal is met. Mastication is the use of a forestry mower to mulch small-diameter trees, and in this case it would be used across a stand to restart habitat.

The challenge was to figure out how many supplemental acres of younger age classes could be harvested commercially and marketed for biomass, as well as how many acres needed to be cleared using mastication to prepare sites for planting. The Woodstock model offered the opportunity to run various scenarios. In 2022, the modeling team evaluated the current condition of the stands that were eligible to receive one of three treatments based on their age and relative average stem diameter:

1. Commercial roundwood production (60-plus years old).
2. Biomass (30-39 years old).
3. Mastication (20-29 years old).

A model scenario was developed for the Kirtland's Warbler Special Analysis Unit using an objective function to minimize mastication and fill in with as little biomass as possible for the first period, also supplementing with the areas that were commercially viable for roundwood production, all while trying to maintain enough habitat to support 750 breeding Kirtland's warbler pairs in the northern Lower Peninsula, which was thought possible at the time. Transitions were also specified to convert eligible stands to planted jack pine whenever possible to maximize the amount of area available for habitat creation. The model solution for projected harvest levels by type and period are shown in Figure 2.

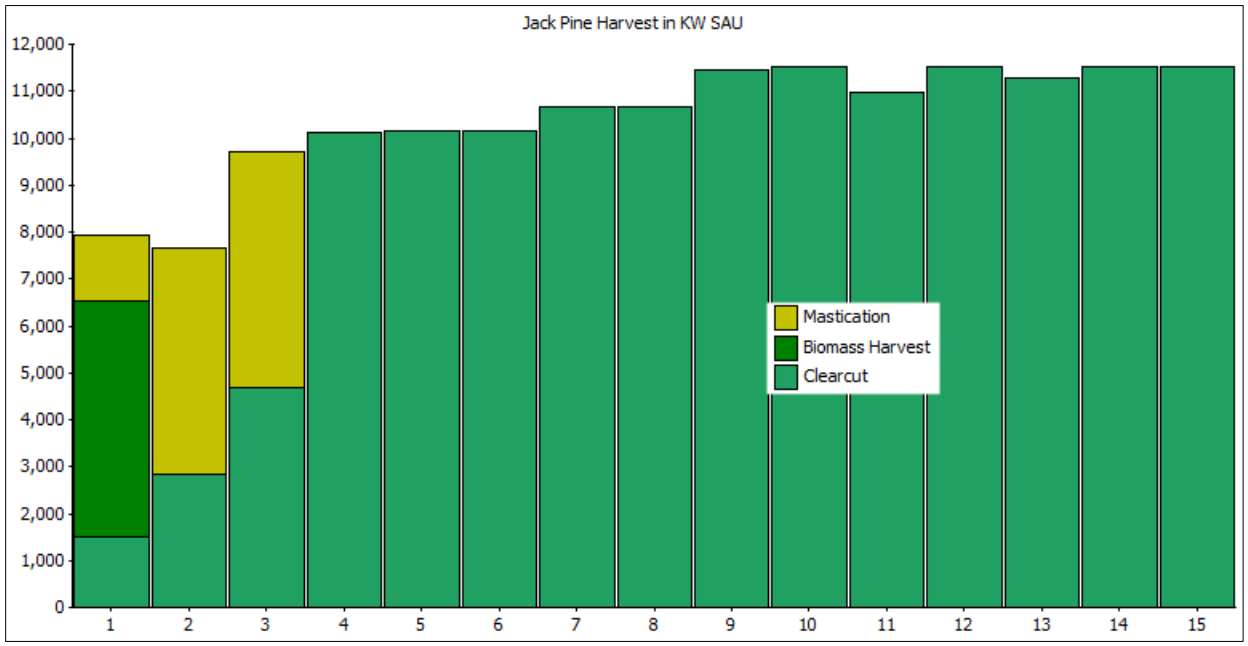

Figure 2. Acres of jack pine harvest/site clearing by method in the Kirtland's Warbler Special Analysis Unit from the 2022 SAU model.

The jack pine harvest (and mastication) levels above for each period provided a plausible solution to minimize mastication treatments and supplement with commercial harvests to return to a long-term sustainable solution that uses only traditional clearcut harvests producing a viable pulpwood/roundwood product. Additional acres of harvest from other cover types like planted red pine

are also forecasted and will be converted to jack pine in each period, resulting in a gradual increase in jack pine across the warbler unit (Figures 3, 4).

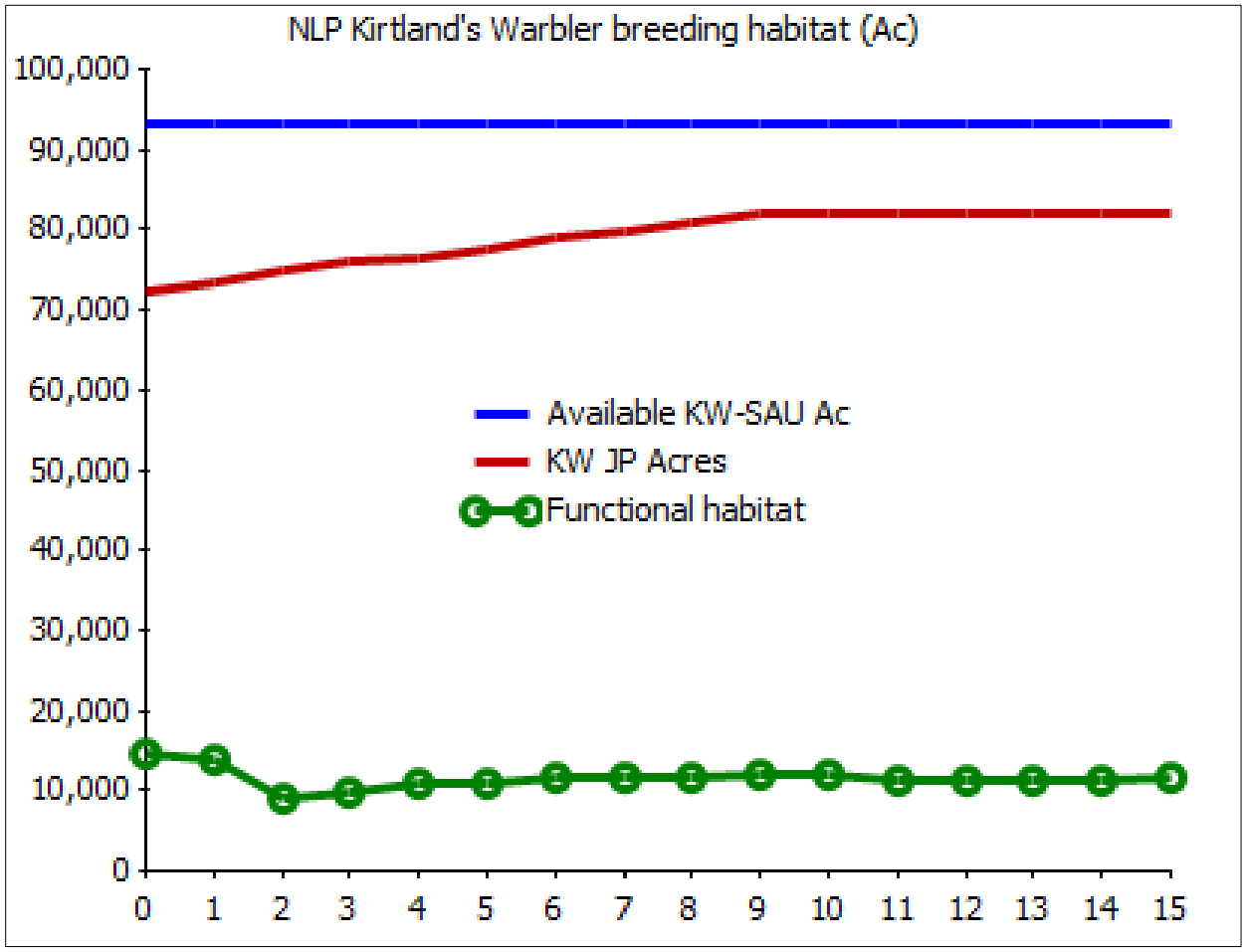

Figure 3. Kirtland's warbler jack pine and functional habitat acres in the special analysis unit from the 2022 SAU model.

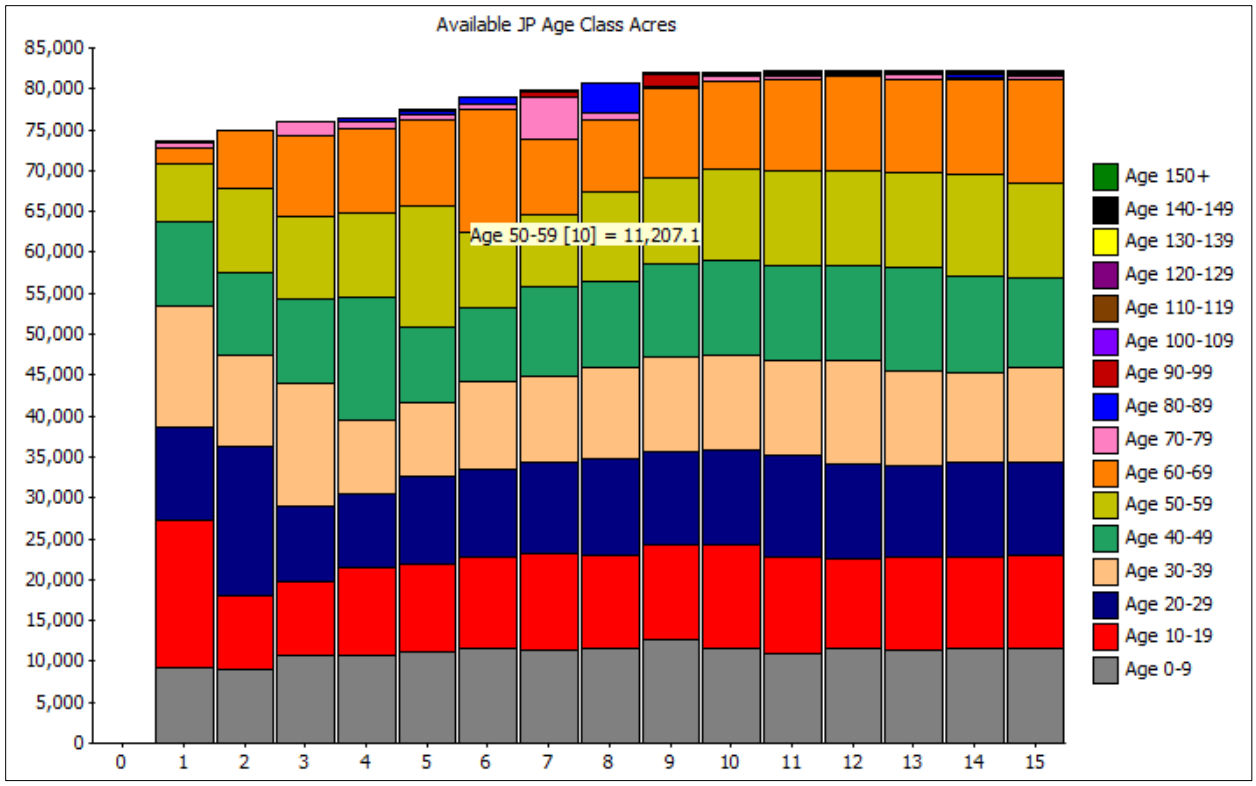

Figure 4. Projected jack pine age class distribution across the Kirtland's Warbler Special Analysis Unit in each 10-year period from the 2022 SAU model.

The model also projected the number of breeding pairs over time. Due to a lack of habitat in the first two periods, the results show a decline from current numbers before rebounding and leveling off as a more sustainable level of harvest is achieved (Figure 5).

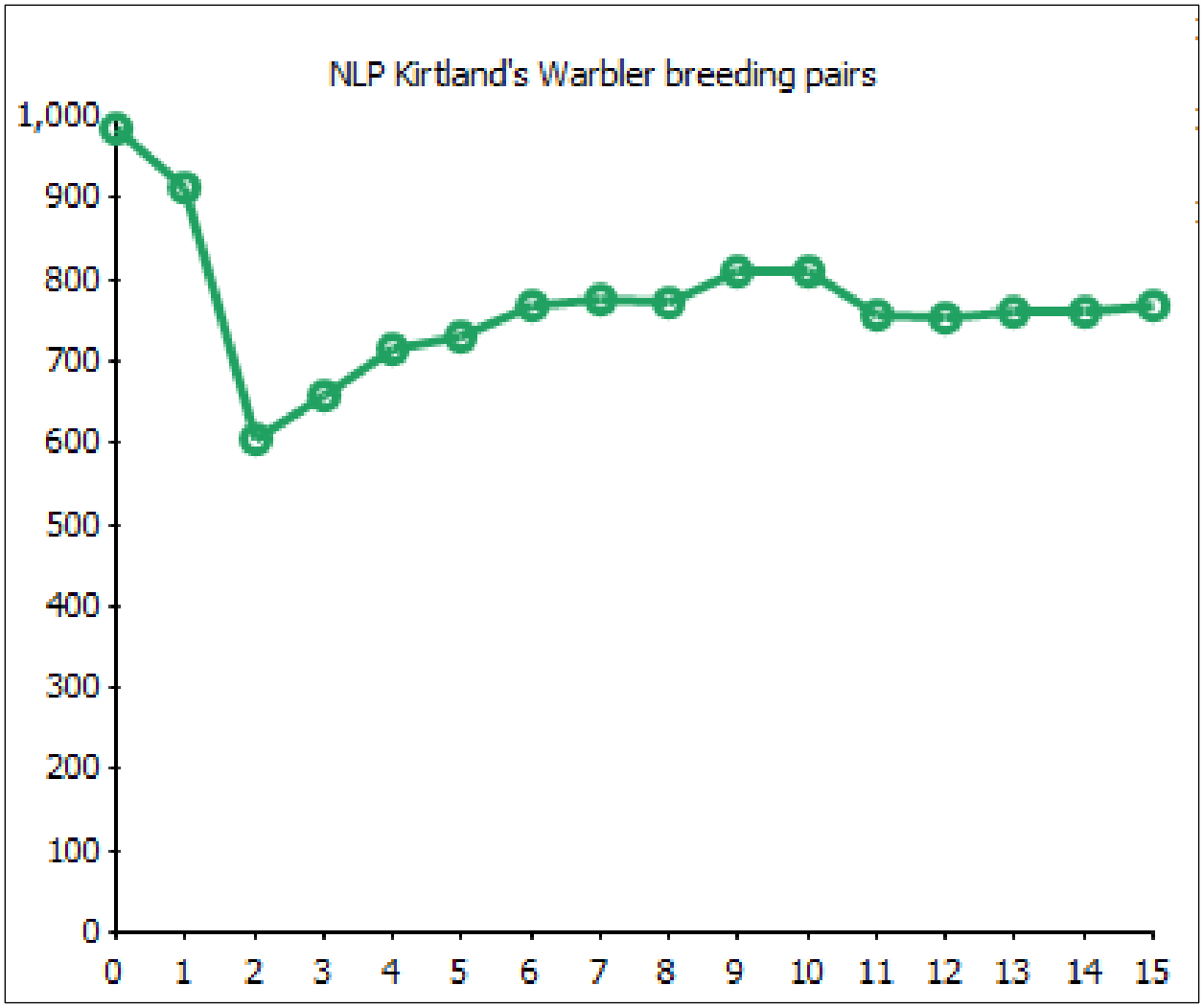

Figure 5. Projected number of breeding pairs of Kirtland's warblers on state forest land in the northern Lower Peninsula from the 2022 SAU model.

Since the SAU model was run in 2022, the planning team has continued to refine the habitat management program. This has included revisions to essential habitat boundaries to reduce the area that can't be managed for jack pine, an increase in the minimum management block size (300 to 500 acres) where possible, the purchase of a masticator through a grant with a minimum acreage commitment and finer resolution of the manageable land base for Kirtland's warbler within essential habitat. This refers to only those acres that can be managed for jack pine; there are many small areas of lowland, aspen and other cover types interspersed within essential habitat.

The result of both the model run and the subsequent program revisions is that, within a commercial pulpwood framework, the habitat goal must be reduced to be sustainable long-term. To balance seven age classes across the manageable land base, the new decadal habitat goal is 12,080 acres. The reduction in habitat creation is expected to be offset by the gradual increase in patch size to a minimum of 500 acres, creating habitat that will support higher bird densities. Larger habitat patches (minimum of 300 and maximum of 1,200 acres) across the landscape are expected to result in bird densities nearing

15 acres per breeding pair, sustaining around 700 breeding pairs on state forest land in the northern Lower Peninsula. Though management is intensive, maximizing bird densities within the Kirtland's warbler essential habitat footprint allows for the ability to manage for other values in other places.

Management actions

Even though the 2022 SAU model uses some outdated numbers, and thus can't be used to generate specific harvest goals for the planning period, the feasibility it showed in using alternate treatment methods to eventually balance age classes and maintain bird numbers is still informative in treatment planning. The following 12-year management actions (Table 1) were developed by the planning team in 2025 and serve as the current habitat treatment plan until the SAU can be updated in the SFMP model. The 12-year total is slightly higher than expected when applying a 12,080-acre decadal habitat goal. However, given that the model projects an initial downturn in both habitat and bird numbers, the slight increase in acreage this represents is anticipated to help offset those without getting too far off track. Further, planned acres and timing are always subject to operational adjustments; the planning team will monitor and adjust annually throughout implementation.

Prescribed fire was not included in the SAU model run, but since then, there has been growing interest in attempting to add it as a management tool. Some sites were identified as options by the planning team, which are reflected in the planned management actions. However, uncertainties remain related to safety, funding and feasibility, such that the acres listed here may change, be delayed or be transferred to one of the other treatment methods.

Following this plan will help to provide enough Kirtland's warbler breeding habitat to support a sustainable population given the current condition of the forested landscape.

Table 1. Planned treatment acres by treatment type within the Kirtland's Warbler Special Analysis Unit over the next 12 years.

Treatment Preparation Year	Biomass	Clearcut	Mastication	Rx Burn	Total Acres
2026	394	1,128	674	207	**2,403**
2027	1,076	25	798	--	**1,900**
2028	457	161	503	280	**1,401**
2029	947	159	--	--	**1,106**
2030	360	639	--	--	**1,000**
2031	839	130	109	--	**1,078**
2032	1,328	190	64	144	**1,726**
2033	--	449	254	--	**703**
2034	247	292	--	--	**539**
2035	--	--	905	--	**905**
2036	1,213	--	--	--	**1,213**
2037	758	344	--	--	**1,102**
2038	634	90	203	--	**927**
Total Acres	**8,252**	**3,607**	**3,509**	**631**	**16,000**

Deer Wintering Complexes

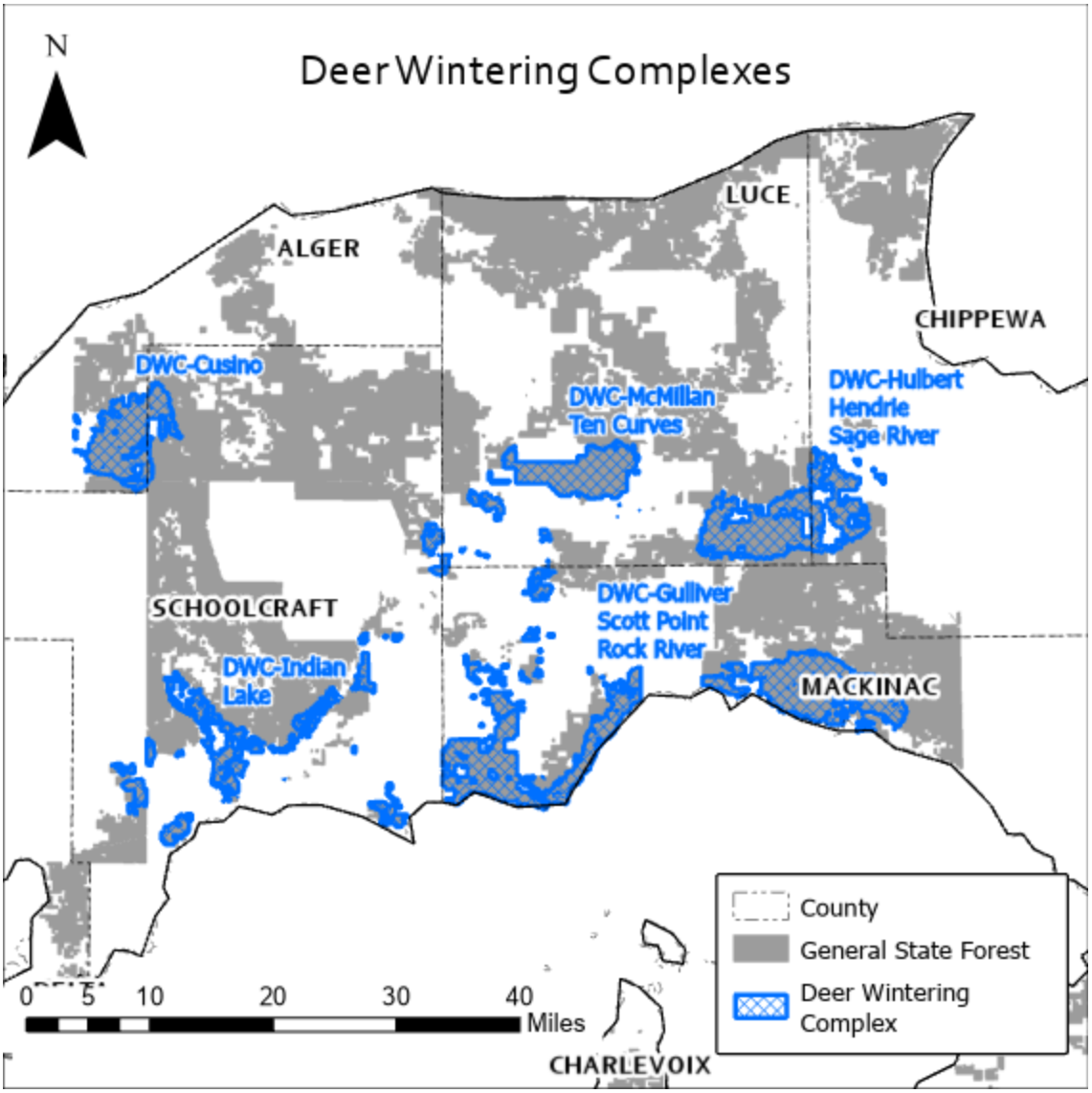

Figure 1. Geographic distribution of the eastern Upper Peninsula deer wintering complex special analysis units.

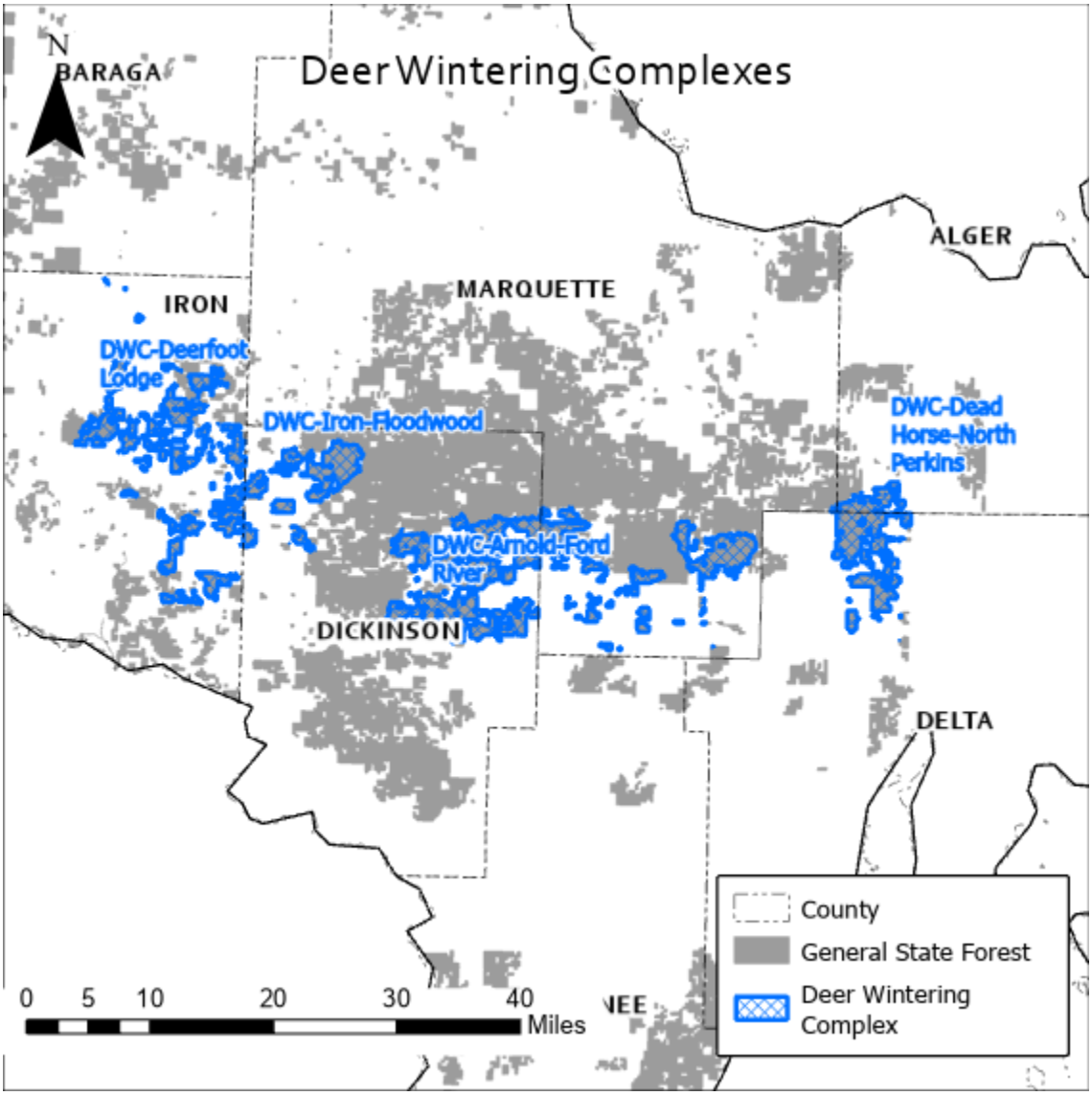

Figure 2. Geographic distribution of the western Upper Peninsula deer wintering complex special analysis units.

Description

Deer wintering complexes included in this planning effort as a special analysis unit contain greater than 15,000 acres of state forest land and have a management plan already in place. Guidance for the modeling work specific to the wintering complexes was pulled from these plans and incorporated into the model in various ways. A summary of the important components of complexes can be found in each plan. An example from the Hulbert-Sage River Deer Wintering Complex Management Plan states:

> *In most of Upper Michigan, deer begin migrating to wintering complexes when snow accumulates between 12-18 inches, typically in mid-late December. Deer remain on their winter ranges until snow melts in spring and their mobility is restored. This confinement period on winter range can vary from 60 days to well over 100 days during an especially long winter. Significant winter-related deer deaths plus reduced physical condition and*

high newborn fawn mortality occur with durations of 90-100 days with greater than 12 inches of snow covering the ground. The U.P. winters of 1996 and 2014 had winter durations greater than 100 days and are remembered as especially severe for deer. To survive these long confinement periods on winter range, deer seek locations that provide both shelter and food suitably interspersed across the landscape.

Conifer stands with high canopy closure provide deer with shelter by reducing snow depths beneath the canopy and facilitating movement via extensive connected packed trails. Trail systems provide easier access to food and also assist deer in evading predators. These shelter stands also reduce wind chill and perhaps radiant heat loss. Shelter is defined by several categories:

- *Functional Shelter: Conifer stands with at least 70% canopy closure and tree heights greater than 30 feet. These thresholds for canopy closure and height ensure the stand is effective at intercepting snow, resulting in decreased snow depths and increased mobility for deer to access food and avoid predators.*
- *Primary Shelter Species: Cedar and hemlock trees provide the best functional shelter as they intercept larger amounts of snow than other conifers. These species also are a favored winter food source which makes them difficult to regenerate and recruit back into the stand canopy. These species are long lived, however, and on some sites may survive 400 years or more. Most stands in the UP are 100-200 years old.*
- *Secondary Shelter Species: White spruce, balsam fir and white pine intercept less snow than cedar and hemlock but contribute to functional shelter especially when mixed with cedar and hemlock trees. These trees also provide feeding corridors through hardwood stands and shelter during periods of lower snow depth. Often these species occur as a component of mixed stands in the transitions between upland and lowland, such as in red maple stands.*

Food is an integral habitat component for deer in winter. While adult deer can enter winter with sizeable fat reserves, fawns have not yet completed skeletal growth and therefore carry smaller percentages of fat. Thus, fawns must have dependable access to food to survive the winter. Some key sources of winter food are:

- *Cedar and hemlock fronds where accessible.*
- *Litter fall – cedar and hemlock fronds, hardwood stems, and lichens dropped due to wind and snow action.*
- *Hardwood browse – most of the browse is available in aspen, red maple and northern hardwood stands, either as felled tops from winter timber harvest activity or as regenerating stems of trees and shrubs such as red-osier dogwood in years following timber harvests or natural disturbances such as windfall.*
- *Oak acorns –deer are able to access acorns early and late in the winter as snow depths allow.*

- *Spring herbaceous foods – forest openings inside and adjacent to DWC's often provide protein-rich food for several weeks in spring and fall before deer enter or vacate the complexes.*

Seven individual outputs were created for the State Forest Management Plan model that helped add up acres of each component that was at the cover-type level.

1. **All shelter** – All acres in the shelter cover types regardless of age and stocking:
    a. Hemlock
    b. Cedar
    c. Lowland conifers
    d. Upland conifers
    e. Upland spruce fir
    f. Lowland spruce fir
    g. Planted red pine
    h. Planted white pine
    i. Natural red pine
    j. Natural white pine
    k. Natural mixed pine
2. **Primary shelter** – Acres of the following cover types:
    a. Hemlock
    b. Cedar
3. **Secondary shelter** – Acres of the following cover types:
    a. Lowland conifers
    b. Upland conifers
    c. Upland spruce fir
    d. Lowland spruce fir
    e. Planted red pine
    f. Planted white pine
    g. Natural red pine
    h. Natural white pine
    i. Natural mixed pine
4. **Functional shelter** – A subset of acres in the cover types that have a/an:
    a. Age greater than or equal to 40 years old
    b. Diameter greater than or equal to 4 inches
    c. Canopy cover greater than or equal to 51%
5. **All food** – Acres in the food cover type regardless of age and stocking:
    a. Aspen
    b. Lowland aspen
    c. Northern hardwoods
    d. Lowland deciduous
    e. Upland mixed forest
    f. Lowland mixed forest
    g. Oak mix
6. **Functional food** – A subset of acres in the "all food" cover types dependent on age:
    a. Age classes 0-9 and 10-19 (providing browse opportunities)
7. **Functional food** – Northern hardwood selection harvest:
    a. Food created as tops are left from the harvest

These thematic outputs generated acres of each component specific to each deer wintering complex so they could be used in the goal statements as well as graphics displaying scenario results.

Special analysis unit goals

The overall long-range goal of the deer wintering complexes is to reach a 50:50 ratio of shelter and food types in each complex while providing a consistent flow of food resources available to wintering deer. The management of deer wintering complexes is focused on providing and maintaining deer habitat over maximizing timber harvest.

Specific goals were extracted from the Hulbert – Sage River Deer Wintering Complex Management Plan but remain consistent across the other wintering complexes.

Deer winter range goal:

1. Sustainably manage shelter and food resources on deer winter range to reduce overwinter deer population fluctuations by:
    a. Maintaining or enhancing conifer shelter, thereby facilitating deer movement to obtain food.
    b. Providing high-quality food adjacent to shelter.

Deer wintering complex objectives:

2. Move toward 50% of the complex in shelter species.
    a. Maintain primary shelter (cedar and hemlock).
    b. Increase secondary shelter (white spruce, balsam fir, white pine and mixed stands) when below 50%.
3. Move toward 50% of the complex in sustainable food stands to enhance available browse.

Sustainable management of both food and secondary shelter cover types was incorporated into the model using specific age class goals for each relevant cover type in each wintering complex. This incentivizes the model to only harvest at a level that would generate a balanced age class distribution over time in each cover type specific to each complex. These goals help address concerns from the previous planning period where age class goals were only set at the management area level and not specific to each deer wintering complex.

The specific age class goals essentially perform area regulation strategies specific to each food and shelter cover type in each deer wintering complex, bringing confidence to a sustainable flow of habitat components over time. Goal 1.b. from above will have to be accomplished during the implementation phase at the local unit level during the compartment review process. The State Forest Management Plan model does not have spatial relationships built in to ensure proximity requirements are met between food and shelter stands. Likewise, avoiding additional fragmentation should be considered related to this goal, with the intention of not increasing fragmentation of shelter stands, which increases energy expenditures for wintering deer. The wintering complex objective 2.a. was incorporated into the management plan model by relying on site conditions, making those stands unavailable for management, and no age class goals were created for cedar and hemlock cover types.

Objectives 2.b. and 3 are accomplished through a specific set of transitions in the management plan model that shows a gradual cover type conversion on a subset of stands harvested over time. The actual selection of stands to convert from food to shelter and vice versa must be done in the field and informed by the importance of individual stands to wintering deer, species composition and prescription specifications resulting in desirable conversions that benefit deer.

Current and desired future conditions

All deer wintering complexes in the eastern Upper Peninsula have a higher component of shelter than food, and conversions are relatively straightforward as mixed coniferous/deciduous stands currently providing secondary shelter can be converted to food stands by expanding the deciduous species component. Western Upper Peninsula deer wintering complexes are in the opposite condition, and accomplishing these objectives requires a bit more effort in regenerating a higher conifer component both through artificial and natural means by converting food cover types to those providing shelter.

These stand conversions from shelter to food and vice versa are not bound by the same requirements or criteria that would be applied to stands outside of the deer wintering complexes. For example, planting mixed pine species (can include white, red and jack pine) when converting food stands to shelter does not need to meet conditions for free-to-grow requirements, spacing or limiting species composition. In addition, flat planting may be desirable, and herbicide treatments for the plantings are likely not desirable in these situations where the competing stems provide a food source for wintering deer. Similarly, retention of conifer species is generally encouraged in aspen and other food stand harvests, as opposed to a more traditional clearcut with very little retention, if it is determined beneficial for deer. Likewise, converting secondary shelter to food stands can be done while retaining small patches of conifer that make the resulting stands more favorable to wintering deer.

The following series of graphs (Figures 3 through 11) illustrates these current conditions and projected improvements through transitions in each period for the “all food” and “all shelter” outputs, as well as the subset of those cover types as functional components that are providing those elements in each period.

Eastern Upper Peninsula deer wintering complexes

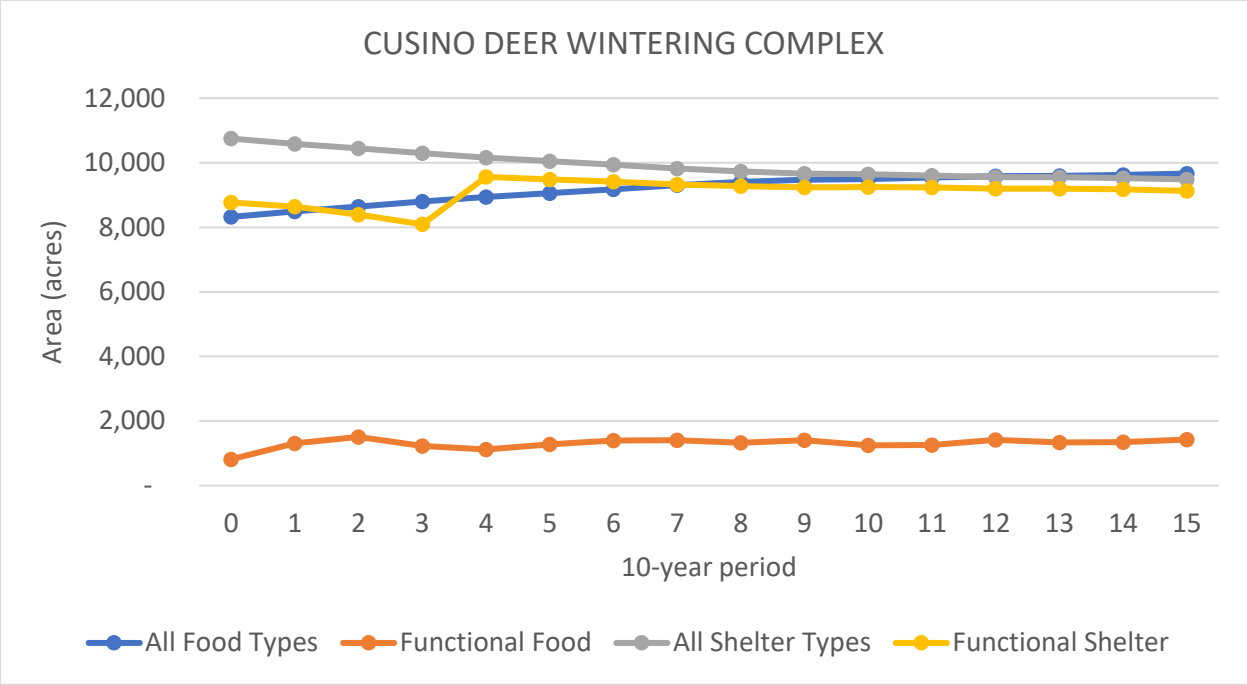

Figure 3. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Cusino Deer Wintering Complex.

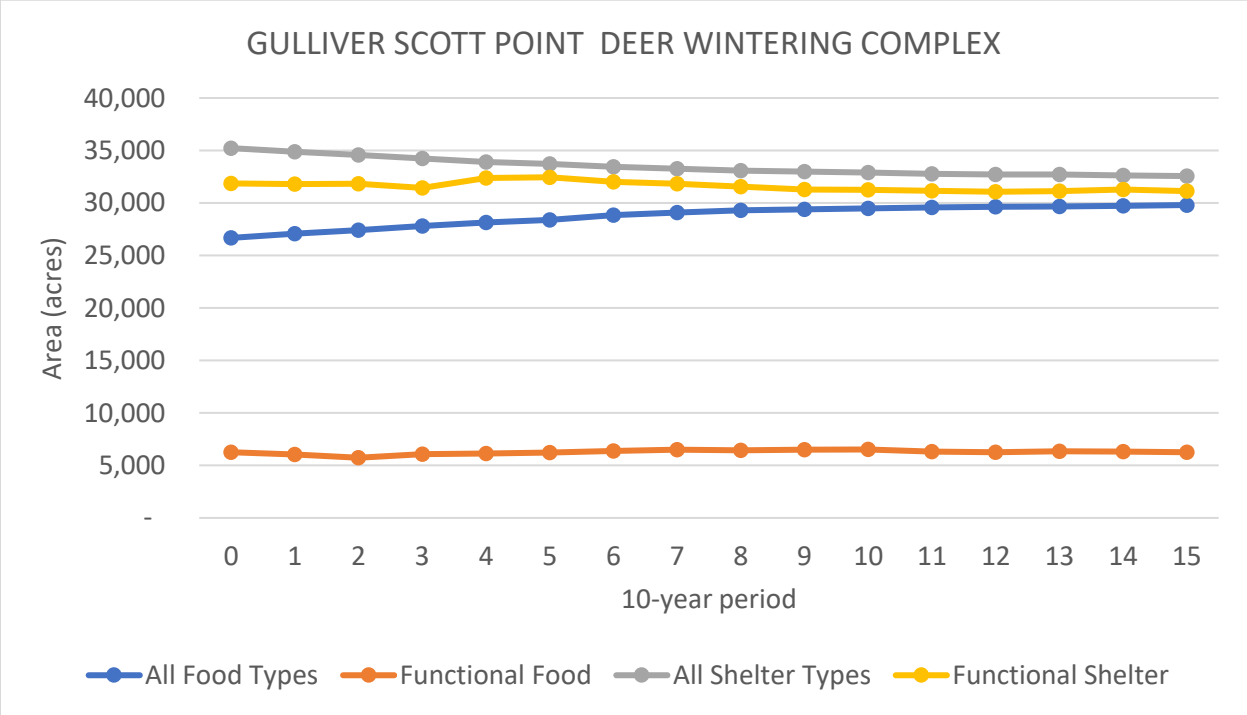

Figure 4. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Gulliver Scott Point Deer Wintering Complex.

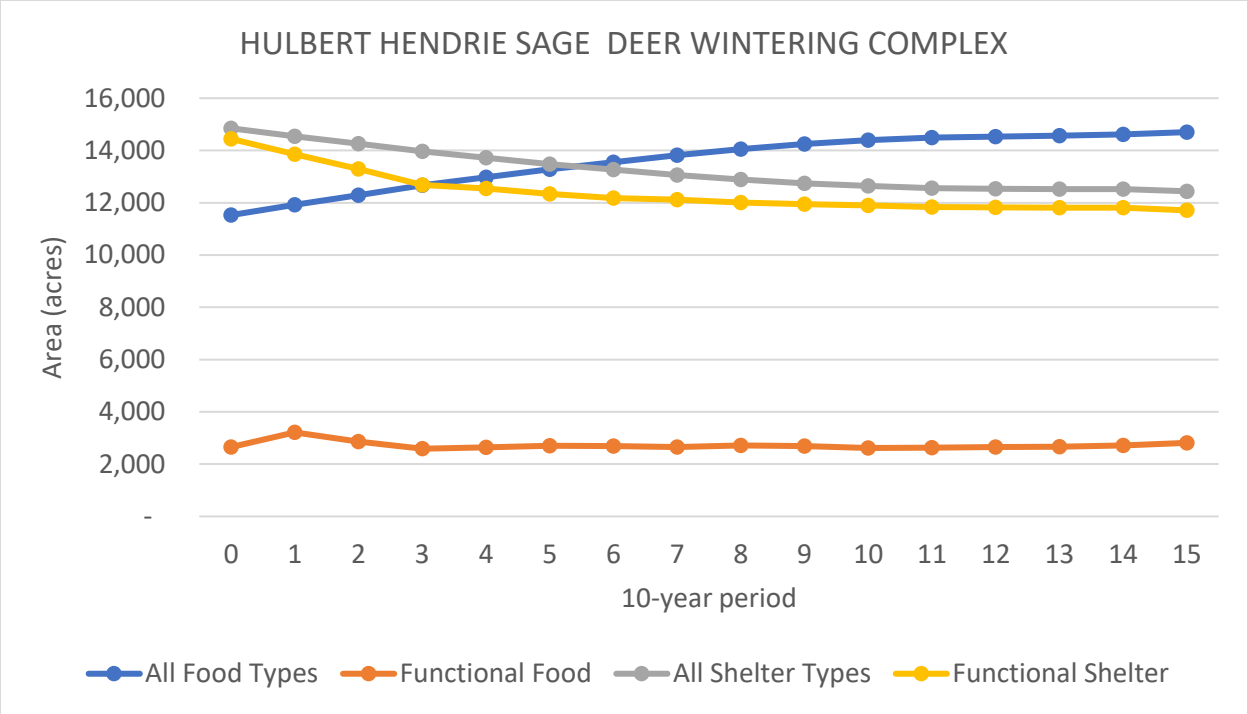

Figure 5. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Hulbert Hendrie Sage Deer Wintering Complex.

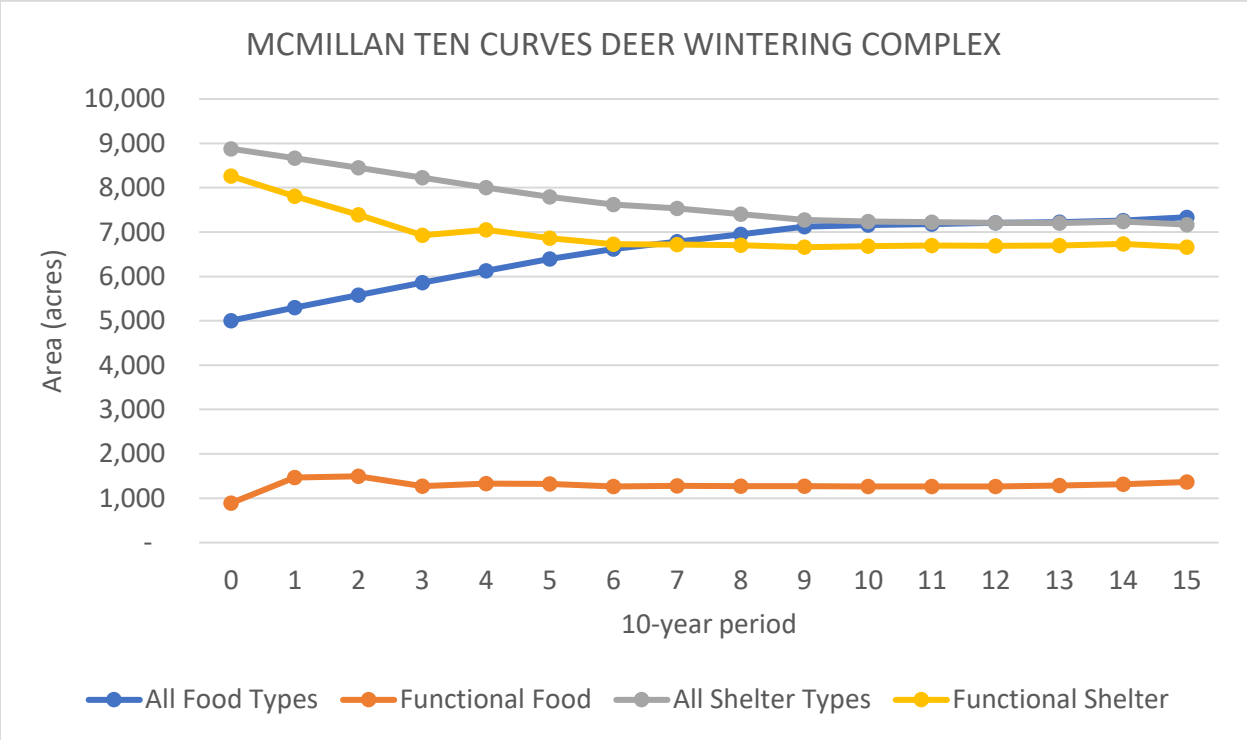

Figure 6. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the McMillan Ten Curves Deer Wintering Complex.

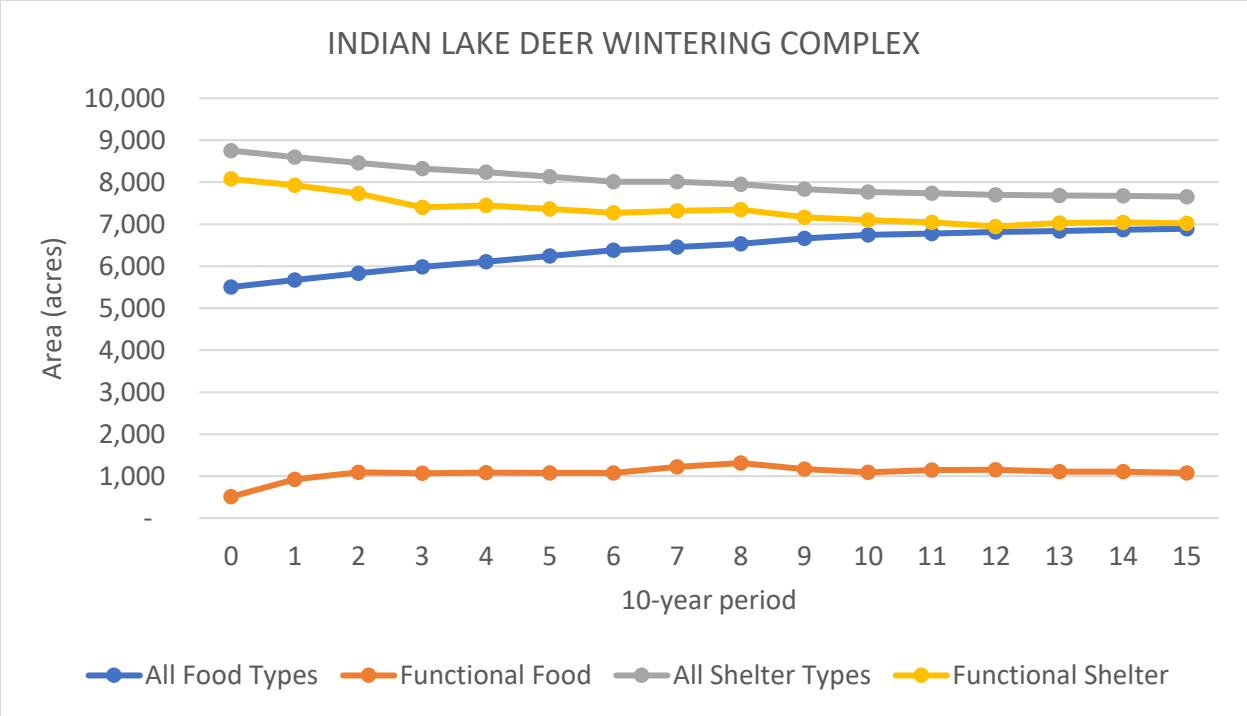

Figure 7. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Indian Lake Deer Wintering Complex.

Western Upper Peninsula deer wintering complexes

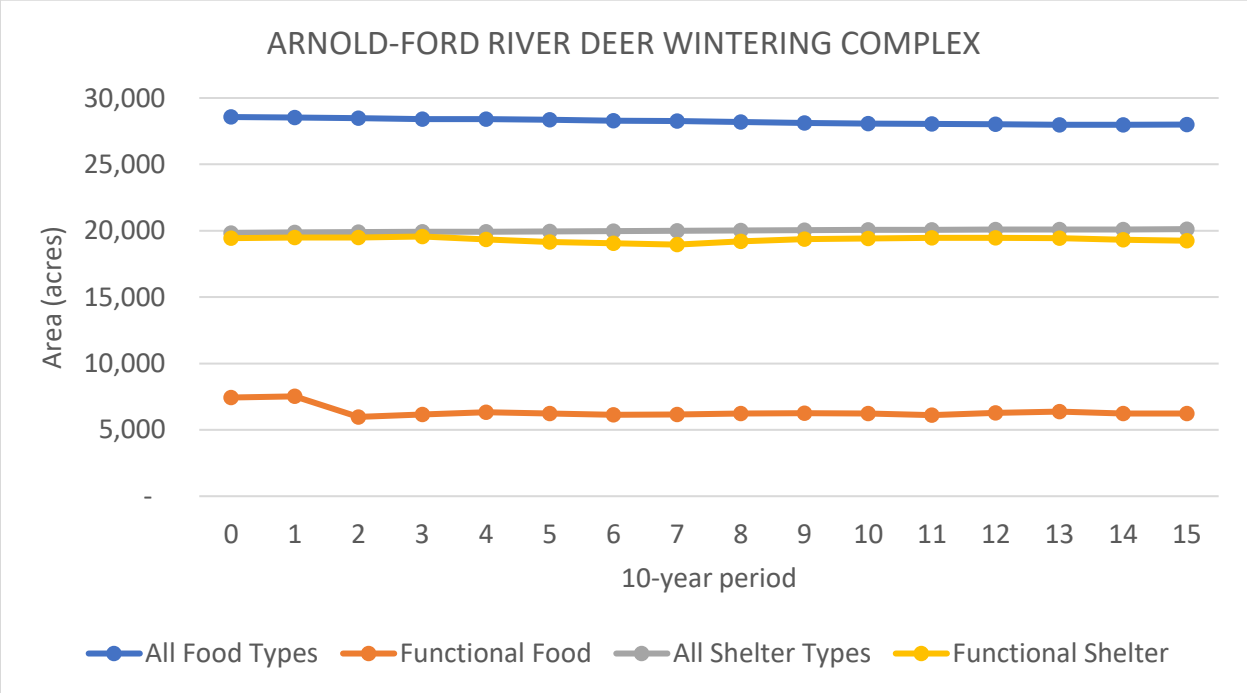

Figure 8. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Arnold Ford River Deer Wintering Complex.

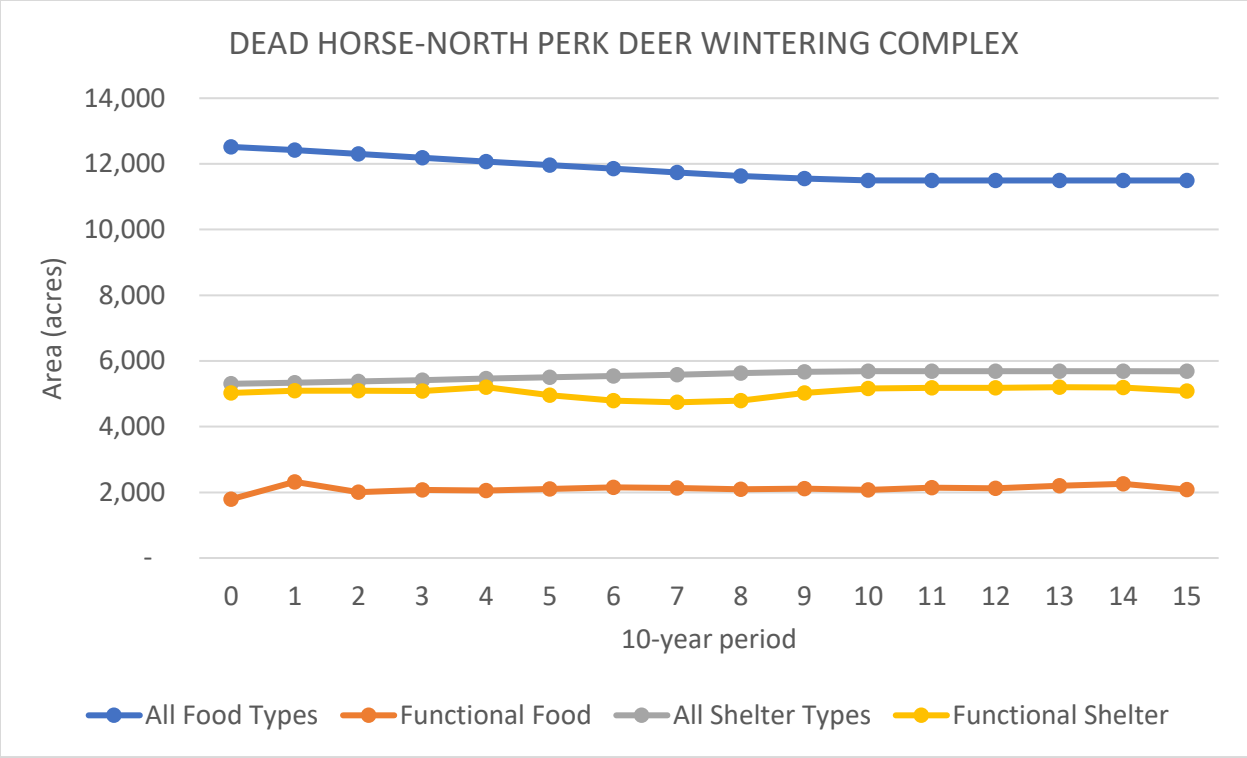

Figure 9. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Dead Horse North Perk Deer Wintering Complex.

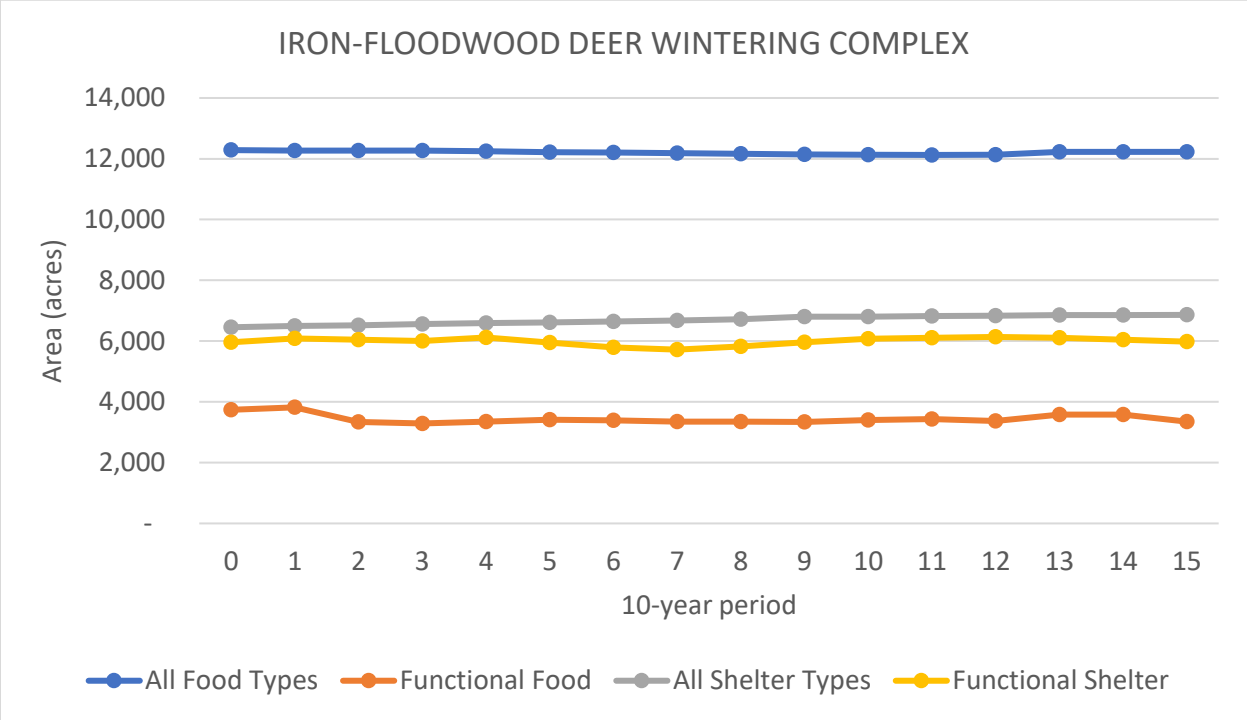

Figure 10. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Deer Foot Lodge Deer Wintering Complex.

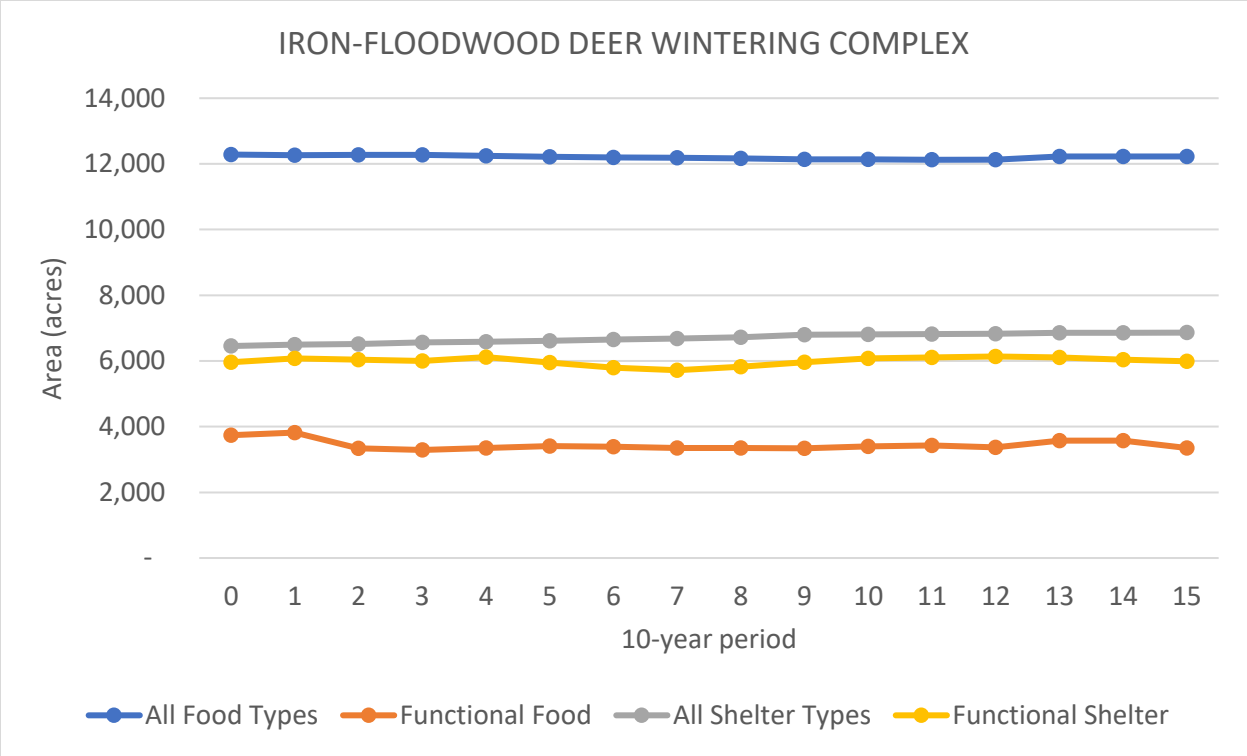

Figure 11. Acres of current and projected food and shelter habitat across all 15 model periods (150 years) in the Iron Floodwood Deer Wintering Complex.

Management actions

The following projected timber harvest levels (Tables 1 through 9) will help inform local decisions during the compartment review process to help us strive for sustainable harvest levels and habitat creation in the planning period and contribute to the longer-range goals. Efforts to refine these harvest projections should be made to work out spatial considerations, importance of maintaining crucial stands for wintering deer, timing of harvests within the decade, access concerns and timber sale marketability.

Furthermore, the projected harvest type can be changed or modified to meet the goals of the deer wintering complex for any given stand. For instance, a traditional aspen clearcut with little retention would be modified to retain all conifers, which benefits numerous wildlife species, including wintering deer. Likewise, when transitioning shelter to food, retaining pockets of dense conifer will improve the future stand qualities for deer. Another possibility is that a particular projected harvest might be dropped or delayed if a stand is still functional and healthy and benefits deer.

Lastly, harvests in deer wintering complexes will have specific conditions and special circumstances that govern sales and prescriptions and should not be bound by standard methods of those treatment types occurring outside of DWCs.

Eastern Upper Peninsula deer wintering complexes

Table 1. Projected harvest levels by silvicultural method this planning period in the Cusino Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Northern hardwood	286	1,560	-	475	-	**2,321**
Lowland conifers	158	-	-	-	-	**158**
Lowland deciduous	112	-	-	-	-	**112**
Aspen	75	-	-	-	-	**75**
Lowland mixed forest	46	-	-	-	-	**46**
Upland conifers	11	-	-	-	30	**41**
Lowland aspen/balsam poplar	39	-	-	-	-	**39**
Mixed upland deciduous	20	-	-	-	-	**20**
Lowland spruce/fir	16	-	-	-	-	**16**
Planted red pine	-	-	9	-	-	**9**
Total	**763**	**1,560**	**9**	**475**	**30**	**2,836**

Table 2. Projected harvest levels by silvicultural method this planning period in the Gulliver Scott Point Rock River Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Aspen	1,819	-	-	-	-	**1,819**
Northern hardwood	-	1,259	-	-	-	**1,259**
Lowland conifers	353	-	-	-	-	**353**
Planted red pine	268	-	60	-	-	**328**
Lowland aspen/balsam poplar	229	-	-	-	-	**229**
Lowland deciduous	117	-	-	-	-	**117**
Upland conifers	103	-	-	-	5	**108**
Upland spruce/fir	95	-	-	-	-	**95**
Natural white pine	-	-	10	-	75	**85**
Lowland spruce/fir	84	-	-	-	-	**84**
Lowland mixed forest	80	-	-	-	-	**80**
Upland mixed forest	80	-	-	-	-	**80**
Mixed upland deciduous	54	-	-	-	-	**54**
Planted mixed pine	12	-	-	-	-	**12**
Natural mixed pines	-	-	-	-	2	**2**
Total	**3,295**	**1,259**	**70**	**-**	**82**	**4,706**

Table 3. Projected harvest levels by silvicultural method this planning period in the Hulbert Hendrie Sage River Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Northern hardwood	70	542	-	417	37	**1,065**
Lowland conifers	633	-	-	-	-	**633**
Aspen	476	-	-	-	-	**476**
Lowland mixed forest	231	-	-	-	-	**231**
Lowland aspen/balsam poplar	147	-	-	-	-	**147**
Upland conifers	-	-	-	-	113	**113**
Lowland spruce/fir	103	-	-	-	-	**103**
Mixed upland deciduous	89	-	-	-	-	**89**
Upland mixed forest	32	-	-	-	-	**32**
Upland spruce/fir	18	-	-	-	-	**18**
Lowland deciduous	-	12	-	-	-	**12**
Natural white pine	-	-	-	-	9	**9**
Planted red pine	4	-	-	-	-	**4**
Total	**1,803**	**554**	**-**	**417**	**158**	**2,932**

Table 4. Projected harvest levels by silvicultural method this planning period in the Indian Lake Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Northern hardwood	-	654	-	9	-	**663**
Planted red pine	159	-	143	-	-	**302**
Aspen	222	-	-	-	-	**222**
Lowland conifers	158	-	-	-	-	**158**
Mixed upland deciduous	96	-	-	-	-	**96**
Upland conifers	18	-	-	-	62	**79**
Northern red oak	-	-	-	68	-	**68**
Oak mix	30	-	-	-	-	**30**
Lowland spruce/fir	30	-	-	-	-	**30**
Lowland aspen/balsam poplar	23	-	-	-	-	**23**
Natural white pine	-	-	22	-	-	**22**
Lowland deciduous	12	-	-	-	-	**12**
Upland spruce/fir	10	-	-	-	-	**10**
Natural red pine	-	-	-	-	9	**9**
Lowland mixed forest	8	-	-	-	-	**8**
Natural mixed pines	-	-	-	-	2	**2**
Total	**767**	**654**	**165**	**77**	**73**	**1,736**

Table 5. Projected harvest levels by silvicultural method this planning period in the McMillan Ten Curves Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Lowland conifers	442	-	-	-	-	**442**
Northern hardwood	4	231	-	12	-	**246**
Natural jack pine	165	-	-	-	-	**165**
Lowland aspen/balsam poplar	162	-	-	-	-	**162**
Aspen	131	-	-	-	-	**131**
Lowland deciduous	126	-	-	-	-	**126**
Lowland mixed forest	97	-	-	-	-	**97**
Lowland spruce/fir	84	-	-	-	-	**84**
Upland conifers	-	-	-	-	23	**23**
Upland mixed forest	10	-	-	-	-	**10**
Total	**1,220**	**231**	**-**	**12**	**23**	**1,485**

Western Upper Peninsula deer wintering complexes

Table 6. Projected harvest levels by silvicultural method this planning period in the Arnold Ford River Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Northern hardwood	-	3,960	-	-	-	**3,960**
Aspen	2,787	-	-	-	-	**2,787**
Mixed upland deciduous	100	19	-	-	-	**119**
Tamarack	95	-	-	-	-	**95**
Lowland aspen/balsam poplar	42	-	-	-	-	**42**
Upland mixed forest	24	-	-	-	-	**24**
Upland spruce/fir	22	-	-	-	-	**22**
Planted red pine	-	-	15	-	-	**15**
Lowland mixed forest	8	-	-	-	-	**8**
Lowland deciduous	3	-	-	-	3	**6**
Total	**3,080**	**3,979**	**15**	**-**	**3**	**7,077**

Table 7. Projected harvest levels by silvicultural method this planning period in the Dead Horse North Perkins Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Northern hardwood	60	1,176	-	-	-	**1,235**
Aspen	559	-	-	-	-	**559**
Lowland mixed forest	205	-	-	-	-	**205**
Mixed upland deciduous	88	-	-	-	-	**88**
Lowland aspen/balsam poplar	81	-	-	-	-	**81**
Upland mixed forest	55	-	-	-	-	**55**
Lowland deciduous	17	20	-	-	8	**44**
Upland spruce/fir	7	-	-	-	-	**7**
Tamarack	6	-	-	-	-	**6**
Total	**1,076**	**1,195**	**-**	**-**	**8**	**2,279**

Table 8. Projected harvest levels by silvicultural method this planning period in the Deer Foot Lodge Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Northern hardwood	-	1,135	-	-	-	**1,135**
Aspen	1,071	-	-	-	-	**1,071**
Lowland mixed forest	76	-	-	-	-	**76**
Tamarack	39	-	-	-	-	**39**
Mixed upland deciduous	36	-	-	-	-	**36**
Upland spruce/fir	19	-	-	-	-	**19**
Natural red pine	-	-	-	-	8	**8**
Natural white pine	-	-	-	-	5	**5**
Total	**1,240**	**1,135**	**-**	**-**	**13**	**2,388**

Table 9. Projected harvest levels by silvicultural method this planning period in the Iron Floodwood Deer Wintering Complex.

Cover Type	Clearcut	Selection	Thinning	Group Selection	Shelterwood	Total
Aspen	1,572	-	-	-	-	**1,572**
Northern hardwood	77	418	-	-	9	**503**
Planted red pine	-	-	103	-	-	**103**
Tamarack	77	-	-	-	-	**77**
Natural mixed pines	-	-	-	-	48	**48**
Upland mixed forest	24	-	-	-	-	**24**
Lowland deciduous	15	2	-	-	-	**17**
Mixed upland deciduous	13	-	-	-	-	**13**
Planted jack pine	12	-	-	-	-	**12**
Natural red pine	-	-	-	-	12	**12**
Natural jack pine	8	-	-	-	-	**8**
Lowland aspen/balsam poplar	7	-	-	-	-	**7**
Total	**1,803**	**420**	**103**	**-**	**68**	**2,394**