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Service

Forest Vegetation Resource Report

For the Lakewood Southeast Project

Chequamegon-Nicolet National Forest

Historical pine barrens area. 1936.
Airport Road Area, Lakewood/ Laona Ranger District

Prepared By:
John Lampereur, Lakewood/Laona
District Silviculturist

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EXECUTIVE SUMMARY

This report will analyze and discuss the effects of the Lakewood Southeast Project activities on forest vegetation. This report considers the proposals and discusses what effects they would have on the upland vegetation within the project area now and in the future. Specific attention will be given to the effects of the alternatives on forest composition and structure as well as how well the alternatives would restore components and processes in plant communities of concern.

This report compares the anticipated changes in vegetation to the desired conditions given in the Chequamegon-Nicolet Forest Plan. It also identifies which alternative actions best respond to the Lakewood Southeast Project's Purpose of and Need for Action.

In comparing and analyzing the alternatives, the following are discussed:

- Vegetation Composition – measured by acres and percent of types by Management Area.
- Vegetation Age Class Distribution – measured by acres and percentages in each age class by species.
- Forest Plan Composition Objectives and Desired Age Class Distributions.
- How well each of the alternatives meets the project's needs for action.

These measures are important as they not only measure how well the action would achieve the purpose and need, but they are also important in determining movement toward or away from Forest Plan desired future conditions (DFCs).

The actions of timber harvests, planting, prescribed burning, mechanical site preparation, and timber stand improvement are the key actions that would result in measurable effects to forest vegetation. All of these actions are considered in this report and the results are discussed in the context of the Forest Plan DFCs.

In preparing this analysis, I summarized the existing condition of the vegetation within the Lakewood Southeast Project Area and identified the expected changes, by alternative. These changes were added or subtracted from the existing condition to arrive at the expected results. The results were displayed in the context of Forest Plan Management Area direction at the project, area, and forest level. With this information, I displayed which actions moved the area in the proper management direction, and to what degree. I also considered previous, other current, and planned future activities and their potential impacts of management to determine cumulative impacts.

My summary of findings are as follows (for further detail, see the Conclusions section on page 84):

Species Age Class Distribution

The following species were identified with the highest need for change. Given its short life span, aspen has the most critical need for age class modification.

Aspen Age Class Distribution

- Alternative 3 would be the most effective alternative for moving the aspen age classes toward desired conditions. Alternative 2 would be the second most effective, followed by Alternative 4 and Alternative 1.

Oak Age Class Distribution

- Alternative 2 would be the most effective alternative for moving the oak age classes toward desired conditions. Alternative 3 would be almost as effective, followed by Alternative 4 and Alternative 1.

Red Pine Class Distribution

- Alternatives 2 and 3 would be equally most effective alternatives for moving the red pine age classes toward desired conditions. Alternative 4 would be the next most effective, followed by Alternative 1.

White Pine Class Distribution

- Alternative 3 would be the most effective alternative for moving the white pine age classes toward desired conditions. Alternative 2 would be the second most effective alternative for modifying white pine age class distribution. Alternative 1 would be the least effective alternative as it would not respond to the need to modify white pine age class distribution.

Species Composition

Aspen Composition

- In terms of moving aspen composition toward desired conditions, Alternative 2 would be the most effective in both the short and long term. Alternative 4 would be the second most effective alternative in both the short and long term. Alternative 1 would be the third most effective overall. Alternative 3, which attempts to maintain as much aspen as possible, is the least effective in reducing aspen in MA 4B (**Table 86**).

- In terms of responding to the concern about the loss of aspen, Alternative 3 would be the most effective. Alternative 1 would be the second best choice in responding to the concern of aspen loss. Alternative 4 would be the third best choice in responding to this concern and Alternative 2 would be the least responsive alternative in terms of aspen maintenance (**Table 86**).

Table 86: Lakewood Southeast Project Effects on Aspen Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 % (short-term)	Alt 1 % (long-term)	Alt 2 % (short-term)	Alt 2 % (long-term)	Alt 3 % (short-term)	Alt 3 % (long-term)	Alt 4 % (short-term)	Alt 4 % (long-term)
2C	196	57.5%	15-30%	57.5%	41.7%	52.0%	37.1%	57.5%	41.7%	57.5%	41.7%
4A	3,628	27.2%	10-30%	27.2%	21.5%	25.0%	22.9%	26.7%	25.2%	26.5%	19.3%
4B	2,423	27.0%	0-7%	27.0%	22.8%	20.2%	16.7%	26.9%	24.3%	26.6%	20.6%
Areawide *	6,987	25.7%	n/a	25.7%	20.5%	22.3%	19.1%	25.4%	22.8%	25.2%	18.7%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Jack Pine Composition

- In the short term, Alternatives 2 and 3 would respond equally well, reducing the amount of jack pine in MA 4B better than the other alternatives. Alternative 4 would be second best in the short term, followed by Alternative 1. In the long term, all of the alternatives would respond equally well.

Red/White Pine Composition

- Alternative 2 goes the farthest in responding to the need of increasing red/white pine composition in the project area. In the short term, this alternative would increase the red and white pine component by 3.3%; in the long term, red and white pine would be increased 6.3%.
- Alternative 3 would be the second best in responding to this need in the short term. However, in the long term, Alternative 4 would be the second most effective option for increasing the red and white pine component.

The Need for Stocking Control

- Overall, Alternative 2 best responds for the needs related to density management, fully meeting the stated needs. Alternative 3 responds nearly as well, treating only slightly fewer pine stands. Alternative 4 partially meets the needs for action, but ranks third overall. Alternative 1 does not respond to the needs for action.

Communities of Concern

Northern Dry Forest

- Overall, Alternative 2 best responds to the need to reestablish components and processes in the northern dry forest ecosystem. Alternative 3 ranks second best and Alternative 4 ranks third. Alternative 1 does not respond to this need and makes no progress toward the Desired Future Conditions.

Pine Barrens / Savanna Restoration

- Overall, Alternative 3 best responds to the need to restore pine barrens / savanna by moving about 1,000 acres in that direction. Alternative 2 ranks second highest by moving about 800 acres toward pine barrens / savanna. Alternative 4 ranks third highest by moving about 300 acres toward pine barrens / savanna. Alternative 1 does not respond to the need to restore pine barrens / savanna.

INTRODUCTION

Issue – Forest Vegetation

This report will analyze and discuss the effects of the Lakewood Southeast Project activities on forest vegetation.

Vegetation management activities result in changes to forest composition and structure. Different types of harvests change stand density and the types and ages of trees that remain in a stand (see **Appendix B** of this document, "**Lakewood Southeast Project Silvicultural Systems**"). Site preparation, planting, and timber stand improvement (TSI), likewise, change vegetative composition and structure. The activities included in the Proposed Action are intended to move vegetative conditions in the Lakewood Southeast Area toward conditions desired in the Chequamegon-Nicolet Forest Plan. Throughout this document, each of the project alternatives will be analyzed and discussed in relation to the desired future conditions given in the Forest Plan.

Some respondents expressed a concern that the amount of aspen at the State and Forest level has been steadily declining over the past 50 years. Aspen is a short-lived, sun-loving species that requires periodic stand replacement disturbances (usually clearcutting) in order to regenerate (Perala, D.A., 1977). Without such disturbances, aspen trees gradually die and are replaced by more long-lived shade-tolerant species, such as hardwoods, pines, or oaks. The Chequamegon-Nicolet Forest Plan gives direction on the management of aspen, both in terms of a range of desired composition and the desired age class distribution.

Some of the activities in the Lakewood Southeast Project have the potential to affect the future amount of aspen in the project area. Therefore, one of the issues that will be analyzed and discussed will be the effects of the project on the aspen resource.

The Affected Environment refers to those national forest system lands that fall within the bounds of the Lakewood Southeast Project Area. This analysis boundary provides a discrete area for analysis in which a quantifiable comparison can be made between the existing condition, the no action alternative, and the action alternatives. For context, this area is compared with adjacent national forest lands under the same management area prescriptions and also with forestwide figures for the same management areas.

Background / Existing Condition

Ecological Classification

In 1997, Cleland and others developed the National Hierarchical Framework of Ecological Units. This is an ecological land classification system that characterizes land areas based on associations of ecological factors at different geographic scales. Broad scale ecological units may cover thousands of square miles and characterize portions of a continent or a region based on similar climates and landforms. Mid scale ecological units may, in turn, divide a region into subregions, based on differences that become more apparent with a finer scale examination (such as lithology and disturbance regimes). Likewise, these mid scale subregions are further subdivided into smaller and smaller areas based on features such as potential natural communities, aspect, and soil types. Characterizations at this scale are far more precise.

Figure 1. The Athelstane Sandy Outwash and Morraines Subsection is a large sand outwash plain that includes the Lakewood Southeast Project Area. This subsection has been identified as having a high potential for Northern Dry Forest and Pine Barrens restoration.

The Lakewood Southeast Analysis Area has been delineated on the basis of the National Hierarchical Framework of Ecological Units. At the regional scale, the entire Chequamegon-Nicolet National Forest (and most of the Western Great Lakes Region) falls into the Laurentian Mixed Forest Province. The Lakewood/Laona Ranger District falls within a subdivision of Laurentian Province known as the Northern Green Bay Lobe Section. The Northern Green Bay Lobe Section, in

turn, is divided into five Subsections. One of these subsections, the **Athelstane Sandy Outwash and Morraines Subsection**, covers the majority of neighboring Marinette County and the entire Lakewood Southeast Project Area (**Figure 1**). This subsection has been of particular interest to a number of groups and land management agencies. This will be discussed further in the later section, the Need for Restoration.

The Athelstane Sandy Outwash and Morraines Subsection is subdivided into several landtype associations (LTAs). Landtype associations describe areas of common ecosystem characteristics and generally number in the thousands of acres. The Lakewood Southeast Project Area is comprised of two landtype associations: 1) The Butler Plains (Tc03) and 2) The Waupee Knolls (Tc04).

Geology and Glaciation

The landscape pattern in these landtype associations is characterized by the northeast-southwest topographic grain that developed about 12,000 years ago with the melting and southwestward retreat of the Green Bay lobe of the Wisconsin Glacier (Attig and Ham, 1997). Bedrock outcrops are very common throughout these LTAs. Meltwater stream sediment and deposits of wind-blown sand provide a low relief landscape among higher relief bedrock-controlled ridges.

Figure 2. The Lakewood Southeast Area has numerous bedrock outcrops that typify the area.

Outcrops of Precambrian rock are a unique feature in this part of the Lakewood/Laona Ranger District and are typical of these landtype associations. These features are a result of intercontinental tectonic plate collisions that occurred 1.5 to 2 billion years ago (CNNF, 2001). These rock outcrops form unique microhabitats that have acted as islands within the larger fire prone landscape (Lampereur, personal observation).

Soils

The soils in the project area are dominated by coarse-textured sands that resulted from glacial outwash and wind-blown deposition. They are predominantly well-drained to excessively well-drained and primarily support such forest types as pine, oak, and aspen. Lowlands bisect large portions of the area and are typified by poorly drained organic soils. These areas are dominated by lowland conifers such as black spruce and northern white-cedar.

Historical Disturbance Regime

The Lakewood Southeast Project Area has been heavily influenced by landscape-level fire for hundreds (and, likely, thousands) of years. This has been long recognized by local resource managers because of the presence of charred material in the soil and the presence of fire-scarred stumps throughout the area. In 2009, Mike Stambaugh and Rich Guyette of the Missouri Tree Ring Laboratory at the University of Missouri spent a week gathering samples of fire-scarred stumps within the project area. Laboratory analysis confirmed the presence of widespread historical fires. In the summer of 2010, Stambaugh and Guyette returned to the area and collected many more samples.

Figure 3. Dr. Mike Stambaugh of the Missouri Tree Ring Laboratory collects a sample from the remains of a fire-scarred stump in the Crooked Lake Area. This easily- overlooked evidence was still sound after being killed by a fire 205 years earlier.

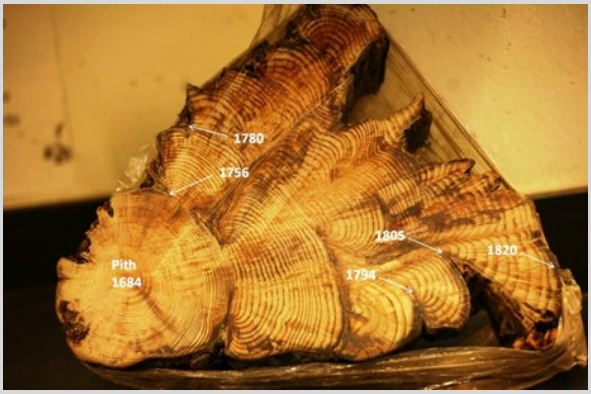


Figure 4. Samples like this one, taken from a fire-scarred stump in the vicinity of Airport Road provides useful information on past fire history. This tree originated in 1684 and survived fires in 1756, 1780, 1794, and 1805 before succumbing to a high intensity fire.

The research has yielded a wealth of information on fire occurrences during the period of 1640 to the present. Of particular interest was the presettlement fire history. At Grindle Lake, in the north-central portion of the project area, there were 24 fires recorded between 1664 and 1923. Fire intervals ranged from 2 to 35 years apart with a mean fire return interval of 10.8 years during the period 1705-1864. Eight high severity fires occurred between 1718 and 1840 (a high severity fire every 15 years).

At Waubee Lake, five miles to the northwest of the project area, there were 25 fires recorded during the period 1708-1864. Fire intervals ranged from 3-21 years apart with a mean fire return interval of 6.3 years. The evidence at this site suggested more frequent, low intensity fires. There were at least six years in which both sites were burned. Since the two study areas are nearly ten miles apart, this would indicate the fires were very large- estimated at 68 square miles (Guyette and Stambaugh, 2010). In fact, a number of large fires occurred in the project area during the same years that widespread fires occurred in the eastern United States and Canada.

The easternmost portion of the project area seems to have had the most frequent fires. This is inferred by the more open landscape conditions, the grassier understories, and the presence of fire-scarred stumps with very short and regular (2-3 year) fire return intervals (Lampereur, personal observation 2010). This area was the focus of the 2010 fire scar research.

This preponderance of fire is in direct correlation with the coarse, drought-prone outwash soils and the fire-adapted species that are present in the project area. It is further illustrated in historical records and photographs in the project area. Finley's Original Vegetation of Wisconsin map (1976) was derived from original land survey information and gives a rough sketch of the vegetation that was present in the project area circa 1857.

The Lakewood Southeast Project Area was the ancestral territory of the Menominee People. The present day Menominee Indian Reservation abuts the far southwestern edge of the project area. Historically, fire was widely used by the Menominee people to maintain

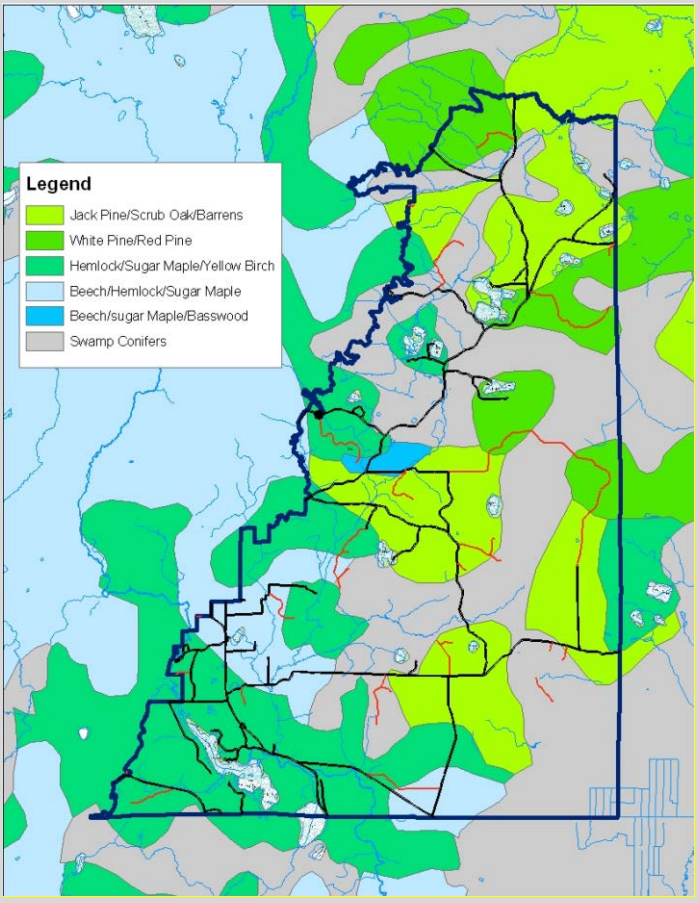


Figure 5. Presettlement Vegetation within the Lakewood Southeast Project Area. This map was derived from original public land survey notes from 1853-7. This map suggests a landscape that was more open and dominated by jack pine, red pine, and pine barrens.

open conditions and regenerate blueberry fields. (Waukau, personal communication).

The eastern portion of the reservation is located on the same sand outwash plain that occupies the Lakewood Southeast Project Area and the lands to the east. Thus, it comes as no surprise that the landscape patterns and fire history are similar.

Wind also played a role in the disturbance ecology of the area, although the frequency and extent of the disturbances are not well understood. Schulte and Mladenoff (2005) found that wind played an important landscape-level role in northern Wisconsin. While most areas were affected by localized blowdowns, they were also periodically subject to large, landscape-level blowdowns, such as the July 4, 1977 Flambeau Forest Blowdown and the Boundary Waters Blowdown of 1999. Schulte and Mladenoff estimate that the area surrounding the Lakewood Southeast project area had a heavy windthrow rotation period of about 6,400 years.

Recent events such as the Quad County Tornado (2007) and the October Storm of 2010 suggest that intense, more localized wind events were frequent. Given the frequency of fires in the area, it was likely that the wind events predisposed areas to high intensity fires.

The wind events also likely created the conditions for forest regeneration. In the event of large scale blow-downs followed by fire, this would have created ideal conditions for pine barrens development and jack and red pine regeneration. On the other hand, wind events causing scattered blow-down would have benefitted the regeneration of mid-tolerant species, such as white pine.

Historical Vegetation and Background

Given the frequency of fire on the landscape, the historical vegetation was quite different than what it is today. Finley's Map of the Original Vegetation of Wisconsin (1976) derived an approximation of the forest types that existed at the time of the original land surveys in the project area. This is useful information for getting a coarse scale snapshot of the landscape-level composition at that time, but it really doesn't tell us very much about the type of stand-level structure or composition that was present. Nonetheless, when we read the survey notes of McBride and Fletcher from 1853 to 1857, we can infer a general sense of what the land probably looked like. It is important to emphasize that, due to the frequent and variable nature of the wildfires, the forests in the project area would have been highly variable in spatial arrangement and through time.

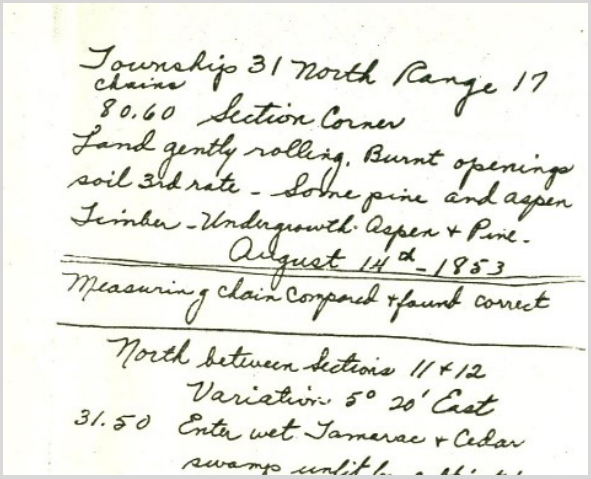

Township 31 North Range 17
chains
80.60 Section Corner
Land gently rolling. Burnt openings
soil 3rd rate - Some pine and aspen
Timber - Undergrowth Aspen + Pine.
August 14th - 1853
Measuring chain Compared + found correct
North between Sections 11 + 12
Variation 5° 20' East
31.50 Enter wet Tamarac + Cedar
swamp

Figure 6. An excerpt from Nelson Fletcher's survey notes of August 14th, 1853. Note his mention of burnt openings and regenerating aspen and pine.

Table 1		
LKSE Historical Vegetation Upland Forest Type	**Acres**	**% Uplands**
Jack Pine/Scrub Oak/Barrens	10,855	44
White Pine/Red Pine	3,709	15
Hemlock/Sugar Maple/Yellow Birch	6,439	26
Beech/Hemlock/Sugar Maple	3,373	14
Beech/Sugar Maple/Basswood	354	1
Total Uplands	**24,730**	**100**

As **Table 1** shows, about 44% of the uplands in the project area were occupied by jack pine, scrub oak, or barrens. These types were located on the driest and most fire-prone sites in the project area (see **Figure 5**). In August of 1853, Deputy Surveyor Nelson Fletcher gave this general description of the southern half of the project area (T31N R17E):

"Nearly one half of this township is swamp and the balance is almost worthless. The soil is sand 3rd rate in places broken and rocky. There is scarcely any valuable timber in the township."

As Mr. Fletcher stated, the majority or this area had little to no merchantable timber. His notes suggest large areas of regenerating jack and red pine and oak interrupted by open, scrubby grasslands. Within this matrix, there probably would have been some scattered mature red and white pine, a few larger oaks, and some mature jack pine that survived the previous fire(s). Open park-like stands of red and white pine would have also probably been present as part of this type. Depending on the recent periodicity of wildfire, there may have been a lot or relatively little standing dead snags or downed woody material present. Within the project area, the jack pine/scrub oak/barrens type was frequently adjacent to lowland conifer types. This juxtaposition would likely have resulted in a transition zone with large widely-spaced red and white pine stands.

According to Finley's map, roughly 15% of the forests in the project area in the mid 1800's were red and white pine types. Likely, they were mixtures of both, unlike the very homogeneous red pine plantations that are present today. We know that ground fires burned through these stands very frequently. This would have often created open, park-like conditions for long time periods. However, due to chance or climatic patterns, some areas occasionally escaped fire for a few decades, allowing young undergrowth to grow into a fire-resistant condition. In other areas, the low intensity ground fires would have climbed into the canopy, creating some pockets of mortality. These pockets would have then developed into patches of young pine regeneration. Through such dynamics, many of these pine stands probably had multiple stories and were structurally diverse.

The remaining 41% of the project area was occupied by late-successional northern hardwood types, such as hemlock, sugar maple, and beech. Given the nature of the soils and the disturbance regime in the area, these stands were likely very diverse in species composition. It is also likely that large conifers, such as white pine and hemlock, were much more widely present in the hardwood stands than they are today. Fire intolerant species, such as red maple, were probably less prevalent.

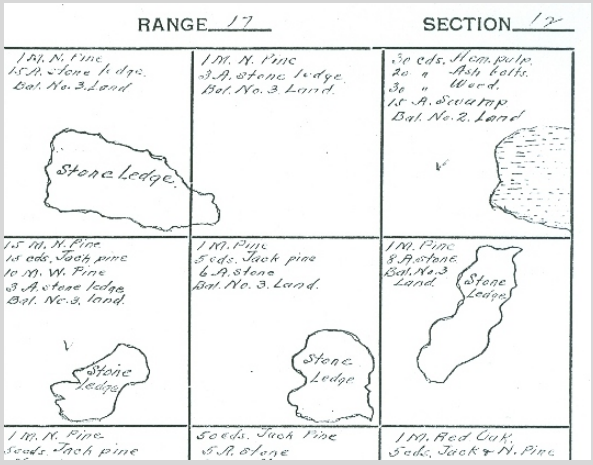


Figure 7. A sample from the 1910 Oconto County cruise maps. This sample describes the northeastern quarter of T31N R17E, Section 12 and suggests a sparsely stocked landscape of jack pine barrens.

In 1910, Oconto County commissioned a timber cruise of all lands in the county. This cruise mapped out and estimated timber volumes by species on a forty acre basis. These are very useful records for gaining a more refined picture of the species, size, and number of trees that were present in specific areas at that time. In general, most of the southern and eastern part of the project area was very sparsely vegetated with scattered large red and white pine and varying amounts of small low density jack pine. Some portions of the project area, such as the southern portion in the vicinity of Twin Pine Road were listed as cut and burnt- there was little to nothing merchantable left. Thus, there had been significant pine logging in parts of the project area in the late 1800's, but we don't know specifically how much or where. The survey notes of the 1850's indicate that most of the project area was not a high volume area. More likely, most of the better pine came from the more nutrient-rich areas to the north and west of the project area.

As noted above, the late 1800's marked a radical change for the forests in the northern Wisconsin. In the wake of the Civil War, the United States was a rapidly growing country and the demand for softwood timber was high. This was the era of "cut and run" logging, an era of exploitation of the seemingly endless supply of virgin pine in the Great Lakes Region. From 1890 through 1898, Wisconsin led the nation in pine lumber production. Unlike other species, pine could be easily rafted down streams and rivers to sawmills in the spring of the year. Wisconsin had a vast network of river highways that could be used to access the timber.

As the vast pineries of northern Wisconsin began to dwindle, the timber barons turned their attention to the new, uncut areas to the west. By the turn of the Twentieth Century, the pine logging era was nearly over in the state of Wisconsin.

In the early Twentieth Century, the hardwood logging era began. Since hardwood could not be floated, narrow gauge railroad systems were built. Nearly all remaining merchantable trees were cut during this time. Logs were skidded on ice roads to landings during the winter by horses. From there, they were loaded onto railcars and shipped to sawmills. By 1930, virtually all of the forests in the area had been cut down. This was, in effect, a landscape level clearcut.

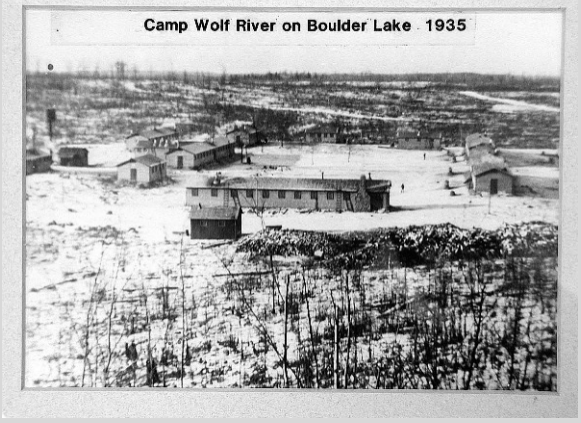


Figure 8. Following the hardwood logging era, views like this one, about 6 miles west of the project area, were common. Longtime residents recall that at night, during the 1930's, one could see the lights of Crivitz through "the Cutover"- a distance of about 20 miles.

Once the lands were cleared of timber, many parcels were sold to immigrant families who were promised their fortune in the Land of Opportunity. Clearing the land was back breaking work. All of the stumps had to be blasted, pulled, or otherwise removed. Many of the northern Wisconsin soils were notoriously rocky. The growing seasons were short. The new homesteads were far from markets and the soils were marginal at best for agricultural production. Then came the Great Depression. The combination of all these factors caused a host of farms to fail. Many of these farms reverted to the county as tax delinquent properties.

Under the authority of the Weeks Act of 1911 the federal government began buying these lands. In 1932, the Nicolet National Forest was formed and the lands were placed under the management of the USDA-Forest Service.

In 1933, the Civilian Conservation Corps was organized and, in this area, placed under the technical direction of the Forest Service. Several camps were established within and around the Lakewood Southeast Project Area. "The CCC Boys" or "Roosevelt's Tree Army", as they came to be known, were instrumental in the recovery of the denuded landscapes. They fought fires, built lookout towers, built forest roads and planted trees by the millions. Within the Lakewood Southeast Project Area alone, they planted an estimated 3,200 acres – or, in rough numbers, nearly 3 million trees. They also fought many forest fires that, undoubtedly, would have otherwise burned though the area.

Much of the historically open land and naturally-maintained pine barrens were planted during this and subsequent times (see **Figure 9**). By all available evidence, most of the forests in the project area are now far more densely stocked than they have been in the past 160 years.

Figure 9. A crew of CCC workers planting a pine barrens area on the Lakewood District in 1936. This photo is believed to have been taken in the vicinity of Airport Road. Note the open landscape, the sod layer, snags, and other evidence of frequent fires.

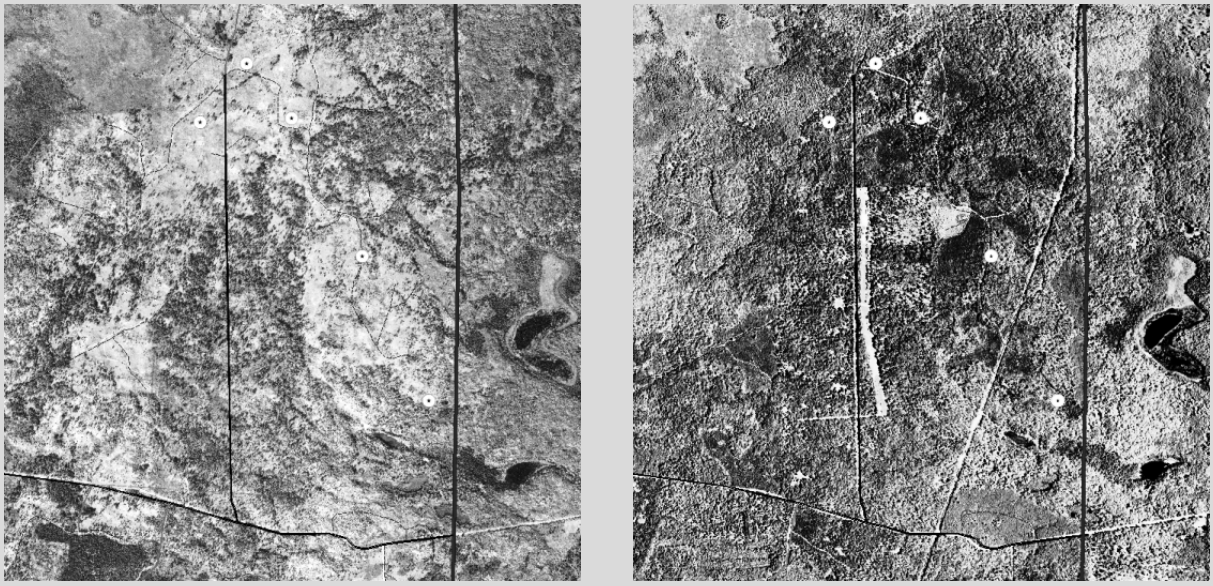


Figure 10. A comparison of the Airport Road Area in 1938 (left) and 2010 (right). Photo point locations and main roads have been included as reference points. Note the contrast in vegetation. In 1938, the area was occupied by pine barrens; in 2010, it had become fully-stocked closed canopy forests

Much research has attempted to describe the changes that have taken place between presettlement and present times. Although most of the discussion is in the larger context of northern Wisconsin, it is still relevant and helps to paint a useful picture of the past and present landscapes. Rhemtulla, Mladenoff, and Clayton (2009) used data from the Public Land Survey, Wisconsin Land Economic Inventory, and Forest Inventory and Analysis to describe and contrast the state's landscapes in the mid 1800's, the mid 1930's and the 1990's respectively. With this information, they analyzed changes in composition and structure at the subsection level. The following **Table 2** summarizes composition in the Athelstane Sandy Outwash and Morraines Subsection by forest type at each point in time:

Table 2: Relative Dominance (% of basal area) by Forest Type by Time Period in the Athelstane Sandy Outwash and Morraines Subsection (after Rhemtulla et al, 2009)

Forest Type	Mid -1800's	1930's	1990's
Aspen-birch	5.1 - 10%	25.1 - 50%	10.1 -25%
Northern Hardwoods	5.1 - 10%	10.1 -25%	10.1 -25%
Oak-hickory	1.1 – 5%	10.1 -25%	10.1 -25%
Ash-elm	1.1 – 5%	5.1 - 10%	5.1 - 10%
Hemlock	10.1 -25%	1.1 – 5%	1.1 – 5%
White Pine	25.1 – 50%	1.1 – 5%	5.1 - 10%
Red Pine	10.1 -25%	1.1 – 5%	10.1 -25%
Jack Pine	5.1 - 10%	5.1 - 10%	1.1 – 5%
Cedar-tamarack	10.1 -25%	5.1 - 10%	10.1 -25%
Spruce-fir	1.1 – 5%	5.1 - 10%	5.1 - 10%

This study also looked at the structural changes that took place during the same time period. While the information is pretty general, it is still useful in helping to get a better sense of the changes that have taken place in the proximity of the Lakewood Southeast project area. **Table 3** gives a

Table 3: Spatial Variability in Percentage of Trees in each Diameter Class by Time Period. After Rhemtulla et al (2009)

Diameter Class	Mid -1800's	1930's	1990's
Small (5 - < 10" DBH)	25.1 – 50%	> 75.1 %	> 75.1 %
Medium (10 - < 20" DBH)	50.1 – 75%	5.1 – 10%	10.1 – 25%
Large (≥ 20" DBH)	10.1 – 25%	≤ 1 %	≤ 1 %

brief summary of the study's findings:
In brief, the subsection surrounding the Lakewood Southeast project area has shifted from a pine-dominated landscape in the 1800's to an aspen-oak-northern hardwood landscape in the 1930's to an aspen-oak-northern hardwood-pine landscape in the 1990's. At the same time, the average diameter class, which was dominated by medium-sized trees in the 1880's, has shifted to the small size classes in the 1930's and 1990's.

Similar results were observed in northwestern Wisconsin in other ecological subsections dominated by sand outwash plains. Another study selected these areas to generate computer visualizations of historic and current landscape views (Stoltman et al, 2007). These graphics present the reader with helpful depictions of landscape conditions then and now. See **Figures 12 a-h**. **Figure 11** illustrates historical conditions in a similar landtype in northwestern Wisconsin. It is likely that substantial portions of the Lakewood Southeast Area appeared this way at various points in presettlement times.
Existing composition and size class information more specific to the Lakewood Southeast project area will be discussed in the upcoming sections on existing composition and age class distribution.

Figure 11. Historical photo of mature red pine woodlands taken in Bayfield County around 1890. Photo credit: William Gray Purcell

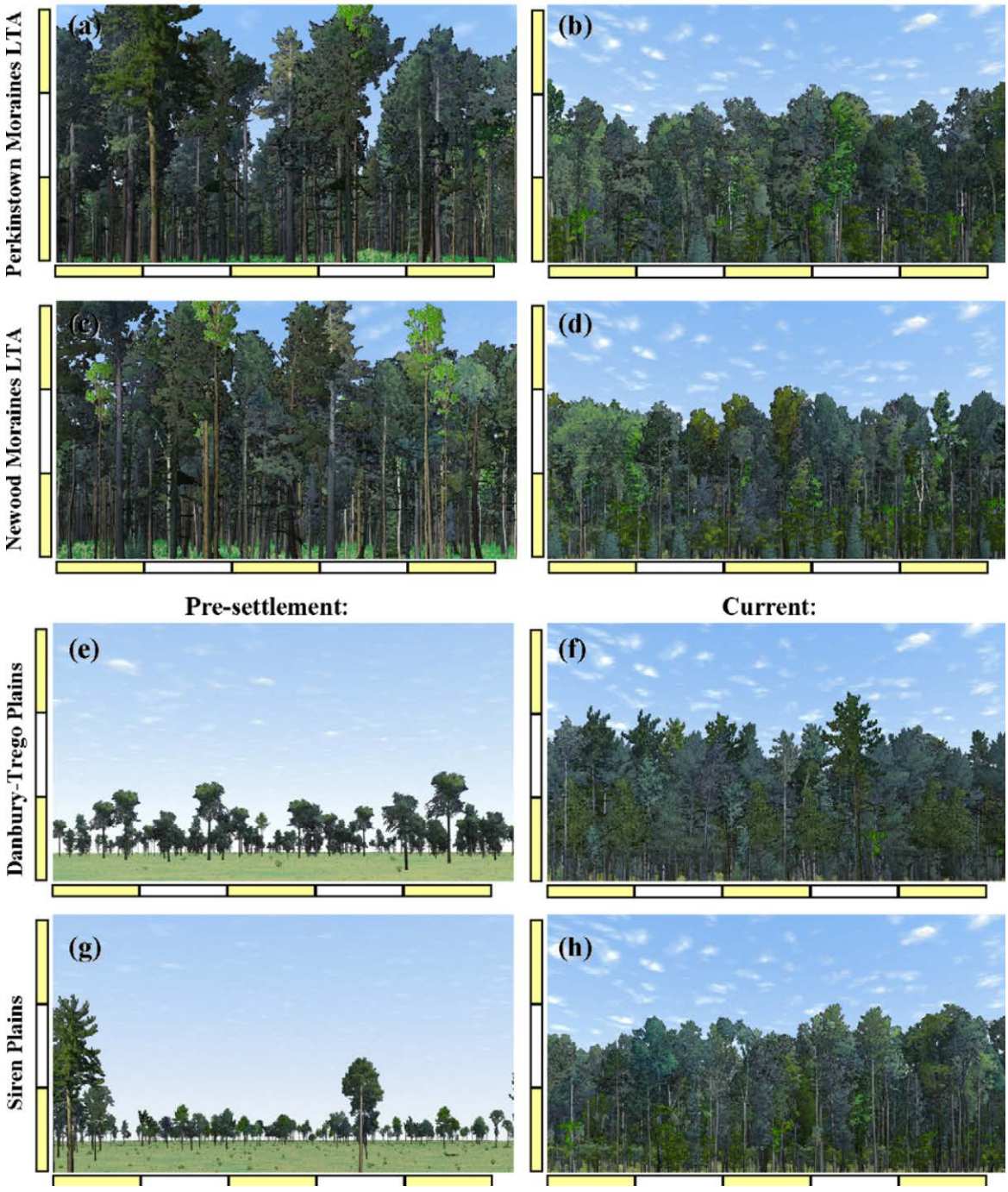


Figure 12. Visualizations of the pre-settlement and the current forests in two land type associations each in the Perkinstown End Moraine (a–d) and the Bayfield Sand Plains (e–h) subsections (from Stoltman et al, 2007)

The Need for Restoration

The Lakewood Southeast Project Area is dominated by forest plant communities known as Northern Dry Forests. Northern Dry Forests are pine- or pine-hardwood-dominated communities found on dry sandy soils and occur mainly on sandy glacial outwash and sandy glacial lake plains and sand ridges. Prior to European settlement, Northern Dry Forest typically originated in the wake of catastrophic fire, and frequent, low-intensity ground fires maintained red pine systems.

Over the past eighty years, fire has been largely excluded from these ecosystems through aggressive fire suppression policies and minimal use of prescribed fire. The removal of fire from the Northern Dry Forest has altered stand densities, species composition, and age class distributions. Stands are generally more dense, contain more fire-intolerant species, more oaks, and understory grasses and forbs are less robust and prevalent.

Forest Plan Objective 1.4c (p. 1-3) gives direction to restore and/or emulate natural disturbance regimes historically present within pine communities. The Wisconsin DNR has identified the Lakewood Southeast area as having a major opportunity to manage for Northern Dry Forest communities (Pohlman et al, 2006). Local Forest Service personnel have also long recognized these opportunities. Please refer to **Forest Vegetation Report Appendix A** for further discussion and illustrations.

Figure 13. Compartment 4089, Stand 15, located in the southeastern portion of the project area.

In the absence of periodic underburns, the understory of this mixed red and white pine stand has become densely stocked with red maple. Historically, this stand would have been more open and park-like, with a grassy understory and with groups of younger pines occupying canopy openings.

The dense red maple understory is impeding the regeneration of understory white pine and has altered the amount and diversity of understory grasses and forbs.

Stands like this can be moved back toward more natural conditions relatively easily. The careful use of timber harvest, prescribed fire, timber stand improvement, and underplanting can be used to emulate natural disturbances and approximate historic stand conditions.

In response to the recognized need to begin restoring northern dry forests in the project area, the Forest Service has identified needs to reduce stocking, improve species diversity, and reintroduce carefully-managed prescribed fire in portions of the Lakewood Southeast Project Area.

This would be done through a combination of timber harvests and prescribed fire. Harvest treatments would change the current high density forests in the area to variable-density conditions. Prescribed fire would encourage the herbaceous understory and reduce woody fire-intolerant species. Underplanting and timber stand improvement activities would aid in the establishment of white pine and other desirable species.

Figure 14. Long-term desired future condition for a closed forest, mixed white and red pine Northern Dry Forest stand.

This stand on Menominee Indian Reservation has attributes associated with an historic closed forest. It has multiple ages and size classes and has been managed using combinations of timber harvests and prescribed fire.

Figure 15. **Open barrens** Note the single mature red pine, lack of brush, high proportion of grasses and forbs, and general openness. Photo credit: USDA Forest Service.

Figure 16. Pine Savanna. Note the scattered red and white pine, low amount of brush, high proportion of grasses and forbs, and general openness between trees. Photo credit: USDA Forest Service.

Figure 17. Candidate barrens restoration area east of Airport Road.

Barrens are types of savanna plant communities that occur on sandy soils and are dominated by grasses, low shrubs, small trees, and scattered large trees. Historically, Pine Barrens covered 2.3 million acres (7%) of Wisconsin's presettlement landscape (Eckstein and Moss, 1995). Pine Barrens are highly variable in nature and can be difficult to characterize. However, one thing that they all have in common is that they tend to be open landscapes on sandy soils that are subject to frequent fires.

Because of the exclusion of fire on the landscape, Pine Barrens have become quite rare. Pine Barrens remain scattered on an estimated 10,000 acres statewide. Because they have become so rare, pine barren communities are considered imperiled both globally (G2) and in the state of Wisconsin (S2) by the Wisconsin DNR Natural Heritage Inventory program (WDNR, 2007a). Because many rare species of flora and fauna depend on barrens habitat, there is great concern that Pine Barrens habitats in Wisconsin be maintained or restored.

Forest Plan Objective 1.4b (p.1-3) gives direction to restore and/or emulate natural disturbance regimes in Pine Barrens. Forest Plan Objective 1.4h (p. 1-3) calls for the increased use of prescribed fire as a management tool within fire-adapted Land Type Associations. Forest Plan Objective 1.4l (p. 1-3) calls for the maintenance and enhancement of existing pockets of barrens and savanna habitat. The lands within the Lakewood Southeast Project Area have long been recognized for their barrens restoration potential. The Northeast Sands Wisconsin Land Legacy Report (WDNR, 2006) identified this area as having one of the highest potential restoration values for Pine Barrens and northern dry forest. Eckstein and Moss (1995) encouraged the Forest Service to explore opportunities for barrens restoration on the Lakewood unit.

The Forest Service has identified a specific area within the project area that has exceptional pine barrens/savanna restoration potential. This is an 800 acre area, east of Airport Road, west of the forest boundary, and north of Old Highway 64, that, historically, was a pine barrens landscape maintained by frequent fires (see **Figure 10**). Most of the ecosystem components (such as the appropriate tree species, grasses, and soils) are present that would enable a fairly quick and effective restoration that approximate historic conditions.

Restoration of the Pine Barrens would be done through a combination of timber harvests and prescribed fire. Harvest treatments would change the current high density forests in the area to low-density, open conditions dominated by grasses, shrubs, red pine, and jack pine.

Following harvest, most of the area would be treated with prescribed fire to further reduce fuel loads and to restore grasses and forbs. This would be the initial step in restoring the landscape to its historical composition. The careful use of periodic maintenance burns would then mimic the historic fire regime and its effects on the ecosystem.

Existing Condition

Vegetative Composition

Composition Overview of Lakewood Southeast Analysis Area

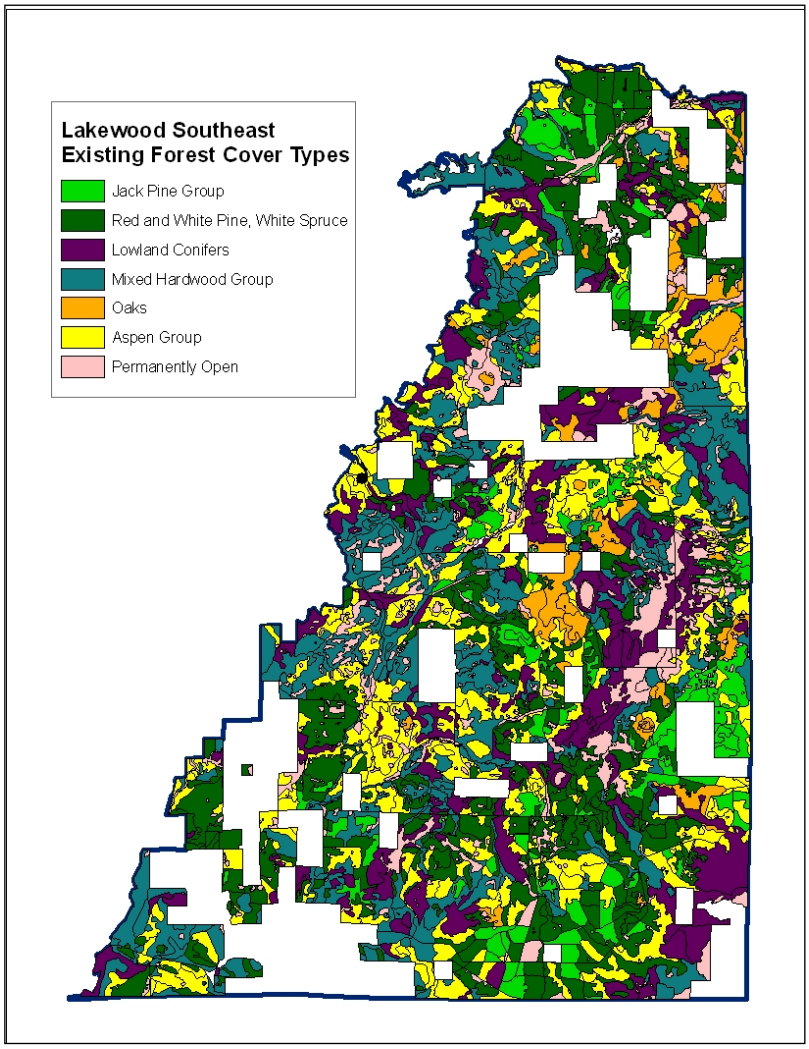
As discussed in the Historical Overview, the Lakewood Southeast project area contains vegetative structure and composition that are the result of historical actions and more recent management activities that started in the late 1800's and have continued to the present. Natural events such as fire and windstorms have played a large role in shaping the area. The primary upland forest types are red and white pine (33%), aspen (26%), and northern hardwoods (16%). See **Table 4** for the Lakewood Southeast forest type breakdown and **Figure G** for a graphical representation of forest cover types on National Forest System Lands in the project area. The majority of the upland forest is in a mid-age condition. Very little of the area is in an old forest condition simply because not enough time has elapsed since the early 1900's when most of the area was regenerated.

The lowlands in the Lakewood Southeast project area are about 54% lowland conifer swamps, 33% lowland hardwoods, and about 13% lowland openings.

The rest of the discussion in the vegetation section of this document will be limited to the upland forest types because no activities are proposed in any lowland areas.

Table 4: **Lakewood Southeast Forest Type Composition for Upland and Lowland Forest Types.**

FOREST TYPE	ACRES	%
Upland Types		
Aspen	6,987	25.7%
Balsam	819	3.0%
Paper Birch	179	0.7%
Jack Pine	1,928	7.1%
Red and White Pine	8,949	32.9%
Northern Hardwood	4,237	15.6%
Oak	2,027	7.5%
Upland Openings	1,774	6.5%
Other Types	284	1.0%
Summary Uplands	***27,183***	***100.0%***
Lowland Types		
Lowland Conifer	5,228	53.6%
Lowland Hardwood	3,227	33.0%
Lowland Openings	1,308	13.4%
Summary Lowlands	***9,763***	***100.0%***
Total All Acres	***36,945***	



Composition by Management Area

The Lakewood Southeast Project Area is divided into Forest Plan Management Areas (MAs) with related Desired Future Conditions (DFCs). The majority of this discussion on vegetation will be in the context of these management areas. Only the management areas that would be affected will be included in this discussion.

In the Chequamegon-Nicolet Forest Plan, the National Forest is divided into numerous management areas, each with specific emphases and Desired Future Conditions. Movement toward these DFCs is intended at the forest level. However, given the large size of the Forest, the compositional changes generated by individual projects like Lakewood Southeast would usually be miniscule. For this reason, managers have been advised to measure project-level effects at the scale of the local Forest Plan management areas, since the differences would be easier to see at this scale.

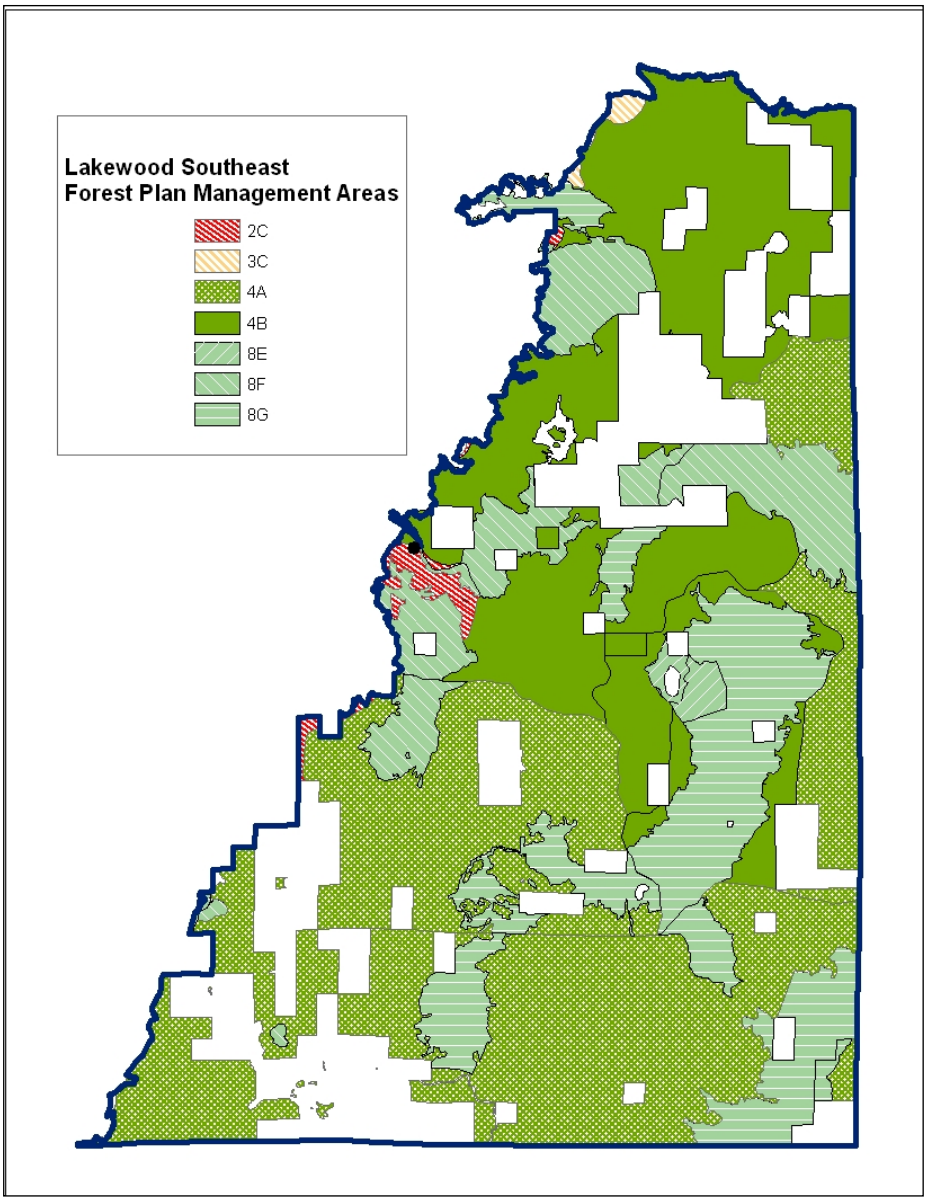
In this analysis, the existing condition and project effects on composition will be displayed at the project and forest levels.

Forest Plan Management Areas

Refer to **Figure I** at right. The Lakewood Southeast Project Area contains portions of the following Forest Plan Management Areas (MAs):

1) MA 2C – Uneven-aged Northern Hardwoods: Mixed Forest
2) MA 3C – Even-aged Hardwood: Oak-Aspen
3) MA 4A – Conifer: Red-White-Jack Pine
4) MA 4B – Conifer: Natural Pine-Oak
5) MA 8E – Existing and Candidate Research Natural Areas
6) MA 8F – Special Management Areas
7) MA 8G – Old Growth and Natural Feature Complexes

More discussion on these Management Areas and their management implications is included in the following paragraphs.



Management Area 2C

A very small area - about 1% (366 acres) of the National Forest lands in the project area falls within Management Area 2C. This management area emphasizes Uneven-aged Northern Hardwoods- Mixed Forest. The following table (**Table 5**) summarizes the existing upland forest composition for Management Area 2C:

Table 5: Existing Upland Forest Composition in Management Area 2C

Management Area 2C		Project Area		Forestwide	
Upland Type	**Desired**	**Acres**	**Existing**	**Acres**	**Existing**
Aspen	15-30%	195.5	57.5%	62044.6	30.7%
Balsam Fir	0-3%	80.4	23.7%	5512.9	2.7%
Paper Birch	0-5%	0	0%	3099.7	1.5%
Jack Pine	0-2%	0.0	0.0%	1077.7	0.5%
Red Pine/White Pine	10-30%	33.4	9.8%	21242.3	10.5%
Northern Hardwoods	30-50%	28.6	8.4%	92821.6	45.9%
Oak	0-10%	0.0	0.0%	2602.6	1.3%
Permanent Openings	1-2%	2.2	0.6%	3519.7	1.7%
Other Types	0-15%	0.0	0.0%	10253.0	5.1%
Summary Uplands		**340.1**	**100.0%**	**202174.1**	**100.0%**

Table 5 illustrates that most of the forest types in the project area fall within (or close to) the range of desired conditions given in the Chequamegon-Nicolet Forest Plan. Aspen and balsam fir, which exceed the desired conditions within the project area, fall within the range when one also includes the surrounding area.

Management Area 3C

A very small area - about 0.3% (101 acres) of the National Forest lands in the project area falls within Management Area 3C. This management area emphasizes Even-aged Northern Hardwood: Oak-Aspen. The following table (**Table 6**) summarizes the existing upland forest composition for Management Area 3C:

Table 6: Existing Upland Forest Composition in Management Area 3C

Management Area 3C		Project Area		Forestwide	
Upland Type	**Desired**	**Acres**	**Existing**	**Acres**	**Existing**
Aspen	20-40%	76.3	75.7%	15845	32.8%
Balsam Fir	0-5%	0.0	0.0%	469	1.0%
Paper Birch	0-10%	0.0	0.0%	1815	3.8%
Jack Pine	0-5%	0.0	0.0%	1716	3.6%
Red Pine/White Pine	5-15%	8.0	7.9%	6529	13.5%
Northern Hardwoods	10-25%	16.6	16.5%	6643	13.7%
Oak	20-40%	0.0	0.0%	13214	27.3%
Permanent Openings	1-3%	0.0	0.0%	1880	3.9%
Other Types	0-5%	0.0	0.0%	214	0.4%
Summary Uplands		**100.8**	**100.0%**	**48326**	**100.0%**

Management Area 4A

The largest portion - about 42.2% (15,585 acres) of the National Forest lands in the project area falls within Management Area 4A. This management area emphasizes Conifers: Red/White/Jack Pine. The following table (**Table 7**) summarizes the existing upland forest composition for Management Area 4A:

Table 7: Existing Upland Forest Composition in Management Area 4A

Management Area 4A		Project Area		Forestwide	
Upland Type	**Desired**	**Acres**	**Existing**	**Acres**	**Existing**
Aspen	10-30%	3628	27.2%	32870	28.6%
Balsam Fir	0-3%	362	2.7%	1547	1.3%
Paper Birch	0-5%	128	1.0%	2425	2.1%
Jack Pine	0-35%	1174	8.8%	13413	11.7%
Red Pine/White Pine	10-50%	4739	35.5%	41755	36.3%
Northern Hardwoods	0-25%	2076	15.6%	9188	8.0%
Oak	0-25%	592	4.4%	9349	8.1%
Permanent Openings	1-6%	568	4.3%	3094	2.7%
Other Types	0-5%	67	0.5%	1443	1.3%
Summary Uplands		**13335**	**100.0%**	**115083**	**100.0%**

Management Area 4B

A large portion - about 35% (10,299 acres) of the National Forest lands in the project area falls within Management Area 4B. This management area emphasizes Conifer: Natural Pine-Oak. The following table (**Table 8**) summarizes the existing upland forest composition for Management Area 4B:

Table 8: Existing Upland Forest Composition in Management Area 4B

Management Area 4B		Project Area		Forestwide	
Upland Type	**Desired**	**Acres**	**Existing**	**Acres**	**Existing**
Aspen	0-7%	2423	27.0%	6435	24.3%
Balsam Fir	0-3%	181	2.0%	531	2.0%
Paper Birch	0-5%	0	0.0%	1459	5.5%
Jack Pine	3-6%	716	8.0%	2212	8.4%
Red Pine/White Pine	45-70%	3085	34.4%	7508	28.3%
Northern Hardwoods	0-10%	729	8.1%	3207	12.1%
Oak	10-25%	1149	12.8%	2863	10.8%
Permanent Openings	2-8%	662	7.4%	2166	8.2%
Other Types	0-10%	14	0.2%	107	0.4%
Summary Uplands		**8960**	**100.0%**	**26488**	**100.0%**

Table 8 illustrates that most of the forest types in the project area fall within (or close to) the range of desired conditions given in the Chequamegon-Nicolet Forest Plan. **The exceptions are aspen and red pine/white pine.**

The maximum amount of aspen desired in MA 4B is 7% (627 acres). The existing amount of aspen in MA 4B is 27% (2,423 acres). Thus, there are about 1,800 acres of aspen in excess of the desired condition within the project area.

The minimum amount of red and white pine in the MA 4B is 45% (4,032 acres). The existing amount of red and white pine in this area is 34% (3,085 acres). Therefore, there is a shortage of about 950 acres of red and white pine within MA 4B in the Lakewood Southeast Project Area.

There is also a small excess of jack pine compared to forest plan DFCs. The maximum DFC for jack pine composition in MA4B is 6% (this equates to 538 acres). Currently, there are about 716 acres of jack pine in the project area- or about 180 acres more than the DFC.

Management Area 8E

Management Area 8E is characterized by ecologically significant natural features, representative ecosystems, and/or unique areas managed as Candidate or Existing Research Natural Areas. Within the Lakewood Southeast Analysis Area, there is one area designated as MA 8E. The 304-acre Waupee Lake Research Natural Area (RNA) features a large, intact cedar swamp. There will be no activities proposed within this area that would have any effects on vegetation. Therefore, there will be no further analysis or discussion related to this area.

Management Area 8F

Management Area 8F – Special Management Areas- is characterized by unique areas of physical, biological, and cultural features of Forestwide or Regional significance. Included are examples or representatives of scenic, historical, geological, botanical, zoological, paleontological, and archeological values. Within the Lakewood Southeast Analysis Area, there are about 3,987 acres designated as MA 8F. This area is encompassed by six Special Management Areas: 1) Hagar Mountain; 2) Nelligan Lake; 3) Chute Pond Vista; 4) Bagley Rapids; 5) Sunrise Lake; and 6) Tar Dam. There will be no activities proposed within this area that would have any effects on vegetation. Therefore, there will be no further analysis or discussion related to this area.

Management Area 8G

MA 8G - Old Growth and Natural Feature Complexes- is characterized by ecosystem complexes and scattered individual stands which feature existing or developing old growth forest, as well as other exemplary natural communities. Within the Lakewood Southeast Analysis Area, there are about 6,288 acres that fall within MA 8G areas. This area falls into four main Old Growth or Natural Feature Complexes: 1) Crosswell Uplands; 2) Hay Creek Swamp; 3) Section 34 Swamp; and 4) Waupee Swamp. There will be no activities proposed within this area that would result in changes to vegetation composition and structure. Therefore, there will be no further analysis or discussion related to this area.

Vegetative Structure

As discussed in the Historical Background section, the existing upland forest type structure is mostly the result of harvest activities and subsequent reforestation and fire suppression efforts that took place starting in the late 1800's and up to the 1940's. As illustrated in **Figure 8**, most of the merchantable timber was harvested resulting in landscape-scale regeneration. Active reforestation efforts, especially those of the CCC, have also had a substantial and long-lasting effect on the vegetative structure in the project area. Some areas were transformed from open pine barrens to closed canopy forests. At the same time, other areas were converted from old growth mixed conifer forests to young, single species plantations.

Recent harvesting, mostly since the 1960's, has also influenced forest structure. Clearcutting stands of shorter-lived, shade intolerant species such as aspen has begun to diversify age class distribution. Thinning and individual tree selection harvesting in longer-lived conifer and hardwood stands has started to develop within stand and landscape structural components.

Overview of Age Class Distribution in Lakewood Southeast Analysis Area
Since desired age class distributions are forestwide guidelines (see pp. 2-5 thru 2-13 of the Chequamegon-Nicolet Forest Plan) without respect to Management Areas, it is appropriate to review existing age class distributions at the project area and forestwide scales.

Aspen

(*Populus tremuloides)*

Aspen management is a key area of interest within the Forest Plan and by a number of interest groups. For this reason, an alternative to the Proposed Action was developed which emphasizes the maintenance and management of aspen. Therefore, there will be much discussion related to the aspen resource in this report.

Within the Lakewood Southeast Project Area, there are about 7,000 acres of aspen forest types. Aspen is a shade intolerant species and is considered a "pioneer" tree species on sites that are recovering from intense disturbance. Under natural conditions, aspen is regenerated by disturbances such as wildfires, windstorms followed by high intensity fires or other events that leave a site devoid of vegetation. These conditions are favorable for aspen root suckering and seeding (Forest Plan FEIS Appendix F, pp. F-4 and F-5).

Aspen is not a long-lived species. By age 50, decay pathogens start to become a concern and are a major deterrent to growing aspen on long rotations (Perala and Russell, 1983, pp.113-14). After 50-70 years, these stands will begin to deteriorate. The deterioration of the aspen stand begins when the crowns of older trees can no longer grow fast enough to fill voids in the canopy left by dying trees. By age 60-80 years, many aspen trees will have died and succession to more shade tolerant trees will begin (Forest Plan FEIS Appendix F, p. F-4). Deteriorating clones will produce significantly fewer root suckers following harvest or catastrophic disturbances than their healthy counterparts.

Wildfires have largely been eliminated from the Great Lakes landscape through active fire suppression. Man-caused disturbance events are needed to maintain aspen on landscape scales. In the absence of stand replacement disturbances, aspen stands will gradually convert to types dominated by more shade tolerant species.

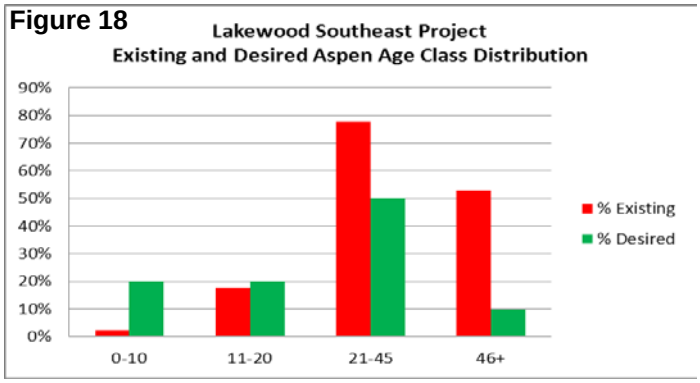
Where regeneration of aspen types is the objective, clearcutting is the optimal method for regenerating fully stocked stands and maximizing growth (Perala,1990, p.10). Aspen needs full sunlight for vigorous growth and successful competition with shade tolerant species. As little as 10-15 square feet of basal area of residual overstory will slow aspen sucker growth by 35-40% (Perala,1977, p.3). Thus, shelterwood and seed tree harvests are not as effective in regenerating aspen stands. Individual tree selection is not effective in regenerating aspen stands since it maintains excessive shade-producing overstory trees.

Table 9: Existing Aspen Age Class Distribution

Age Class	Desired Condition %	Desired Condition (acres)	Existing % in Lakewood Southeast Area*	Existing Acres in Lakewood Southeast Area	Existing Forestwide
0-10	20%	925	2%	107	4%
11-20	20%	925	18%	825	12%
21-45	50%	2314	78%	3599	45%
46+	10%	463	53%	2456	39%

*figures add up to 151% since existing aspen composition is 151% that of DFC.

Figure 18



Since aspen is a short-lived, shade-intolerant species that has high value to many wildlife species, some people are concerned that the amount of aspen on the landscape has been steadily decreasing since the time of "The Cutover". In regard to the Lakewood Southeast Project Area, the concern is that older aspen stands should not be allowed to break up and

convert to other types; rather, they should be regenerated to young aspen stands- thus maintaining the aspen type at or close to its current level in the project area.

Table 9 and **Figure 18** concisely display a summary of the desired and current age class distribution of aspen.

As the graphics clearly illustrate, there is an overabundance of aspen in the two oldest age classes and there is a lack of representation in the youngest age class. This is the case both within the Lakewood Southeast Project Area and at the forest level. It is for this reason that one of the Lakewood Southeast Project's primary purposes is to regenerate older aspen stands in accordance with Forest Plan direction (p. 2-5).

To meet the Desired Future Condition of 20% of the aspen in the young age class about 818 acres of aspen should be regenerated. The majority of this acreage should be taken from the 46+ age class. Assuming an 18% reduction from that age class, 35% of the old-aged aspen would remain. However, much of this remaining 35% of old-aged aspen should be converted to pine types in order to meet composition objectives (see the previous discussion on forest composition – MA 4B). A combination of type conversion and regeneration of some of the remaining older aspen would result in a picture that would be much more closely in line with the desired condition depicted in **Figure 18**.

Paper Birch

Occupying only 179 acres (of this, only128 acres is included within management areas open to timber management), paper birch is not an abundant species within the Lakewood Southeast Project Area. Nonetheless, the Forest Plan gives direction (p. 2-6) to manage the Forest's paper birch resource with 25% in each of the age classes as shown in **Table 10**.

Table 10: Paper Birch Age Class Distribution

Age Class	Desired Condition	Existing in Lakewood Southeast Area	Existing Forestwide
0-20	25%	0%	4%
21-40	25%	0%	1%
41-60	25%	4%	2%
61+	25%	96%	93%

Paper birch (*Betula papyrifera)* is a sun-loving species that regenerates areas after widespread disturbances, such as stand-replacement fires. It is a short-lived species that must be regenerated using even-aged methods (Forest Plan FEIS Appendix F, pp. F-8 and F-9; Perala and Alm, 1989, p. 151). It also regenerates best when mechanical site prep, such as the use of a salmon blade, follows the harvest. If not regenerated by some sort of disturbance, the paper birch type will be replaced by more tolerant types, such as oak or northern hardwoods.

Within the project area, 100% of the paper birch is presently aged 60 or older. This is beyond the standard rotation age and is approaching the extended rotation age given in the Forest Plan (p. 2-4). If this birch is not regenerated during the next 20 years, it will most likely convert to other more tolerant types through natural succession. However, it should also be stated that all but 7 acres of this birch is located in MA 8F and 8G. Timber management is not allowed in this area and, therefore, the topic of birch age class distribution becomes moot.

Northern Hardwoods

Within the Lakewood Southeast Project Area are approximately 4,240 acres of Northern Hardwood types.

Northern Hardwoods are forest types that are dominated by sugar maple (*Acer sacharum)*. Northern hardwood stands can be highly variable and typically contain a wide variety of species, including white ash, red maple, basswood, yellow birch, beech, and hemlock. Other associates may also be present, such as aspen, paper birch, and pine species.

Because many of the constituent northern hardwood species are more shade tolerant, northern hardwood stands can be managed under a wide variety of silvicultural systems. Most commonly, they are managed under the uneven-aged single tree selection method or the even-aged shelterwood method.

Within the Lakewood Southeast Project Area, however, due to the sandier soils, most of the hardwood stands have strong components of pine, oak, and mid-tolerant hardwood species. These types lend themselves well to even-aged management, which is emphasized in the majority of the project area (see forest plan, p. 3-17 thru p. 3-19). The IDT estimated that about 90% of the hardwoods in the project area would be good candidates for even-aged management. The ID Team spatially reviewed the edaphic and vegetative conditions and determined the conditions in the Lakewood Southeast Project Area are reasonably capable of providing 90% of the upland hardwoods in this condition. To meet the goals of MA 4, this level was determined by the team as the benchmark against which to measure our maximum attainment of this desired condition.

Currently, the age class distribution of the hardwood types differs from the desired condition identified in the forest plan (see **Table 11** and **Figure 19**). There is an overabundance of acreage in the 61-100 year age class and a shortage of acreage in the 0-20 year age class. It is estimated that, in order to achieve the DFC for hardwood age class distribution, about 1,600 acres of 61-100 year old stands would need to be shifted to other age classes- either older or younger. At the same time, the 0-20 year age class would need to be increased by about 525 acres. It would be impossible to fully meet these two objectives at the same time. While it may be possible to increase the young age class by 525 acres (presumably by regenerating that amount of 61-100 year old stands), it would not be possible to further reduce the old-aged stand acreage without causing an excess in the young age class.

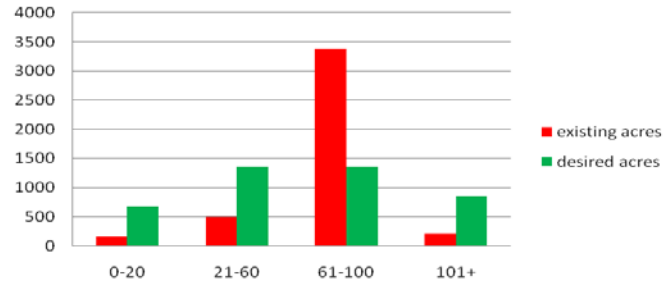
The process of moving age classes toward desired distributions is called “regulation”. Usually, this process requires multiple treatment entries and the passage of considerable time.

Table 11: Northern Hardwoods Age Class Distribution

Age Class	Desired Condition	Existing in LKSE Area	Existing Forestwide*
0-20	16%	4%	2%
21-60	32%	12%	2%
61-100	32%	80%	76%
101+	20%	5%	8%

***There are also about 12% uneven-aged hardwood stands forestwide.

Figure 19 Lakewood Southeast Project
Existing and Desired Hardwood Age Class Distribution



No set of treatments today will instantly change the Lakewood Southeast Project Area to meet all DFC’s in the Forest Plan. This would take many entries and much time. But there are some actions that could be taken today that would move the area toward those DFC’s.

No hardwood stands in the project area are currently *uneven*-aged- that is, containing three or more distinct age classes. About 10% of the hardwoods in the project area would be good candidates for management under an uneven-aged system. We’ve identified approximately 300 acres of hardwoods within the project area that are good candidates for uneven-aged management and which currently exceed desired stocking levels. These have been proposed for individual tree selection harvest.

Jack Pine

Within the Lakewood Southeast Project Area, Jack pine (*Pinus banksiana)* is found on approximately 1,930 acres, or 7% of the area.

Jack pine is a very shade intolerant pioneer species that regenerates following widespread stand replacement disturbances, such as fires or clearcuts. It is a short-lived species and is best managed under the even-aged system using the clearcut method. This is the optimal method for regenerating this species (Forest Plan Appendix F, pp. F-5 and F-6; Benzie, 1977). If it is not regenerated, more shade tolerant species, such as oak or red maple will gradually take over the site.

Jack pine has been aggressively managed in the Lakewood Southeast Area over the past 40 years. Much of what had been planted in the mid to late 1930's began to decline in the mid 1970's and, as a result, there was a large scale salvage program in the project area in the late '70's and early '80's.

Following the salvage, most of the areas were replanted to jack or red pine. Consequently, unlike many of the other species, jack pine does not have a large "bubble" of acreage in the oldest age class; rather, it has a "bubble" in the 11-30 year age class.

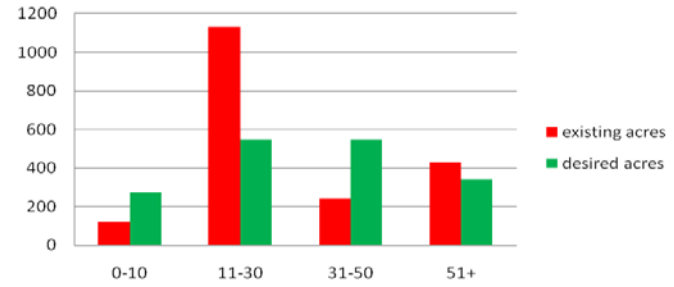
There is also a shortage of representation in the 0-10 year age class. About 150 acres of new jack pine regeneration would be needed to increase the current 6% to the desired 16% in the young age class.

A reduction of about 90 acres is also desired in the 51+ age class. These figures reflect the desired reduction in MA 4B jack pine composition in discussed earlier.

Table 12: Jack Pine Age Class Distribution

Age Class	Desired Condition	Existing in LKSE Area	Existing Forestwide
0-10	16%	6%	9%
11-30	32%	59%	55%
31-50	32%	13%	7%
51+	20%	22%	29%

Figure 20 Lakewood Southeast Project
Existing and Desired Jack Pine Age Class Distribution



Red Pine

Red Pine (*Pinus resinosa)* occupies about 7,356 acres (27%) of the Lakewood Southeast uplands- a considerable component of the upland vegetation.

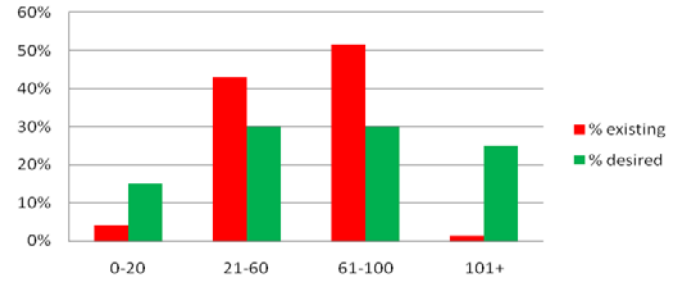
Red pine is fairly intolerant of shade, but more tolerant than species such as aspen, paper birch, and jack pine. It is best managed under even-aged conditions (Forest Plan FEIS Appendix F, page F-6). Desired age classes for red pine are given in the Forest Plan (p. 2-10) and are displayed in **Table 13**.

Thirty-three percent of the red pine in the Lakewood Southeast Area was planted in the era of the Civilian Conservation Corps. Planting records from the 1930's and early 1940's describe the planting of vast areas in the project area. These 69-77-year-old stands comprise a "spike" in the amount of 61-100 year old stands. On the other hand, there is a shortage of red pine stands 0-20 years of age (see **Figure 21** at right).

Table 13: Red Pine Age Class Distribution

Age Class	Desired Condition	Existing in Project Area	Existing Forestwide
0-20	15%	4%	6%
21-60	30%	43%	42%
61-100	30%	52%	50%
101+	25%	1%	2%

Figure 21 Lakewood Southeast Project
Existing and Desired Red Pine Age Class Distribution



At the forest level, the red pine age class distribution is congruent with this pattern, varying little.

As noted in the discussion on Forest Composition for MA 4B, there is a need to increase red and white pine composition within the project area. Likewise, as **Table 13** and **Figure 21** illustrate, there is also a need to increase representation in the 0-20 year age class while also reducing representation in the 61-100 year age class. These two objectives will need to be pursued concurrently.

White Pine

White pine (*Pinus strobus)* occupies about 1593 acres, or about 6%, of the Lakewood Southeast Project Area.

White pine is intermediate in shade tolerance. It commonly becomes established under the canopy of overstory trees and can sometimes persist under considerable shade. It grows best under open conditions, but can be easily out-competed by faster-growing species. For this reason, white pine generally does best under partial shade.

Table 14: White Pine Age Class Distribution

Age Class	Desired Condition	Existing in LKSE Area	Existing Forestwide
0-20	12%	6%	8%
21-60	24%	9%	3%
61-120	36%	82%	80%
121+	28%	3%	9%

It can be managed in a number of ways, but the shelterwood method is generally considered the most effective (Forest Plan FEIS Appendix F, p. F-10). Due to its many ecological values, white pine is frequently planted in the understories of existing stands. White pine was extensively logged in parts of the area during the late 1800's. What remains today in the Lakewood Southeast Area is undoubtedly a fraction of what formerly existed. During the CCC Era, white pine plantations were planted in the project area, but not to the extent of the red pine. About 31% of the white pine in the project was planted between 1933 and 1942.

As shown in **Table 14** above, the vast majority of the white pine in the project area is greater than 61 years of age. Since these age classes are over-represented, an opportunity exists to convert some of the area to the young age class through regeneration harvests. Opportunities also exist to increase the young white pine component through underplanting, especially along riparian corridors.

On the Lakewood/Laona District, the Lakewood Southeast Area is pine country. While the representation of white pine as a type is not great, understory white pine regeneration is widespread in this area. The natural trend is a return to white pine on the Lakewood Southeast landscape.

Balsam Fir

At about 820 acres in the uplands, balsam fir comprises about 3% of the Lakewood Southeast Area.

Balsam fir (*Abies balsamea*) has a strong ability to become established and grow under the shade of larger trees. It is classified as very tolerant. Typically, balsam fir grows in mixed stands with paper birch, aspen, maple, and other species. Balsam fir stands break up at fairly young ages and tend not to persist into old ages. In the absence of disturbance, the sites tend to become occupied by longer lived and more shade tolerant species such as red and sugar maple. Rotation ages are generally between 45 and 60 years of age depending on the site and the risk factors (Forest Plan FEIS Appendix F, p. F-8).

Balsam fir can be managed under both even and uneven-aged silvicultural systems. Even-aged systems are the preferred method. Under even-aged systems, **Table 15** displays the desired age class distribution (Forest Plan, p. 2-11). Also shown is the existing condition in the Lakewood Southeast Project Area.

Table 15: Balsam Fir Age Class Distribution

Age Class	Desired Condition	Existing in LKSE Area	Existing Forestwide
0-10	20%	0%	2%
11-30	40%	17%	5%
31-45	30%	7%	14%
46+	10%	75%	80%

Currently, there is a great overabundance of balsam fir in the 46+ year age class and a lack of any in the 0-10 year age class. This presents an opportunity to regenerate some older stands to move conditions more in line with desired conditions. Opportunities to do this may be limited, however, since many of these stands tend to be small, isolated, or in areas with conflicting management objectives.

Northern Red Oak

Northern red oak (*Quercus rubra)* occupies about 1,593 acres, or about 6%, of the Lakewood Southeast Project Area.

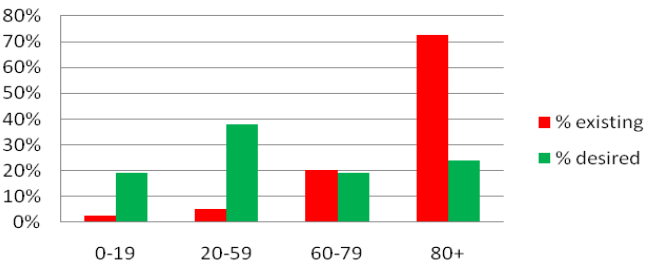
Northern red oak is classified as intermediate in shade tolerance. It is less tolerant of shady conditions than some species, such as sugar maple, beech, or hemlock; yet is more shade tolerant than other species, such as aspen and white ash.

Oak stands are best managed under even-aged silvicultural systems. They are most commonly regenerated using the shelterwood method (Forest Plan FEIS Appendix F, pp. F-10 and F-11).

Table 16: Red Oak Age Class Distribution

Age Class	Desired Condition	Existing in LKSE Area	Existing Forestwide
0-19	19%	3%	2%
20-59	38%	5%	2%
60-79	19%	20%	27%
80+	24%	72%	69%

Figure 22 Lakewood Southeast Project
Existing and Desired Oak Age Class Distribution



Currently, within the Lakewood Southeast Project Area, there is an overabundance of oak in the 80+ year age classes and shortage of stands in the 0-19 year age class (**Table 16** and **Figure 22**). In the 0-19 year age class, there is a 16% shortage when compared to the forest plan's desired conditions. This equates to the need to regenerate about 330 acres of oak.

As **Figure 22** clearly shows, there is a substantial overabundance of oak acres in the 80+ age class. This is the standard rotation age for most of the oak stands in the Lakewood Southeast Area. In order to move the 80+ year age class to the DFC, about 980 acres of oak would need to be regenerated. It is not realistic to do this at this time. Oak is a challenging species to regenerate, due to the fact that it is a weak competitor against many of its associate species. In order to successfully regenerate older oak stands to well-stocked young oak stands, several shelterwood prepatory cuts are usually needed. Therefore, there is a need to begin the process of regenerating some of these older stands. Some of these treatments may be able to effectively swap 80+ year old stands for 0-19 year old stands, but this would have to be contingent on the level of successful oak reproduction realized.

Measures

In this analysis, the primary unit of measure will be acres of forest types and age classes. Forest composition by type was calculated using Microsoft Excel® spreadsheets ("Lakewood Southeast.xlsx" and "forestwide_comp_age_class_distr_0310.xlsx" and compared to desired conditions given by the Chequamegon-Nicolet Forest Plan. Likewise, age class distributions were determined in the same manner as the Forest Plan and compared to the guidelines to assess progress towards goals.

Thresholds

A threshold is generally described as a point where, if exceeded, action or inaction would result in a significant impact to the human environment. In regard to the issues of vegetation composition and structure and aspen management, there are no thresholds *per se*. However, the Chequamegon-Nicolet Forest Plan (Forest Plan p 2-5 and p 3-10) has guidelines and objectives for age class distribution, density and stand structure. This analysis will compare the existing conditions and the outcomes of each alternative to those desired conditions and report the findings.

Assumptions

Only those species that would be directly affected by the Lakewood Southeast Project were analyzed in detail.

Short-term effects will be defined as those that take place immediately following the implementation of the alternative in question and last for about five years. In reality, the actions included in each of the action alternatives will likely occur over a five year period. For simplicity and for consistent analysis of the alternatives, the actions were assumed to take place in a single year- 2013. These short-term effects will also be displayed in tables under the discussion of each alternative.

Long-term effects will be defined as those that would be foreseeable about 15 years from the time of implementation of a given alternative. Since the treatments were assumed to take place in 2013, the year of long-term effects, for the sake of this analysis, is 2028.

I assumed that no future actions would take place other than the Lakewood Southeast alternative actions. In some of my discussion, however, I did state that future managers may have certain options or likely wish to manage in a certain way. However, I didn't make any calculations based on those possibilities.

I assumed that aspen and jack pine convert by age 80. This has been my experience on this district. Unless stand-specific conditions suggested otherwise, I further assumed that aspen would convert to mixed hardwoods under passive management. Although this does vary, it is generally the case in the Lakewood Southeast Area.

In accordance with the information contained in the Silvics of North American Trees (R.M. Frank) and my own personal experience, I assumed that balsam fir stands lived to maximum age of 80 years, but maintained themselves as a type on site. Following this, I assumed that any balsam that is currently greater than 80 years of age would break up and regenerate, being 15 years old in 2028, the year for long-term effects. I realize that this is not realistic, but it is very difficult to predict exactly when these stands will break up and regenerate themselves. I made this assumption for consistency and simplification.

I assumed that it would take about 15 years to establish an oak understory with an oak shelterwood. This is ideal and actually varies widely, but, for the sake of analysis, I had to be consistent and simplify things. I assumed that other shelterwood treatments became fully stocked five years after harvest, thus 10 years old in 2028. In reality, however, most oak stands will take longer than 15 years to regenerate.

I assumed that paper birch would live to a maximum age of 80 years. This is generally the case. Since birch stands usually contain a mixture of aspen and oak (and that the aspen will have also faded out by age 80), I assumed that paper birch stands would generally convert to oak after age 80. However, there were some stands that had a strong balsam fir component. Some of these were assumed to convert to balsam.

Aspen conversions as a result of thinnings, burnings, and underplantings were predicted on a case-by-case basis. I consulted the stand tables and my personal knowledge of each of these stands to make my determination. Most of them converted to hardwoods immediately. Some of them converted to pines, a few to oaks. Nearly all remained the same age since the aspen component would be greatly reduced, leaving other species of the same age as the original aspen.

However, some stands were comprised of an overmature aspen overstory and a pine or hardwood understory. These were assumed to convert, in most cases, by 2028, resulting in a 15-year-old stand as the remaining overmature aspen declined.

In the case of the special cuts, I assumed that they would generally result in maintenance of the same forest type, only at a greatly reduced stocking level.

FINDINGS

The following discussion on effects to forest composition will be described by Management Area and compared to desired conditions. Effects on age class distribution are at the scale of the project area.

Alternative 1 (No Action)

Direct and Indirect effects

Under Alternative 1, no harvests, planting, or any of the other proposed activities would take place. Other than normal ongoing administrative, maintenance, and protection work, no actions would take place within the Lakewood Southeast Project Area.

The following section discusses the effects Alternative 1 would have on the vegetation composition and age class distribution of each forest type within the project area.

Aspen

Composition

Under Alternative 1, there would be no anticipated change in the composition of aspen in the short term. The analysis I conducted showed no change in aspen composition in any of the management areas. However, in 2013, 36% (2,538 acres) of the aspen would be in the 46+ year age class; 23% (1,636 acres) would be aged 60 or older. This would have some long term implications.

Due to natural succession and aspen's short longevity, there would be definite long-term consequences of no action. By 2028 (15 years after treatment), it is estimated that the long-term effect of Alternative 1 on aspen composition would be a loss of about 1,400 acres to longer-lived or more shade-tolerant types, such as white pine, oak, or hardwoods. At that point, about 1,100 acres (21%) of the aspen would be 60+ years old. Further conversion of these acres to other shade-tolerant or long-lived types would, therefore, be imminent.

Table 17: Long-term Effects of Alternative 1 on Aspen Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 Acres	Alt 1 %
2C	196	57.5%	15-30%	142	41.7%
4A	3,628	27.2%	10-30%	2,866	21.5%
4B	2,423	27.0%	0-7%	2,040	22.8%
Areawide*	6,987	25.7%	n/a	5,580	20.5%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Table 17, gives a concise listing of how the aspen composition would change in the long term. Aspen composition would be expected to decline across all management areas by the amounts shown.

Structure (Age Class Distribution)

Table 18: Alternative 1 Effects on Aspen Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 1 Short-Term	Alt 1 Long-Term	Alt 1 Deviation from DFC
0-10	2%	20%	-18%	2%	0%	-20%
11-20	12%	20%	-8%	4%	1%	-19%
21-45	52%	50%	+2%	58%	32%	-18%
46+	35%	10%	+25%	36%	67%	+57%

As shown in **Table 18**, in the short term, Alternative 1 would result in a shift toward older age classes. This trend would continue in the long term. As noted in the discussion on Aspen Composition, above, by the year 2028, it is anticipated that there would be a loss of about 1,400 acres

of aspen due to succession. Of the 5,580 acres that would remain, 67% (3,716 acres) would be in the 46+ year age class.

This would move the aspen age class distribution further away from desired conditions in the youngest and oldest age classes, skewing the distribution further toward the oldest age class. Currently, the average deviation of the existing from the desired conditions is 13.3%. This would be further increased to 28.5%.

Paper Birch

Composition

Under Alternative 1, there would be no anticipated change in the composition of paper birch in the short term. As noted in the discussion for the existing condition, there are 128 acres of paper birch within management areas that are open to timber management. As it happens, all of this acreage falls within Management Area 4A. In the short term, the percentage of Management Area 4A in paper birch in would remain at about 1%.

In the long term, it is expected that 172 of the total 179 acres of birch in the project area would convert to other types- mainly balsam fir. Only one 7 acre stand would likely remain. And, in fact, this one remaining stand (in MA 8G) would be 78 years old at that time – a high likelihood for conversion at this age.

Structure (Age Class Distribution)

See **Table 19**. In the short term, the age class distribution of paper birch would change slightly under Alternative 1. Currently, one birch stand (7 acres) is 41-60 years old. However, by 2013, this stand would grow into the 61+ year age class. Thus, in the short term, the birch age class distribution would shift from 96% to 100% in the 61+ age class group.

Table 19: Alternative 1 Effects on Paper Birch Age Class Distribution

Age Class	Existing	Desired	Alt 1 Short-term	Alt 1 Long-term
0-20	0%	25%	0%	0%
21-40	0%	25%	0%	0%
41-60	4%	25%	0%	0%
61+	96%	25%	100%[1]	100%[2]

[1] based on 179 acres
[2] based on 7 acres

In the long term, barring some natural stand-replacement event, there would probably be only one 78-year-old 7 acres of paper birch left in the Lakewood Southeast Project Area. All of this would be in the 61+year age class. All other paper birch would have declined, broken up, and converted to other types.

Northern Hardwoods

Composition

No change would be expected in northern hardwoods composition in the short term.

In the long term, the composition of hardwood in the Lakewood Southeast Project Area would be expected to increase across all management areas (see **Table 20**). This would result from many acres of overmature early-successional forests (such as aspen and birch) converting to the more shade-tolerant hardwoods.

Table 20: Long-term Effects of Alternative 1 on Northern Hardwood Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 Acres	Alt 1 %
2C	29	8.4%	30-50%	82	24.2%
4A	2,076	15.6%	0-25%	2,839	21.3%
4B	729	8.1%	0-10%	1,113	12.4%
Areawide*	4,237	15.6%	n/a	5,650	20.8%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

Table 21, displays the northern hardwood age class distribution within the Lakewood Southeast Project Area. Under Alternative 1, no harvest activities would take place in the project area.

In the short term, as noted earlier, there would be no change in hardwood composition. However, there would be a shift in the age class distribution within the project area. As displayed in **Table 21**, there would be a shift of hardwood acreage in the next higher age classes. The net result would be a decrease of hardwood in the 0-60 year old groups and an increase of hardwood in the 61+ age groups.

Table 21: Short and Long-term Effects of Alternative 1 on Northern Hardwood Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 1 Short-term	Alt 1 Long-term	Alt 1 Deviation from DFC
0-20	4%	16%	-12%	2%	1%	-15%
21-60	12%	32%	-20%	9%	3%	-29%
61-100	80%	32%	+48%	83%	63%	+41%
101+	5%	20%	-15%	7%	34%	+14%

This would also be the trend in the long term. However, the change would be especially dramatic in the 61-100 and 101+ year age classes. Note that the 61-100 year age class would drop from 80 to 63% while the 101+ year age class would increase from 5% to 34%. Some of this movement would be toward the desired conditions. However, the movement out of the younger two age classes would represent a departure from the desired future conditions. In all, rather than moving the area closer to the DFC's, the average deviation from the DFC would increase (to 25%) from the existing condition (23.75%) in Alternative 1.

Stocking

The preliminary analysis for the Lakewood Southeast Project identified that there are currently about 179 acres of mixed upland hardwood stands that exceed desired stocking levels. Alternative 1 proposes no treatments that would reduce the stocking levels. Therefore, Alternative 1 would not respond to this need for action.

Uneven-aged Hardwood

The preliminary analysis for the Lakewood Southeast Project identified that that 307 acres in 8 stands should be moved toward an uneven-aged condition. Since then, additional review amended that recommendation to 194 acres. Alternative 1 proposes no treatments that would move these stands toward uneven-aged conditions. Therefore, Alternative 1 would not respond to this need for action.

Jack Pine

Composition

There would be no short-term effects on the composition of jack pine within the Lakewood Southeast Project Area as a result of Alternative 1. The composition of jack pine would remain the same as it currently is.

In the long term, however some changes would result from Alternative 1. See **Table 22** at right. As a result of natural succession of old-aged jack pine stands to other more shade-tolerant types such as oak and white

Table 22: Long-term Effects of Alternative 1 on Jack Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 Acres	Alt 1 %
2C	0	0%	0-2%	0	0%
4A	1,174	8.8%	0-35%	975	7.3%
4B	716	8.0%	3-6%	543	6.1%
Areawide*	1,928	7.1%	n/a	1,532	5.6%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

pine, there would be a loss of about 400 acres of the jack pine type. As shown in **Table 22**, the jack pine composition in Management Areas 4A and 4B would be reduced, but they would still fall within the range of desired composition percentages.

Structure (Age Class Distribution)

There would be no short-term effects on the age class distribution of jack pine within the Lakewood Southeast Project Area as a result of Alternative 1. The age class distribution of jack pine would remain the same as it currently is.

Refer to **Table 23**. In the long-term, the main effect of Alternative 1 would be the movement of acreage into the next successive age classes. For example, all of the existing 0-10 year-old jack pine would move into the 11-30 year age class. As noted earlier, about 400 acres of the oldest jack pine would convert to other types. This would also have the effect of reducing the acreage of jack pine in the 51+ year age class and increasing the proportion of the 31-50 year age class. As a result of ingrowth from the 11-30 year age class and a reduction of overall jack pine acreage, we would see a substantial jump in the representation of 31-50 year-old stands.

Table 23: Long-term Effects of Alternative 1 on Jack Pine Age Class Distribution

Age Class	Existing	Desired	Alt 1 Long-term
0-10	6%	16%	0%
11-30	59%	32%	8%
31-50	13%	32%	80%
51+	22%	20%	12%

Red Pine / White Pine

Since the Chequamegon-Nicolet Forest Plan groups red and white pine as a composition objective, these two types will be combined for the discussion of composition. However, since the Forest Plan gives different age class objectives for each species, age class distribution for the two types will be discussed separately.

Composition

In the short term, there would be no changes to the existing composition of red and white pine within the Lakewood Southeast Project Area as a result of Alternative 1.

In the long term, there would be an increase of about 33 acres of the red/white pine type in MA 4B. This would result from the natural succession of a jack pine stand with a white pine component.

Table 24: Long-term Effects of Alternative 1 on Red/White Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 Acres	Alt 1 %
2C	33	9.8%	10-30%	33	9.8%
4A	4,739	35.5%	10-50%	4,739	35.5%
4B	3085	34.4%	45-70%	3,118	34.8%
Areawide*	8,949	32.9%	n/a	8,949	32.9%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

Red Pine

In the short term, as the result of Alternative 1, there would be some shifts in red pine age class distribution toward the next higher age class (See **Table 25**). Overall, this would move the red pine age class distribution away from desired conditions for most age classes. The exception to this would be the 101+ year age class, which would see a 1% increase, nudging the age class distribution toward the desired 25% for that age class.

Table 25: Alternative 1 Effects on Red Pine Age Class Distribution

Age Class	Existing	Desired	Alt 1 Short-Term	Alt 1 Long-Term
0-20	4%	15%	1%	0%
21-60	43%	30%	44%	38%
61-100	52%	30%	54%	56%
101+	1%	25%	2%	6%
Total	100%	100%	100%	100%

In the long term, this trend would continue. The 101+ year age class would have 6% of the red pine, the 61-100 year age class would see an increase due to ingrowth, and the lowest two age classes would see reductions.

White Pine

In the short term, as a result of Alternative 1, there would be no changes to the age class distribution of white pine. However, in the long term, there would be a shift of acreage into each successive age class. See **Table 26**. All stands in the 0-20 year age class would shift into the 21-60 year age class. Meanwhile, an even larger acreage in the 21-60 year age class would grow into the 61-120 year age class. Finally, a still larger acreage in the 61-120 year age class would grow into the 121+ year age class. The result is a net reduction in all age classes – except for the 121+ year class.

Table 26: Alternative 1 Effects on White Pine Age Class Distribution

Age Class	Existing	Desired	Alt 1 Long-Term
0-20	6%	12%	0%
21-60	9%	24%	8%
61-120	82%	36%	75%
121+	3%	28%	16%
Total	100%	100%	100%

Stocking

Red Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 3,632 acres of red pine in 149 stands that are or soon will be in need of stocking reduction. Alternative 1 proposes no treatments that would reduce stocking in these stands to desired conditions. Therefore, Alternative 1 would not respond to this need for action.

White Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 314 acres of white pine in that are in need of stocking reduction. Alternative 1 proposes no treatments that would reduce stocking in these stands to desired conditions. Therefore, Alternative 1 would not respond to this need for action.

Balsam Fir

Composition

Under Alternative 1, in the short term, there would be no change in the composition of balsam fir within the Lakewood Southeast Project Area.

Over the long term, the composition of balsam fir would be expected to increase slightly. As shown in **Table 27**, in Management Areas 2C and 4B, the acreage of balsam fir would remain the same. However, in Management Area 4A, the Lakewood Southeast Project Area would see an increase of about 170 acres of balsam fir. This would be the result of paper birch stands breaking up and converting to the more shade-tolerant balsam fir.

Table 27: Long-term Effects of Alternative 1 on Balsam Fir Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 Acres	Alt 1 %
2C	80	23.7%	0-3%	80	23.7%
4A	362	2.7%	0-3%	490	3.7%
4B	181	2.0%	0-3%	181	2.0%
Areawide*	819	3.0%	n/a	991	3.7%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

See **Table 28**. In the short term, about 6 percent of the balsam fir in the project area would grow out of the 31-45 year age class and into the 46+ year age class. This would be the only short term effect of Alternative 1 on balsam fir age class distribution in the Lakewood Southeast Project Area.

Table 28: Long-term Effects of Alternative 1 on Balsam Fir Age Class Distribution

Age Class	Existing	Desired	Alt 1 Short-term	Alt 1 Long-term
0-10	0%	20%	0%	6%
11-30	17%	40%	17%	53%
31-45	7%	30%	1%	12%
46+	75%	10%	82%	28%

In the long term, the age class distribution of balsam fir in the Lakewood Southeast Area would be expected to move closer to desired conditions. This is because the old stands (46+ years) would be expected to break up and regenerate to young balsam fir, thereby reducing the amount of overabundant old-aged balsam and increasing the amount of under abundant young-aged balsam. At the same time, there would be an infusion of 11-30 year-old balsam resulting from paper birch conversions.

Oak

Composition

In the short term, there would be no changes to the existing composition of oak in the Lakewood Southeast Project Area.

In the long term, there would be an increase of about 400 acres of the oak type in the project area. This would result from type conversions from old-aged stands of early successional types such as aspen, paper birch, and jack pine.

Table 29: Long-term Effects of Alternative 1 on Oak Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 Acres	Alt 1 %
2C	0	0%	0-10%	0	0%
4A	592	4.4%	0-25%	791	5.9%
4B	1,149	12.8%	10-25%	1,289	14.4%
Areawide*	2,027	7.5%	n/a	2,423	8.9%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

In the short term, Alternative 1 would have measurable effects on the age class distribution of oak in the project area. As it happens, there are many acres of oak within the area that are on the verge of growing into the next greater age class. Thus, as **Table 30** shows, by 2013, there would be an increase of oak acreage in the 61-100 and 101+ year age classes. Correspondingly, there would be decreases of representation in the two youngest age classes.

Table 30: Short and Long-term Effects of Alternative 1 on Oak Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 1 Short-term	Alt 1 Long-term	Alt 1 Deviation from DFC
0-19	3%	19%	-16%	2%	16%	-3%
20-59	5%	38%	-33%	5%	4%	-34%
60-79	20%	19%	+1%	7%	2%	-17%
80+	72%	24%	+48%	85%	77%	+53%

In the long term, Alternative 1 would further skew the age class distribution of oak away from the desired conditions. **Table 30** illustrates that, while there would be an increase of 0-19 year-old oak, most of the stands in the 20-79 year-old range would grow into the 80+ year-old category. The net result of this is that the average deviation from the desired conditions would increase to 28.6% (compared to the existing 24.5%).

White Spruce

Composition and Structure

There are no activities proposed in white spruce types in Alternative 1 or any of the other alternatives. There would be no direct or indirect effects on white spruce as a result of the Lakewood Southeast Project. Therefore, there will be no further discussion of this type in this report.

Communities of Concern

Northern Dry Forest

Among its stated needs for action, the Lakewood Southeast Project has identified the need to reestablish components and processes in the northern dry forest ecosystem. This is also discussed on page 16 of this report. Alternative 1 proposes no actions that would address this need for action. While some of the components of the northern dry forest ecosystem could be achieved through passive management (that is, allowing nature to take its course), this would be a very slow process and, likely, wouldn't come as close to desired conditions as active management. Prescribed fire wouldn't be used in this alternative and it is very unlikely that naturally-caused fires would be allowed to mimic historic processes. Timber stand improvement and reforestation activities would, likewise, not be included in Alternative 1. Absent these activities, the components and processes of the northern dry forest ecosystem likely would not develop for many decades, if ever.

Pine Barrens

The Lakewood Southeast Purpose of and Need for Action has identified an opportunity and need to restore Pine Barrens plant communities within the project area. This is also discussed on page 17 of this report. Alternative 1 proposes no actions that would address this need for action. Under a No Action scenario, the only conceivable way Pine Barrens communities could become reestablished in the project area would be if a specific large area was repeatedly and intensely burned to the point that most of the trees are killed and grassy communities take over. This is a highly unlikely scenario. In spite of the recognized benefits of fire, due to concerns of public safety and property protection, the Forest Service's policy in the project area is still one of active suppression. Thus, a wildfire would not be permitted to perform its historic function. Alternative 1 would not meet the need of restoring Pine Barrens communities in the project area.

Cumulative effects

Since Alternative 1 includes no agency actions, there would be no direct and indirect effects that would result from anything the Forest Service does. Any changes would result from natural succession and processes. Because of this, by definition, there would be no cumulative effects as a result of Alternative 1.

Alternative 2 (Proposed Action)

Alternative 2 proposes about 11,707 acres of timber harvest to respond to the Purpose and Need for Action. These silvicultural treatments are listed in Chapter 1 of the EIS and are the basis used for effects calculations in a Microsoft Excel® spreadsheet entitled "Lakewood_Southeast.xlsx". The harvest treatments are summarized in the following table:

Table 31. Lakewood Southeast Alternative 2 Harvest Treatment Summary

Harvest Treatment	Acres	Stands	Jack Pine	Red Pine	White Pine	Balsam	White Spruce	Paper Birch	Oak	Northern Hardwood	Aspen
Thin	*5,592*	*253*	*18*	*3,712*	*314*	*0*	*20*	*0*	*14*	*179*	*1,335*
Shelterwood	*4,282*	*145*	*32*	*154*	*298*	*332*	*0*	*128*	*1,392*	*1,866*	*79*
Clearcut	*1,246*	*58*	*269*	*241*	*0*	*0*	*0*	*0*	*0*	*0*	*736*
Special Cut	*393*	*10*	*242*	*30*	*0*	*0*	*0*	*0*	*0*	*54*	*67*
Selection	*194*	*7*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*194*	*0*

Total	***11,707***	***473***	***561***	***4,137***	***612***	***332***	***20***	***128***	***1,406***	***2,293***	***2,218***

Other Alternative 2 treatments (with approximate acreages) that have the potential to affect vegetative composition and structure are:

Table 32. Lakewood Southeast Alternative 2 Other Treatment Summary

Other Treatment	***Acres***	***Stands***
Underplant	2045	*63*
Underburn	2527	*107**
TSI	903	*27*
Full Plant	510	*20*
Salmon Blade	97	*3*
Precommercial thin	48	*2*

*approximate

Direct and Indirect Effects

Aspen

Composition

In the short term, Alternative 2 would reduce the representation of aspen types across all management areas (see **Table 33**). In the short term, it is estimated that over 900 acres of aspen stands would be immediately converted to other upland forest types. This would be done, in large part, by the widespread thinning of aspen stands. Many older aspen stands contain a strong oak or hardwood component. Thinning these stands would reduce the aspen component and instantly convert them to oak or hardwood types.

Table 33: Effects of Alternative 2 on Aspen Composition

MA	Existing Acres	Existing %	Desired %	Alt 2 Acres Short term	Alt 2 % short term	Alt 2 Acres Long term	Alt 2 % Long term
2C	196	57.5%	15-30%	177	52.0%	126	37.1%
4A	3,628	27.2%	10-30%	3,335	25.0%	3,052	22.9%
4B	2,423	27.0%	0-7%	1,806	20.2%	1,494	16.7%
Areawide*	6,987	25.7%	n/a	6,058	22.3%	5,197	19.1%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the long term, the amount of aspen in the project area would be reduced even further. By 2028, (15 years after treatment) it is estimated that Alternative 2 would result in nearly 1,800 acres of aspen types being converted to other upland forest types. **Table 33** illustrates this trend across all management areas. In addition to the short-term type conversions discussed above, many other stands in the project area have less of a secondary component or are, otherwise, less advanced in age and stand development. For example, there are many aspen stands in which Alternative 2 proposes thinning and underplanting to another type, such as white pine. In the short term, following treatment, these stands would continue to be dominated by aspen. However, during the next 15 years, the aspen overstory would begin to decline as the white pine understory takes over and becomes the characteristic species.

As discussed in the Existing Condition section of this report, there presently is about 1,800 acres more aspen than what is desired in the Chequamegon-Nicolet Forest Plan. **Table 33** shows the existing and desired component of aspen within each of the management areas. It also illustrates how Alternative 2 would cause

a considerable shift from the existing condition toward the desired composition objectives for aspen. Overall, Alternative 2 would move the aspen type closest to the desired conditions.

Structure (Age Class Distribution)

Table 34: Alternative 2 Effects on Aspen Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 2 Short-Term**	**Alt 2 Deviation from DFC (short-term)**	**Alt 2 Long-Term**	**Alt 2 Deviation from DFC (long-term)**
0-10	2%	20%	-18%	14%	-6%	0%	-20%
11-20	12%	20%	-8%	4%	-16%	16%	-4%
21-45	52%	50%	+2%	62%	+12%	34%	-16%
46+	35%	10%	+25%	19%	+9%	50%	+40%
Mean			13.3%		10.8%		20.0%

As shown in **Table 34**, in the short term, Alternative 2 would result in a substantial and immediate shift of aspen age class distribution toward the desired conditions. Alternative 2 would increase aspen's 0-10 year age class from 2% to 14% in the short term. It would do so mainly by regenerating 40+ year old stands. Thus, the 46+ year-old age class would be reduced from 35% to 19%. While this alternative moves the area toward the desired conditions of 20% (0-10) and 10% (46+), Alternative 2 doesn't go far enough to actually meet the desired conditions. The reader may, understandably, ask "why?".

The answers to this question lie in the location of many of the older aspen stands and the Chequamegon-Nicolet Forest Plan's standards and guidelines:

- Many of the older aspen stands are located within beaver management zones, where the forest plan (p. 2-17) does not allow the regeneration of aspen within specified distances from designated streams. This was the most critical limitation I found.
- Many of the older aspen stands are located in places where there is no access for logging equipment.
- Many older aspen stands are adjacent to features that otherwise limit the option to regenerate the stand. Examples include MA's 8E,F, and G as well as areas with high scenic integrity objectives.
- Several older aspen stands are adjacent to aspen stands in which clearcut regeneration harvests are proposed; regenerating these stands would result in temporary openings greater than 40 acres.

Thus, in designing Alternative 2 to comply with Forest Plan Standards and Guidelines, while we moved toward short-term Forest Plan DFC's for aspen age class distribution we were unable to meet them.

In the long-term, the short-term attainments in age class distribution would begin to disappear. Refer to **Table 34**. Due to the short-lived nature and rapid development of aspen, with the absence of subsequent regeneration harvests, by 2028 there would be no acreage in the 0-10 year age class and there would, again, be a great excess of acreage in the 46+ year age class. However, active management of aspen at present in the Lakewood Southeast Project would improve the distribution of the two middle age classes and give managers a better set of options to regulate aspen age class distribution in the future. In all likelihood, this area would be reviewed again for management needs in 15-20 years and, at that time, managers should be able to design a set of treatments that would come closer to meeting aspen age class distribution objectives.

Paper Birch

Composition

Under Alternative 2, there would be no anticipated change in the composition of paper birch in the short term. As noted in the discussion for the existing condition, there are 128 acres of paper birch within management areas that are open to timber management. All of this acreage falls within Management Area 4A and would be treated with shelterwood harvests designed to regenerate the stands to young paper birch. Thus, in the short term, the percentage of Management Area 4A in paper birch in would remain at about 1%.

In the long term, the newly-regenerated birch stands would remain birch types and the composition of birch would remain the same at 1%.

Structure (Age Class Distribution)

See **Table 35**. In the short term, 128 acres of paper birch would be regenerated through shelterwood harvests. Another 51 acres of birch stands, located within Management Areas 8F and G, would be in the 61+ year age class.

In the long term, the 51 acres in MA 8F and 8G would be expected to convert to oak types. The remaining 128 acres would be regenerating 15-20 year-old birch. Thus, 100% of the birch would be in the youngest age class 15 years after implementing Alternative 2.

Table 35: Alternative 2 Effects on Paper Birch Age Class Distribution

Age Class	Existing	Desired	Alt 2 Short-term	Alt 2 Long-term
0-20	0%	25%	71%	100%
21-40	0%	25%	0%	0%
41-60	4%	25%	0%	0%
61+	96%	25%	28%	0%

Northern Hardwoods

Composition

In the short term, as a result of Alternative 2, the composition of northern hardwoods would be expected to increase across all management areas (see **Table 36**). This change would be a direct result of the many acres of aspen thinning that are part of this alternative. These conversions would move the composition closer to desired conditions in Management Areas 2C and 4A. However, in Management Area 4B, these treatments would have the effect of increasing the amount of northern hardwoods slightly beyond the desired range of 0-10%. This would be one of the tradeoffs of decreasing the aspen composition in MA 4B. It should also be pointed out that this is happening mainly within riparian areas and beaver management corridors.

In the long term, this trend would be expected to continue. Because of the aspen thinning, as well as natural conversion anticipated in many types across all management areas, the amount of northern hardwood would be expected to rise to the levels shown in **Table 36**.

Table 36: Long-term Effects of Alternative 2 on Northern Hardwood Composition

MA	Existing Acres	Existing %	Desired %	Alt 2 Acres (short-term)	Alt 2 % (short-term)	Alt 2 Acres (long-term)	Alt 2 % (long-term)
2C	29	8.4%	30-50%	47	13.9%	98	28.8%
4A	2,076	15.6%	0-25%	2,199	16.5%	2,347	17.6%
4B	729	8.1%	0-10%	1,134	12.7%	1,174	13.1%
Areawide*	4,237	15.6%	n/a	4,784	17.6%	5,236	19.3%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

Alternative 2 proposes the use of over 1,800 acres of shelterwood harvests to modify hardwood composition and age class distribution. **Table 37** illustrates how the resulting age class distribution would differ from the existing and desired conditions.

Table 37: Short and Long-term Effects of Alternative 2 on Northern Hardwood Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 2 Short-term	Alt 2 Deviation from DFC (Short-term)	Alt 2 Long-term	Alt 2 Deviation from DFC (Long-term)
0-20	4%	16%	-12%	2%	-14%	36%	+20%
21-60	12%	32%	-20%	16%	-16%	8%	-24%
61-100	80%	32%	+48%	76%	-26%	34%	+2%
101+	5%	20%	-15%	6%	-4%	22%	+2%
Mean			23.8%		15.0%		12.0%

In the short term, there would be little change from the existing condition. Mainly, the acreage in the youngest age class would be expected to decrease while the next successive age classes would be expected to increase slightly. This is because I assumed that it would take several years for the hardwood regeneration to become established and for the removal cut to take place.

In the long term, however, there would be a large pulse in the 0-20 year age class. At the same time, there would be a big increase in acres in the 101+ year age class and a reduction of the existing bulge in the 61-100 year age class. As **Table 37** shows, this movement would result in an overall movement toward the desired hardwood age class distribution. While the acreage in 0-20 year age class would greatly exceed the desired condition, it is viewed as a temporary adjustment that will ultimately aid in the long-term attainment of the desired age class structure.

Stocking

The preliminary analysis for the Lakewood Southeast Project identified that there are currently about 179 acres of mixed upland hardwood stands that exceed desired stocking levels. Alternative 2 proposes all 179 acres of thinning treatments that would reduce the stocking levels. Therefore, Alternative 2 would fully respond to this need for action.

Uneven-aged Hardwood

The preliminary analysis for the Lakewood Southeast Project identified that that 307 acres in 8 stands should be moved toward an uneven-aged condition. Since then, additional review amended that recommendation to 194 acres. Alternative 2 proposes selection harvests in all 194 acres identified. Therefore, Alternative 2 would fully respond to this need for action.

Jack Pine

Composition

In the short term, there would be a reduction in the composition of jack pine in all management areas (see **Table 38**). In all, there would be a loss of about 400 acres

Table 38: Alternative 2 Effects on Jack Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 2 Acres (short-term)	Alt 2 % (short-term)	Alt 2 Acres (long-term)	Alt 2 % (long-term)
2C	0	0%	0-2%	0	0%	0	0%
4A	1,174	8.8%	0-35%	795	6.0%	795	6.0%
4B	716	8.0%	3-6%	569	6.4%	543	6.1%
Areawide*	1,928	7.1%	n/a	1,532	5.2%	1,353	5.0%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

of the jack pine type across the project area.

About half of the conversion would come as a result of clearcutting old jack pine stands and replanting the sites with red and white pine. The remainder of the conversions would come from the use of special cuts and thinnings. Most of these would take place east of Airport Road and the focus would be on moving older-aged jack pine stands from a closed forest condition to pine barrens/savanna conditions. In these areas, extensive cutting would be used to greatly reduce the stocking levels. The cuts would create a more open, grassland condition with scattered trees and woodlands. In most cases, jack pine would be removed in favor of larger and more fire-tolerant red pines and oak. Then, prescribed fire would be used to reduce woody debris and encourage the development of grasses and forbs. The resulting landscape would resemble the 1936 photograph on the cover of this report.

In the long term, there would be a further reduction of about 200 acres of jack pine within the analysis area. However, only about 26 acres of this would result from the actions included in Alternative 2. This long-term effect of Alternative 2 would be expected to come as a result of underburning mixed jack pine types. The less fire-tolerant jack pine would be expected to die from cambial scorch; the more fire-tolerant red and white pines would survive and become the dominant type in those locations.

The majority of the long-term reduction of jack pine would not be an effect of the Lakewood Southeast Project, but, rather, would be expected to occur in Management Areas 8 E, F, and G and would be the result of aging, decline, and natural succession to more long-lived types.

Structure (Age Class Distribution)

In the short term, the amount of jack pine in the 0-10 year-old age class would be expected to rise from 6% to 18%. This compares to a desired condition of 16%. The increase would come from clearcutting and planting 59 acres to jack pine and from conducting 91 acres of special cutting and burning in the Airport Road Area.

Table 39: Alternative 2 Effects on Jack Pine Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 2 % Short-term	Alt 2 Deviation from DFC (short-term)	Alt 2 % Long-term	Alt 2 Deviation from DFC (long-term)
0-10	6%	16%	-10%	18%	+2%	0%	-16%
11-30	59%	32%	+27%	64%	+32%	8%	-24%
31-50	13%	32%	-19%	15%	-17%	80%	+48%
51+	22%	20%	+2%	4%	-16%	12%	-8%
Mean			14.5%		16.8%		24.0%

In the short term, Alternative 2 would result in nearly all of the 51+ year old jack pine being harvested and added to the 0-10 year age class. While this would increase the difference between desired vs. Alternative 2 age classes in the oldest age class, it would set the jack pine resource up for better future age class regulation.

In the long-term, there would be no further direct effects on the jack pine age class distribution as a result of Alternative 2. The figures shown in **Table 39** assume that no future harvests would take place prior to 2028. However, it is likely that the Lakewood Southeast Area would be re-evaluated for management needs in 15-20 years. At that time, managers would have better options to readjust age class distribution to more closely match desired conditions. In particular, future managers would probably focus on regenerating 40-50 year-old stands to reduce the 31-50 year age class and increase the 0-10 year age class for jack pine.

Red Pine / White Pine

Since the Chequamegon-Nicolet Forest Plan groups red and white pine as a composition objective, these two types will be combined for the discussion of composition. However, since the Forest Plan gives different age glass objectives for each species, age class distribution for the two types will be discussed separately.

Composition

Since preliminary analysis indicated that the Lakewood Southeast Project Area is deficient in the amount of red and white pine, the Proposed Action (Alternative 2) attempted to remedy this by converting other overabundant types, such as aspen and jack pine, into red and white pine types.

In the short term, Alternative 2 would have the effect of increasing the composition of red and white pine across all Management Areas 4A and 4B (**Table 40**).

Table 40: Alternative 2 Effects on Red/White Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 2 Acres (short-term)	Alt 2 % (short-term)	Alt 2 Acres (long-term)	Alt 2 % (long-term)
2C	33	9.8%	10-30%	33	9.8%	33	9.8%
4A	4,739	35.5%	10-50%	4,892	36.7%	5,027	37.7%
4B	3085	34.4%	45-70%	3,375	37.7%	3,648	40.7%
Areawide*	8,949	32.9%	n/a	9,392	34.6%	9,823	36.1%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

This would mainly be done by thinning older aged aspen stands with a strong pine component. It would also be done by using the special cut and burning in the Airport Road Area. In many cases, this would discriminate against short-lived species such as aspen and jack pine and tend to favor red pine and oak mixes. Finally, about 210 acres of jack pine would be clearcut and replanted to red and white pine.

In the long term, the trend would continue. By 2028, an additional 430 acres would convert to red and white pine types. Where, in the short term, the changes would be due to the immediate conversions discussed above, the long-term effects would come mainly from extensive thinning of aspen stands, coupled with white pine underplanting or natural white pine regeneration.

Figure 23. White pine is actively regenerating in the understory of many Lakewood Southeast stands. This will have the long-term effect of converting many acres to pine types in the project area.

In addition to type changes, Alternative 2 would have the effect of improving within-stand diversity in many stands in the project area. The Proposed Action includes many acres of underplanting, underburning, timber stand improvement (TSI), precommercial thinning, and mechanical site preparation. All of these actions will aid in the establishment and development of more mixed stands-both in terms of composition and structure. For example, the over 2,000 acres of underburning that's included in Alternative 2 would have the effect of controlling less fire-tolerant (but more shade-tolerant) understory red maple. At the same time, it would reduce the duff layer and produce improved seedbeds for white pine regeneration. Timber stand improvement and precommercial thinning would enable managers to control the stocking and composition of regenerating stands and developing understories. Together, the use of all of these tools would move thousands of acres toward desired future conditions.

Structure (Age Class Distribution)

Red Pine

As discussed in the historical background and existing condition sections of this report, there is currently a "spike" in the 21-60 and 61-100 year age classes within the project area. This is a result of the aggressive reforestation efforts of the CCC and Post-war Eras. Responding to this bulge of middle-aged red pine, the Forest Service has proposed activities in Alternative 2 that are designed to diversify the age class distribution of red pine stands in the project area.

The main actions that would affect the red pine age class distribution in Lakewood Southeast are: 1) clearcutting red and jack pine stands and replanting them to red pine; and 2) converting other types to red pine through treatments such as thinnings and shelterwood harvests.

Table 41: Alternative 2 Effects on Red Pine Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 2 % Short-term**	**Alt 2 Deviation from DFC (short-term)**	**Alt 2 % Long-term**	**Alt 2 Deviation from DFC (long-term)**
0-20	4%	15%	-11%	7%	-8%	8%	-7%
21-60	43%	30%	+13%	42%	+12%	36%	+6%
61-100	52%	30%	+22%	50%	+20%	50%	+20%
101+	1%	25%	-24%	2%	-23%	6%	-19%
Mean			17.5%		15.8%		13.0%

Table 41, above, shows that in the short term, the amount of red pine in the 0-20 year age class would increase to 7%. This increase would result mainly from regenerating stands in the 61-100 year age class. At the same time, there would be modest improvements in the 21-60 and 101+ age classes. In brief, there would be some improvement in all age classes in the short term. The difference from the desired age class distribution would be reduced from 17.5% to 15.8%.

In the long term, further gains would be made in moving toward desired conditions. Additional gains would be expected in the youngest age class as shelterwood regeneration becomes established. The 21-60 year age class would move more in line with desired conditions as some of the stands grow into the 61-100 year class. Due to equal ingrowth and outgrowth, the 61-100 year class would remain at about 50% (still, an improvement over the existing condition, however). Finally, the 101+ year age class would see some movement toward desired conditions as nearly 350 acres is added through ingrowth. The net result is that, in the long term, the red pine age class distribution would move considerably closer to desired conditions than it currently is. The difference from the desired age class distribution would be reduced from 17.5% to 13.0%.

White Pine

Due to the thousands of acres of underplanting, TSI, and prescribed underburning, Alternative 2 would result in substantial changes to the age class distribution of white pine in the Lakewood Southeast Project Area.

In the short term, there would be few immediate changes that would come as a direct result of Alternative 2 actions. Rather, the changes would come mainly from movement from one age class to the next as a result of aging. This natural progression would result in the area's white pine age class distribution moving slightly closer to desired conditions (**Table 42**). The deviation from desired conditions would be reduced from 23% to 22.3%.

Table 42: Alternative 2 Effects on White Pine Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 2 % Short-term**	**Alt 2 Deviation from DFC (short-term)**	**Alt 2 % Long-term**	**Alt 2 Deviation from DFC (long-term)**
0-20	6%	12%	-6%	5%	-7%	34%	+22%
21-60	9%	24%	-15%	11%	-13%	6%	-18%
61-120	82%	36%	+46%	80%	+44%	47%	+11%
121+	3%	28%	-25%	3%	-25%	12%	-16%
Mean			23.0%		22.3%		16.8%

In the long term, the effects of the Alternative 2 actions would become very apparent. As a result of many thousands of acres of underplanting, burning, TSI, and shelterwood regeneration harvests, by 2028 there would be over 600 acres of young white pine added the 0-20 year age class. This would have the effect of creating an overabundance of white pine in that age class (**Table 42**). However, since there is presently a shortage of 21-60 year old white pine, this would be a long-term good. In the long term, there would be a reduction of 61-120 year-old white pine acreage, putting it more in line with desired conditions. This would result from some stands moving into the next higher age class and also from some stands being regenerated over the next ten years. In the long term, Alternative 2 would make considerable progress in moving the area's white pine age class distribution toward desired conditions. The deviation from desired conditions would be reduced from 23% to 16.8%.

Stocking

Red Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 3,632 acres of red pine in 149 stands that are or soon will be in need of stocking reduction. Alternative 2 proposes 3,712 acres of thinning treatments that would reduce stocking to desired conditions. Therefore, Alternative 2 would fully respond to this need for action. In fact, it would exceed it by 2%. One may ask how this is possible when only 3,632 acres have been identified with the need to be thinned. The answer is that an additional 80 acres of mixed pine stands (that weren't initially included in the total) were subsequently identified and would also be thinned.

White Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 314 acres of white pine in that are in need of stocking reduction. Alternative 2 proposes thinning in all 314 acres, which would reduce stocking to the desired conditions. Therefore, Alternative 2 would fully meet this need for action.

Other Considerations

Annosum is among the greatest causes of damage to conifer forests throughout the world (Stanosz, 2009). This disease caused by *Heterobasidion annosum* (syn. *Fomes annosus),* can result in root rot, butt rot, reduced growth, and mortality of host trees.

First observed in Wisconsin in 1993, Annosum is now known to occur in 23 counties (as of July, 2011) including Oconto and Forest counties. Annosum has been most commonly observed on red and white pine plantations in Wisconsin (Scanlon, 2010).

Infection most often occurs when spores land and germinate on the surface of a freshly cut stump. Following stump colonization, the fungus spreads through interconnected root systems to attack other trees. Growth is reduced and trees will become susceptible to windthrow and eventually die. The pathogen persists for years in stumps and roots of killed trees (Stanosz, 2009). Seedlings planted on a newly harvested site can be infected with the fungus from contact with infected stumps and roots (Cram, 2009).

Red and white pine are the species in the project area most susceptible to Annosum infections.

The US Forest Service Forest Health Protection pathologists have recommended stump treatment on sites with a moderate to high risk of infection based on distance (within 50 miles of known infection) and where impacts would be high based on management situation. Management situations with potentially high impacts are stands managed for red or white pine and the residual or future stand will also be red or white pine.

Control measures are directed toward preventing establishment of this root rot pathogen in new locations. The chemical, borax, has been used to prevent infection of conifer stumps that are not already colonized (Stanosz, 2009). Treatment will help prevent new infection, but will not stop the growth of the pathogen if the stump is already infected.

To prevent the introduction of Annosum in the Lakewood Southeast Project Area, the following design feature should be included in all red and white pine harvests (with the exception of final removal harvests where the target regeneration is not pine):

- To prevent the introduction and/or spread of Annosum root rot, borax-based products, such as Sporax® or Cellu-Treat® should be applied (in accordance with Special Provision R9-CT6.41#) to all conifer stumps within 24 hours of harvest.

Balsam Fir

Composition

In the short and long terms, the composition of balsam fir would not be expected to change (**Table 43**). Alternative 2 proposes about 330 acres of shelterwood harvests in balsam fir stands in the Lakewood Southeast Project Area. These treatments would regenerate the stands to the same type. Other untreated fir stands throughout the project area would be expected to remain as fir in the short and long term. This is because balsam fir is a very shade tolerant species; even if the parent stand becomes overmature and breaks up, it would be expected to regenerate to the same species.

Table 43: Alternative 2 Effects on Balsam Fir Composition

MA	Existing Acres	Existing %	Desired %	Alt 2 Acres (short-term)	Alt 2 % (long-term)	Alt 2 Acres (long-term)	Alt 2 % (long-term)
2C	80	23.7%	0-3%	80	23.7%	80	23.7%
4A	362	2.7%	0-3%	362	2.7%	362	2.7%
4B	181	2.0%	0-3%	181	2.0%	181	2.0%
Areawide*	819	3.0%	n/a	819	3.0%	819	3.0%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

In the short term, there would be no expected change in the age class distribution of balsam fir. While Alternative 2 proposes shelterwood harvests in about 330 acres of balsam fir in the project area, it was assumed that it would take several years before the understory becomes established and the overstory is removed. Thus, the change in balsam age class distribution would not take place until the long term.

Table 44: Alternative 2 Effects on Balsam Fir Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 2 % Short-term	Alt 2 Deviation from DFC (short-term)	Alt 2 % Long-term	Alt 2 Deviation from DFC (long-term)
0-10	0%	20%	-20%	0%	-20%	43%	+23%
11-30	17%	40%	-23%	17%	-23%	28%	-12%
31-45	7%	30%	-23%	1%	-29%	15%	-15%
46+	75%	10%	+65%	82%	+72%	14%	+4%
Mean			32.8%		36.0%		13.5%

See **Table 44**. In the long term, there would be a large increase in the amount of 0-10 year-old balsam fir. This would result in the 43% of the balsam fir being in the young age class- up from the current 0%. During the 15 year span between 2013 and 2028, much of the balsam in the 0-10 year age class would grow into the 11-30 year class. This would increase that age class to 28%, bringing it closer to the desired condition. Likewise, the 31-45 year acreage would increase and the 46+ year age class would decrease, moving all age

classes closer to desired conditions. The long-term effect of Alternative 2 on balsam fir age class distribution would be a substantial movement toward DFC's. The long-term deviation from desired conditions would be reduced to 13.5% from the current 32.8%.

Oak

Composition

Alternative 2 proposes a number of actions that have the potential to affect oak composition and age class distribution. Nearly 1,400 acres of oak are proposed for shelterwood regeneration harvests and about 450 acres have been identified for white pine underplanting. In addition, harvest treatments in other types, such as red pine, white pine, aspen, and mixed hardwoods, have the potential to increase oak as a stand type or secondary component.

Table 45: Alternative 2 Effects on Oak Composition

MA	Existing Acres	Existing %	Desired %	Alt 2 Acres (short term)	Alt 2 % (short-term)	Alt 2 Acres (long-term)	Alt 2 % (long-term)
2C	0	0%	0-10%	0	0%	0	0%
4A	592	4.4%	0-25%	1,008	7.6%	1,008	7.6%
4B	1,149	12.8%	10-25%	1,218	13.6%	1,244	13.9%
Areawide*	2,027	7.5%	n/a	2,512	9.2%	2,589	9.5%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the short term, the amount of oak in Management Areas 4A and 4B would be expected to increase (see **Table 45**). This change would occur on nearly 500 acres across the project area. The majority of the change would be expected in overage jack pine and aspen stands where thinnings are proposed. This short-term change would be in the direction of desired conditions.

The picture is similar in the long term. There would be no further change to oak composition in MA 4A. In MA 4B, there would be an increase of 26 acres of oak types, due mainly to natural succession of some mixed jack pine/oak stands. Some similar type changes are expected in the long term in MA 8G. The overall effect of Alternative 2 on oak composition as a cover type would be an increase of 3.2% in MA 4A and 1.1% in MA 4B.

As noted earlier, there are about 450 acres of white pine underplanting proposed in oak stands in Alternative 2. There are also numerous areas of prescribed underburning. These actions would not change the forest type designations of the target stands. However, they would affect the composition of the oak stands in question by increasing within stand diversity. In the long run, this would certainly be desirable. As discussed in the existing condition section, many of the oak stands within the project area have low levels of within stand diversity and would benefit with the addition of a conifer component. These stands would be less susceptible to pests such as gypsy moth and diseases such as oak wilt. Further, historical evidence suggests that, in the past, these areas were more species diverse than they presently are. Such actions would aid in moving the areas more toward historical conditions.

Structure (Age Class Distribution)

As discussed in the existing condition section, the oak in the project area is skewed heavily to the oldest age class. The Forest Service responded to this need for more age class diversity by proposing nearly 1,400 acres of shelterwood regeneration harvests in the project area. This would be the action most likely to affect oak age class distribution.

In the short term, few changes would be expected that would directly result from these actions. Rather, most of the expected shifts in the age classes would result from the natural aging of stands in the area. **Table 46**

shows that, in the short term, the 20-59 and 80+ year age classes would see some increases as some of the stands would grow into these classes. Some increase in the 20-59 year class would be expected as a result of type conversions. For example, a 50-year-old mixed aspen stand that is thinned and converted to an oak type would result in an increase to the 20-59 year class.

Table 46: Alternative 2 Effects on Oak Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 2 Short-term	Alt 2 Deviation from DFC (short-term)	Alt 2 Long-term	Alt 2 Deviation from DFC (long-term)
0-19	3%	19%	-16%	3%	-16%	59%	+40%
20-59	5%	38%	-33%	11%	-27%	5%	-33%
60-79	20%	19%	+1%	13%	-6%	9%	-10%
80+	72%	24%	+48%	74%	+50%	27%	+3%
			24.5%		24.8%		21.5%

In the long term, the effects of Alternative 2 would become much more apparent. Because I am assuming that it would take several years for the shelterwood treatment to establish a new cohort, by 2028, we see a major increase in the amount of 0-19 year-old oak. This acreage would come overwhelmingly from the overabundant 80+ year-old age class. As **Table 46** shows, by 2028, the excess of acreage in the 80+ year age class would be transferred to the 0-19 year age class. While this is less than ideal, it would help to move the oak resource towards a more balanced condition in the long term. The long-term deviation from desired conditions would be reduced from 24.5% at present to 21.5%.

While I assumed that it would take about 15 years to establish an oak understory, this would be ideal and would actually vary widely. In reality, most oak stands take longer than 15 years to regenerate. The length of time necessary to regenerate an oak stand is contingent on the establishment of adequate numbers and sizes of oak seedlings in the understory. Oak seedlings can take decades to develop in an understory. Because oaks are slow growing and weak competitors at the seedling stage, they must not be released too early. Doing so will put them at a competitive disadvantage and result in a young stand of hardwood or aspen.

There are many types of shelterwood harvests. Most often, they are done in a series of two to three cuts, but this varies. In the case of oak shelterwood harvests in the Lakewood Southeast Area, the exact type of shelterwood harvest will depend on the amount and condition of understory oak seedlings.

In most stands, insufficient oak seedlings are present. In these cases, we would employ shelterwood *preparatory* (or "prep") cuts. Prep cuts thin the stand from below to a level similar to a commercial thinning (~80% crown closure). The main difference is that there is an increased emphasis on removing competing vegetation in the understory. This often involves removal of submerchantable trees and shrubs as means to reduce low shade. Low shade is detrimental to developing understory seedlings. High shade results from diffuse light filtering through the high canopy. Mid-tolerant species, such as oak and white pine, are well-adapted to growing under high shade.

Sometimes, repeated prep cuts may be used to weed out undesirable overstory trees and control the amount of light reaching the understory. This depends on both the quality of the overstory trees and the amount of understory oaks that develop as a result of previous treatments.

In stands where sufficient oak seedlings are present, a shelterwood *seed* cut may be employed. The seed cut normally reduces overstory stocking to the best, largest, evenly-spaced trees (to about 60% crown closure). This creates conditions for established seedlings to grow in size and vigor while, at the same time, creating conditions for new seedlings to develop from acorns dropped by overstory parent trees.

Once the understory has reached a predetermined size and density (for example, 5000 seedlings/acre 4+ feet tall), the normal course of action is to conduct a shelterwood *removal* cut (or overstory removal). This is usually done in the winter to minimize understory damage and normally leaves a small number of overstory trees per acre ($\leq$ 10% crown closure) for future habitat benefits. The removal cut fully releases the understory trees, giving them full sunlight for rapid growth.

In some cases, depending on stand-level objectives, the decision may be made to modify or forego the removal cut. This may result in an eventual two-aged oak stand – or an even-aged young oak stand with a larger residual overstory remnant for habitat needs.

During the course of analysis, the Interdisciplinary Team (IDT) identified a potential concern that the level of oak shelterwood treatments proposed in Alternative 2 could have a negative effect on woodland raptor habitat. This concern was based on the assumption that all of the shelterwood harvests proposed in Alternative 2 would include seed/removal cuts. However, given what we know about the slow process of oak regeneration, it is highly unlikely that removal cuts would be conducted in the majority of the proposed shelterwood areas. In fact, it is probably unlikely that greater than half of the areas will have sufficient established oak seedlings to conduct shelterwood seed cuts. In other words, it is likely that at least half of the shelterwood treatments would be limited to prep cuts.

Nonetheless, as an effort to limit the effects of the Lakewood Southeast Project on woodland raptor habitat, the IDT identified 1,035 acres of suitable raptor habitat in the vicinity of known nest sites (429 acres oak, 606 acres hardwood) and has agreed to limit shelterwood treatments in these stands to prepatory cuts. While these treatments would probably result in fewer acres of young oak stands over the next fifteen years, they would still move the stands toward long-term desired conditions while ensuring key habitat is maintained.

Other Considerations
Oak wilt is a fungal disease of oak that is present in and around the project area. The primary vector of oak wilt spread is root-to-root grafting. Oaks in the red oak group readily graft their roots with neighboring oaks. When an oak tree is infected by the oak wilt fungus, that tree will die. If there are any nearby oaks, their roots will likely be grafted to the affected tree and, thus, the infection will spread.

New infections begin when oak trees are wounded during the growing season. When oak trees are pruned, cut, or otherwise wounded, the wound site is attractive to a type of beetle for a 48-hour period. The beetle is also attracted to oak wilt fruiting bodies. Since the beetles congregate on oak wilt fungus, they transport spores wherever they go. Thus, if oak trees are wounded during the growing season, oak wilt beetles may transmit the disease to a previously healthy area and start a new infection center.

To prevent the spread of oak wilt, oak stands should not be harvested during the period of April 1 through September 1, the period when the beetles are active. The following design feature should be used in all oak stands proposed for harvest:

- To prevent the spread of oak wilt, limit harvesting or pruning in the red oak group to the period between September 1 and April 1.

This design feature should also be used in mixed stands in which 40% or more of the basal area is in oak species of the red oak group.

Communities of Concern

Northern Dry Forest

Among its stated needs for action, the Lakewood Southeast Project has identified the need to reestablish components and processes in the northern dry forest ecosystem. This is also discussed on page 16 of this report. Alternative 2 proposes many activities that would address this need for action:

- 4,026 acres of commercial thinning harvests in red and white pine stands
- 732 acres of prescribed underburning in red and white pine stands
- 625 acres of underplanting in red and white pine stands
- 452 acres of shelterwood harvests in red and white pine stands
- 350 acres of timber stand improvement in older (not newly-planted) red and white pine stands

The actions listed above would take place specifically in red and white pine types. Here is how these actions would move mostly plantation-origin pine stands toward desired northern dry forest conditions:

Commercial thinning, while also reducing stocking and improving stand vigor, would increase spacing between residual trees and increase their growth, resulting in bigger trees in a shorter timeframe. Small temporary openings would be created in the canopy which would provide improved growing conditions for mid-tolerant and tolerant understory seedlings and saplings. Thinning would also reduce the "corn row"-like appearance of the plantations and result in a more naturally-appearing stand. Thinning prescriptions would also have the ability to encourage within-stand diversity and steer the stand toward more variable spacing.

Prescribed underburning would normally be used to reduce the amount of competing understory vegetation by shade-tolerant species such as red maple and hazel. Because of what we know about the fire history of the area, we believe that, historically, there was far less understory brush in the northern dry forests within the Lakewood Southeast area. Prescribing the use of understory fire would reduce these species and create better conditions for the establishment and development of species such as white pine and oak. Since these species respond well to fire, we would be using fire under controlled conditions to emulate historic processes.

Underplanting white pine and hemlock (primarily) in the understories of select stands would speed up the development of northern dry forest components, namely multiple species and age classes. Multi-cohort stands of mixed pine provide much more habitat value and biological diversity than homogenous single species plantations. Planting would be done with varying species, densities, and patterns with an eye on trying to emulate natural northern dry forest ecosystems.

Shelterwood regeneration harvests, while mainly aimed at regenerating new, young pine stands, would be designed to emulate the effects of historic disturbances, such as wind storms, moderate intensity fires, and insect outbreaks. The design of the shelterwood harvests would vary, depending on local conditions, and could result in both evenly-spaced residual trees over a dense understory – and irregularly-spaced residual trees with dense understory clumps in some areas and more sparsely-stocked understories in other areas. As with the other treatments, the shelterwood harvests would be modified in each location to take advantage of unique opportunities. For example, in an area where overstory hemlocks are present, we would tailor the harvest treatment to encourage understory hemlock development.

Timber stand improvement is another tool that would be used to control the development and composition of northern dry forest ecosystems. In most cases "TSI" would be used to "weed out" competing vegetation around desired understory trees. For example, TSI would often target less desirable and more shade-tolerant red maple so that white pine seedlings are not overtopped and are free to grow up in the understory. Like the other treatments, TSI would be tailored to take advantage of the unique conditions that are present at each site.

Among the alternatives considered in detail, Alternative 2 would rank the highest in responding to the need to reestablish components and processes in the northern dry forest ecosystem. Using a combination of all these tools, Alternative 2 would move thousands of acres of red, white, and mixed pine forests toward the historic conditions that typified northern dry forests. The Lakewood Southeast Purpose of and Need for Action does not specify an acreage figure of Northern Dry Forest to be treated, but, rather, simply states that the need exists. Alternative 2 proposes a combined total of 6,185 acres of treatments within red and white pine types that are designed to restore Northern Dry Forest components and processes. This is the highest amount of treatments among the alternatives considered in detail.

Pine Barrens

The Lakewood Southeast Purpose of and Need for Action has identified an opportunity and need to restore Pine Barrens plant communities within the project area. This is also discussed on page 17 of this report. As noted in that section, Pine Barrens are highly variable and can be difficult to characterize. They tend to be open landscapes on sandy soils that are subject to frequent fires. They vary from open barrens (as illustrated in **Figure 15**, p. 17) to variable density pine savanna (as illustrated in **Figure 16**, p. 17) to open park-like woodlands (**Figure 11**, p. 14). Alternative 2 proposes a number of activities that would be designed to create an 800-acre complex of open barrens, pine savanna, and pine-oak woodlands in the Airport Road Area.

Figure 24. Pine Barrens / Savanna Desired Future Condition. This photo also illustrates the historical conditions in the vicinity of the Airport Road restoration area.

Figure 24, at right, best illustrates the goal of Pine Barrens / Savanna restoration in the Lakewood Southeast Project. Beyond being a good illustration of desired conditions, this photo is particularly relevant since it is believed to have been taken in the Airport Road Area in 1936. Note the thick grass, the open character of the landscape, and the variable nature of forest vegetation. The foreground and middleground shows open pine barrens. The left background shows pine savanna conditions. The right background shows mixed closed canopy aspen and pine forest. The reader should also note the recently-created furrows that would soon be planted with jack pine seedlings. These same seedlings are now overmature, decadent trees.

About 388 acres of special cuts are proposed in the Airport Road Area. This harvest treatment is so-named because it really doesn't fit into any other traditional harvest categories. This harvest method is not intended to be a regeneration harvest, such as the clearcut or shelterwood method. However, it would greatly reduce the density of the target stand – from a closed forest stand to a variably open, grassy condition that still qualifies as a sparsely-stocked forested type. Responding to the Purpose and Need – and with an eye on historical reference conditions – the special cut would vary widely in implementation. In some areas, adjacent to existing grassy openings, nearly all the trees would be removed. In other areas that are currently more dense, the resulting stand would resemble a shelterwood seed cut. The areas treated by special cuts would constitute a mosaic of varying densities that would be much more in line with historical conditions.

Alternative 2 proposes some small areas of more traditional harvest methods in the Airport Road restoration area, intermingled with the special cuts. Among these would be 110 acres of white pine and mixed hardwood shelterwood harvests, 23 acres clearcut of aspen, and 16 acres commercial thinning of aspen.

Finally, Alternative 2 proposes about 800 acres of prescribed burning throughout Airport Road restoration area. Following the harvests, the area would be broken into burn units and controlled burns would be used to regenerate grasses and forbs, reduce brush and submerchantable trees, and residual logging slash and other fuels that have built up over the past 75 years. Like the harvest prescriptions, burn prescriptions would be variable in response to the unique conditions in each unit. For example, a burn unit containing little in the way of oak sprouts, but much dead and downed large woody debris, might be burned during dry spring conditions to lessen the amount of woody debris while stimulating grasses and forbs. Conversely, areas containing a lot of oak sprouts might be prescribed for a slow creeping burn in late summer when the sprouts would be impacted the most.

This intent of all the treatments described is to emulate the effects of the historic disturbance regime within the context of modern social realities. Today, there are many people on the landscape. Private properties and homes are present to the east, west, and south of the area in question. Yet there is a real ecological need to restore these increasingly rare landscapes. Using the treatments prescribed in Alternative 2 would respond to the project's Need for Action to Restore Pine Barrens Ecosystems in a manner that is also responsive to public safety.

Alternative 3 (Aspen Emphasis)

Alternative 3 proposes about 10,752 acres of timber harvest to respond to the Purpose and Need for Action. These silvicultural treatments are listed in Chapter 1 of the EIS and are the basis used for effects calculations in a Microsoft Excel® spreadsheet entitled "Lakewood_Southeast.xlsx". The harvest treatments proposed for Alternative 3 are summarized in the following table:

Table 47. Lakewood Southeast Alternative 3 Harvest Treatment Summary

Harvest Treatment	***Acres***	***Stands***	***Jack Pine***	***Red Pine***	***White Pine***	***Balsam***	***White Spruce***	***Paper Birch***	***Oak***	***Northern Hardwood***	***Aspen***
Thin	*4,249*	*180*	*11*	*3,550*	*372*	*0*	*20*	*0*	*14*	*179*	*102*
Shelterwood	*3,894*	*126*	*0*	*122*	*116*	*303*	*0*	*128*	*1,359*	*1,866*	*0*
Clearcut	*2,021*	*99*	*298*	*421*	*0*	*30*	*0*	*0*	*0*	*0*	*1,272*
Special Cut	*393*	*10*	*242*	*30*	*0*	*0*	*0*	*0*	*0*	*54*	*67*
Selection	*194*	*7*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*194*	*0*
Total	***10,752***	***422***	***551***	***4,124***	***488***	***332***	***20***	***128***	***1,373***	***2,293***	***1,442***

Other Alternative 3 treatments (with approximate acreages) that have the potential to affect vegetative composition and structure are:

Table 48. Lakewood Southeast Alternative 3 Other Treatment Summary

Other Treatment	***Acres***	***Stands***
Underburn	2733	*114**
Underplant	1768	*48*
TSI	850	*25*
Full Plant	598	*26*
Salmon Blade	97	*3*
Precommercial thin	48	*2*

*approximate

Alternative 3 Development

Alternative 3 was developed, in large part, in response to a public concern that the Proposed Action (Alternative 2) went too far in reducing the amount of aspen in the project area. This is part of a larger concern that state and regional aspen acreage has been declining for many years. In developing this alternative, we attempted to regenerate mature and overmature aspen wherever we could. In addition, unlike Alternative 2, we didn't attempt to actively convert aspen types in beaver management zones. The thought was that, by walking away from such stands at this time, we might maintain the option of managing for aspen at a future date. Active conversion treatments, on the other hand, would almost certainly remove that option.

The hope with Alternative 3 was to maintain aspen acreage near their present levels. However, despite our best efforts, a number of factors prevented us from doing this:

- Many aspen stands are located within management areas that do not allow timber management. There are about 650 acres of aspen types located in MA 8E, 8F, and 8G in the project area. About 400 acres (61%) of these acres are currently over 40 years old. In the long term, 205 acres would be expected to convert to hardwoods.
- Roughly 350 acres of aspen types are located within beaver management zones. The Forest Plan (p. 2-17) doesn't allow the regeneration of aspen within specified distances from designated streams. About 250 acres of these stands are greater than 40 years old.
- Many aspen stands are isolated in areas where logging access is not available. Examples include islands of aspen surrounded by swamps or aspen stands isolated by streams where there are no roads or crossings.
- About 120 acres of aspen stands are located along high scenic integrity objective areas (Forest Plan p. 2-29) where even-aged management options are severely limited.
- Finally, there are about 1,800 acres of aspen stands that are adjacent to Forest Plan Management Areas 8E, 8F, or 8G. The Forest Plan limits our ability to manage for aspen in areas directly adjacent to these areas (p. 2-4). While this doesn't preclude us from regenerating the majority of these stands for aspen, those portions that are immediately adjacent to the 8 Areas may not be regenerated.

Thus, we were quite limited in designing Alternative 3 to respond to concerns about the loss of aspen. Nonetheless, we were able to develop an alternative that minimizes active conversion of aspen and maximizes (within our limitations) the maintenance of the type by actively regenerating older stands.

Direct and Indirect effects

Aspen

Composition

As a result of Alternative 3, in the short term, there would be a reduction of aspen composition in Management Areas 4A and within the project area (**Table 49**). Most of this would take place in MA 4A as a result of special cuts in 2 stands in the Airport Road Area and 26 acres of thinning in 2 stands in riparian areas.

In the long term, Alternative 3 would result in further reductions in aspen acreage. By 2028, about 786 acres of aspen would be expected to convert from

Table 49: Effects of Alternative 3 on Aspen Composition

MA	Existing Acres	Existing %	Desired %	Alt 3 Acres Short term	Alt 3 % short term	Alt 3 Acres Long term	Alt 3 % Long term
2C	196	57.5%	15-30%	195	57.5%	142	41.7%
4A	3,628	27.2%	10-30%	3,565	26.7%	3,354	25.2%
4B	2,423	27.0%	0-7%	2,409	26.9%	2,180	24.3%
Areawide*	6,987	25.7%	n/a	6,909	25.4%	6,201	22.8%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

aspen to other types as follows: MA 2C – 54 Ac; MA 4A – 274 Ac; MA 4B – 243 Ac; MA 8EFG – 215 Ac. Nearly all of these stands would be expected to naturally convert to northern hardwoods since they would be 80+ years old by that time. This assumes there are no regeneration harvests in these stands prior to 2028.

While the goal of this alternative is to prevent further aspen conversion through active management, it would be unable to fully do so. This is due to the forest plan and other limitations outlined above in the discussion on Alternative 3 development. However, of the alternatives analyzed, Alternative 3 would result in the highest composition of aspen.

Structure (Age Class Distribution)

Table 50: Alternative 3 Effects on Aspen Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 3 Short-Term	Alt 3 Deviation from DFC (short-term)	Alt 3 Long-Term	Alt 3 Deviation from DFC (long-term)
0-10	2%	20%	-18%	20%	0%	0%	-20%
11-20	12%	20%	-8%	4%	-16%	22%	+2%
21-45	52%	50%	+2%	57%	+7%	29%	-21%
46+	35%	10%	+25%	19%	+9%	49%	+39%
Mean			13.3%		8.0%		20.5%

As shown in **Table 50**, in the short term, Alternative 3 would move the aspen age class distribution much closer to the desired condition than it currently is. Because of the extensive regeneration harvests used to prevent conversion, Alternative 3 would move the aspen age class distribution closer to the desired conditions than the other three alternatives analyzed.

Due to the many limitations previously discussed, this alternative was unable to reduce the acreage in the 21-45 and 46+ year age classes to desired levels. However, it was able to meet the desired condition for the 0-10 year age class.

In the long term, much of the acreage would shift into other age classes as the stands age. Due to movement between the 21-45 and 46+ year age classes, the short term gain would be lost. However, if future managers implement additional harvests 10-15 years from now, they would have an opportunity to move the age class distribution even more in line with desired conditions.

Paper Birch

Composition

Under Alternative 3, there would be no anticipated change in the composition of paper birch in the short term. As noted in the discussion for the existing condition, there are 128 acres of paper birch within management areas that are open to timber management. All of this acreage falls within Management Area 4A and would be treated with shelterwood harvests designed to regenerate the stands to young paper birch. Thus, in the short term, the percentage of Management Area 4A in paper birch in would remain at about 1%.

In the long term, the newly-regenerated birch stands would remain birch types and the composition of birch would remain the same at 1%.

Structure (Age Class Distribution)

See **Table 51**. In the short term, all paper birch acreage would be in the 61+ year age class. The 128 acres of paper birch proposed for shelterwood regeneration would, in the short term, remain in that age class. Another 51 acres of birch stands, located within Management Areas 8F and G, would be in the 61+ year age class.

Table 51: Alternative 3 Effects on Paper Birch Age Class Distribution

Age Class	Existing	Desired	Alt 3 Short-term	Alt 3 Long-term
0-20	0%	25%	0%	100%
21-40	0%	25%	0%	0%
41-60	4%	25%	0%	0%
61+	96%	25%	100%	0%

In the long term, the 128 acres of shelterwood harvest would be regenerating 15-20 year-old birch. The remaining 51 acres in MA 8F and 8G would be expected to convert to oak types. Thus, 100% of the birch would be in the youngest age class 15 years after implementing Alternative 3

Northern Hardwoods

Composition

In the short term, under Alternative 3, the composition of northern hardwoods would be expected to change little (**Table 52**). There would be a net decrease of 14 acres across all management areas.

Table 52: Alternative 3 Effects on Northern Hardwood Composition

MA	Existing Acres	Existing %	Desired %	Alt 3 Acres (short-term)	Alt 3 % (short-term)	Alt 3 Acres (long-term)	Alt 3 % (long-term)
2C	29	8.4%	30-50%	29	8.4%	82	24.2%
4A	2,076	15.6%	0-25%	2,048	15.4%	2,197	16.5%
4B	729	8.1%	0-10%	744	8.3%	972	10.9%
Areawide*	4,237	15.6%	n/a	4,223	15.5%	4,868	17.9%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the long term, the composition of hardwood in the Lakewood Southeast Project Area would be expected to increase across all management areas (see **Table 52**). This would result mainly from many acres of overmature early-successional forests (such as aspen and birch) converting to the more shade-tolerant hardwoods.

Structure (Age Class Distribution)

Alternative 3 proposes the use of over 1,800 acres of shelterwood harvests to modify hardwood composition and age class distribution. **Table 53** illustrates how the resulting age class distribution would differ from the existing and desired conditions

Table 53: Short and Long-term Effects of Alternative 3 on Northern Hardwood Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 3 Short-term	Alt 3 Deviation from DFC (Short-term)	Alt 3 Long-term	Alt 3 Deviation from DFC (Long-term)
0-20	4%	16%	-12%	2%	-14%	38%	+22%
21-60	12%	32%	-20%	9%	-25%	3%	-29%
61-100	80%	32%	+48%	82%	+50%	34%	+2%
101+	5%	20%	-15%	7%	-13%	24%	+4%
Mean			23.8%		25.5%		14.3%

In the short term, there would be little change from the existing condition. Mainly, the acreage in the youngest age class would be expected to decrease while the next successive age classes would be expected to increase slightly. This is because I assumed that it would take several years for the hardwood regeneration to become established and for the removal cut to take place.

In the long term, however, there would be a large bubble in the 0-20 year age class. At the same time, there would be a big increase in acres in the 101+ year age class and a reduction of the existing bulge in the 61-100 year age class. As **Table 53** shows, this movement would result in an overall movement toward the desired hardwood age class distribution. While the acreage in 0-20 year age class would greatly exceed the desired condition, it is viewed as a temporary adjustment that will ultimately aid in the long-term attainment of the desired age class structure.

Stocking

The preliminary analysis for the Lakewood Southeast Project identified that there are currently about 179 acres of mixed upland hardwood stands that exceed desired stocking levels. Alternative 3 proposes all 179 acres of thinning treatments that would reduce the stocking levels. Therefore, Alternative 3 would fully respond to this need for action.

Uneven-aged Hardwood

The preliminary analysis for the Lakewood Southeast Project identified that that 307 acres in 8 stands should be moved toward an uneven-aged condition. Since then, additional review amended that recommendation to 194 acres. Alternative 3 proposes selection harvests in all 194 acres identified. Therefore, Alternative 3 would fully respond to this need for action.

Jack Pine

Composition

In the short term, there would be a reduction in the composition of jack pine in all management areas (see **Table 54**). In all, there would be a loss of about 443 acres of the jack pine type across the project area.

Table 54: Alternative 3 Effects on Jack Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 3 Acres (short-term)	Alt 3 % (short-term)	Alt 3 Acres (long-term)	Alt 3 % (long-term)
2C	0	0%	0-2%	0	0%	0	0%
4A	1,174	8.8%	0-35%	872	6.5%	872	6.5%
4B	716	8.0%	3-6%	576	6.4%	550	6.1%
Areawide*	1,928	7.1%	n/a	1,485	5.5%	1,436	5.3%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

About half of the conversion would come as a result of clearcutting old jack pine stands and replanting the sites with red and white pine. The remainder of the conversions would come from the use of special cuts, and thinnings. Most of these would take place east of Airport Road and the focus would be on moving older-aged jack pine stands from a closed forest condition to pine barrens/savanna conditions. In these areas, extensive cutting would be used to greatly reduce the stocking levels. The cuts would create a more open, grassland condition with scattered trees and woodlands. In most cases, jack pine would be removed in favor of larger and more fire-tolerant red pines and oak. Then, prescribed fire would be used to reduce woody debris and encourage the development of grasses and forbs. The resulting landscape would resemble the 1936 photograph on the cover of this report. Similar to this would be a proposal to clearcut and burn a 35 acre stand along Twin Pine Road. This is part of a treatment block that would clearcut 3 stands (including the jack

pine stand mentioned) adjacent to some large existing openings. The areas would then be periodically burned to create and maintain a 205-acre grassland.

In the long term, there would be a further reduction of about 50 acres of jack pine within the analysis area. However, only about 26 acres of this would result from the actions included in Alternative 3. This long-term effect of Alternative 3 would be expected to come as a result of underburning mixed jack pine types. The less fire-tolerant jack pine would be expected to die from cambial scorch; the more fire-tolerant red and white pines would survive and become the dominant type in those locations.

Structure (Age Class Distribution)

In the short term, the amount of jack pine in the 0-10 year-old age class would be expected to rise from 6% to 15%. This compares to a desired condition of 16%. The increase would come from clearcutting and planting 133 acres to jack pine.

Table 55: Alternative 3 Effects on Jack Pine Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 3 % Short-term	Alt 3 Deviation from DFC (short-term)	Alt 3 % Long-term	Alt 3 Deviation from DFC (long-term)
0-10	6%	16%	-10%	15%	-1%	0%	-16%
11-30	59%	32%	+27%	64%	+32%	16%	-16%
31-50	13%	32%	-19%	17%	-15%	83%	+51%
51+	22%	20%	+2%	3%	-17%	1%	-19%
Mean			14.5%		16.3%		25.5%

In the short term, Alternative 3 would result in nearly all of the 51+ year old jack pine being harvested and added to the 0-10 year age class. While this would increase the difference between desired vs. Alternative 3 age classes in the oldest age class, it would set the jack pine resource up for better future age class regulation.

In the long-term, there would be no further direct effects on the jack pine age class distribution as a result of Alternative 3. The stands would simply continue to age and move into successive age classes. The figures shown in **Table 55** assume that no future harvests would take place prior to 2028. However, it is likely that the Lakewood Southeast Area would be re-evaluated for management needs in 15-20 years. At that time, managers would have better options to readjust age class distribution to more closely match desired conditions. In particular, future managers would probably focus on regenerating 40-50 year-old stands to reduce the 31-50 year age class and increase the 0-10 year age class for jack pine.

Red Pine / White Pine

Since the Chequamegon-Nicolet Forest Plan groups red and white pine as a composition objective, these two types will be combined for the discussion of composition. However, since the Forest Plan gives different age glass objectives for each species, age class distribution for the two types will be discussed separately.

Composition

In the short term, Alternative 3 would have the effect of increasing the composition of red and white pine across the project area (**Table 56**). Due to the conversion of two red pine plantations to grassland (86 ac) on Twin Pine Road, red/white pine composition would actually go down by 0.3% in MA 4A. However, in MA 4B, there would be an increase of 130 acres (1.5%). This would be done mainly by using the special cut and burning in the Airport Road Area. In many cases, this would discriminate against short-lived species such as aspen and jack pine and tend to favor red pine and oak mixes. Also, about 51 acres of jack pine would be clearcut and replanted to red and white pine.

Table 56: Alternative 3 Effects on Red/White Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 3 Acres (short-term)	Alt 3 % (short-term)	Alt 3 Acres (long-term)	Alt 3 % (long-term)
2C	33	9.8%	10-30%	33	9.8%	33	9.8%
4A	4,739	35.5%	10-50%	4,698	35.2%	4,761	35.7%
4B	3085	34.4%	45-70%	3,215	35.9%	3,215	35.9%
Areawide*	8,949	32.9%	n/a	9,037	33.3%	9,123	33.6%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the long term, the trend would continue. By 2028, an additional 86 acres would convert to red and white pine types. Where, in the short term, the changes would be due to the immediate conversions discussed above, the long-term effects would come mainly from thinning mixed stands, underplanting white pine, or natural white pine regeneration.

In addition to type changes, Alternative 3 would have the effect of improving within-stand diversity in many stands in the project area. Alternative 3 includes many acres of underplanting, underburning, timber stand improvement (TSI), precommercial thinning, and mechanical site preparation. All of these actions will aid in the establishment and development of more mixed stands-both in terms of composition and structure. For example, the over 2,000 acres of underburning that's included in Alternative 3 would have the effect of controlling less fire-tolerant (but more shade-tolerant) understory red maple. At the same time, it would reduce the duff layer and produce improved seedbeds for white pine regeneration. Timber stand improvement and precommercial thinning would enable managers to control the stocking and composition of regenerating stands and developing understories. Together, the use of all of these tools would move thousands of acres toward desired future conditions.

Structure (Age Class Distribution)

Red Pine

Table 57 shows that in the short term, the amount of red pine in the 0-20 year age class would increase to 7%. This increase would result mainly from regenerating stands in the 61-100 year age class. At the same time, there would be modest improvements in the 21-60 and 101+ age classes. In brief, there would be some improvement in all age classes in the short term. The difference from the desired age class distribution would be reduced from 17.5% to 15.8%.

Table 57: Alternative 3 Effects on Red Pine Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 3 % Short-term**	**Alt 3 Deviation from DFC (short-term)**	**Alt 3 % Long-term**	**Alt 3 Deviation from DFC (long-term)**
0-20	4%	15%	-11%	7%	-8%	8%	-7%
21-60	43%	30%	+13%	42%	+12%	36%	+6%
61-100	52%	30%	+22%	50%	+20%	50%	+20%
101+	1%	25%	-24%	2%	-23%	6%	-19%
Mean			17.5%		15.8%		13.0%

In the long term, further gains would be made in moving toward desired conditions. Additional gains would be expected in the youngest age class as shelterwood regeneration becomes established. The 21-60 year age class would move more in line with desired conditions as some of the stands grow into the 61-100 year class. Due to equal ingrowth and outgrowth, the 61-100 year class would remain at about 50% (still, an improvement over the existing condition, however). Finally, the 101+ year age class would see some movement toward desired conditions as nearly 350 acres is added through ingrowth. The net result is that, in the long term, the red pine age class distribution would move considerably closer to desired conditions than it currently is. The difference from the desired age class distribution would be reduced from 17.5% to 13.0%.

White Pine

Due to the thousands of acres of underplanting, TSI, and prescribed underburning, Alternative 3 would result in substantial changes to the age class distribution of white pine in the Lakewood Southeast Project Area.

Table 58: Alternative 3 Effects on White Pine Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 3 % Short-term**	**Alt 3 Deviation from DFC (short-term)**	**Alt 3 % Long-term**	**Alt 3 Deviation from DFC (long-term)**
0-20	6%	12%	-6%	6%	-6%	11%	-1%
21-60	9%	24%	-15%	9%	-15%	8%	-16%
61-120	82%	36%	+46%	81%	+45%	65%	+29%
121+	3%	28%	-25%	3%	-25%	15%	-13%
Mean			23.0%		22.8%		14.8%

In the short term, there would be very few immediate changes to the white pine age class distribution that would come as a direct result of Alternative 3 actions. Rather, the changes would come mainly from movement from one age class to the next as a result of aging. This natural progression would result in the area's white pine age class distribution moving slightly closer to desired conditions (**Table 58**). The deviation from desired conditions would be reduced from 23% to 22.8%.

In the long term, the effects of the Alternative 3 actions would become much more apparent. As a result of many thousands of acres of underplanting, burning, TSI, and shelterwood regeneration harvests, by 2028 there would be over 600 acres of young white pine added the 0-20 year age class (**Table 58**). There would be a reduction of 61-120 year-old white pine acreage, putting it more in line with desired conditions. This would result from some stands moving into the next higher age class and also from some stands being regenerated over the next ten years. In the long term, Alternative 3 would make considerable progress in moving the area's white pine age class distribution toward desired conditions. The deviation from desired conditions would be reduced from 23% to 14.8%.

Stocking

Red Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 3,632 acres of red pine in 149 stands that are or soon will be in need of stocking reduction. Alternative 3 proposes 3,550 acres of thinning treatments in red pine that would reduce stocking to desired conditions. Therefore, Alternative 3 would respond 98% to this need for action.

White Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 314 acres of white pine in that are in need of stocking reduction. Alternative 3 proposes thinning in 372 acres. This is more than the 314 acres originally identified, but includes 58 acres in 5 stands that are proposed for shelterwood regeneration harvests in Alternative 2. Thus, Alternative 3 would meet this need for action, actually exceeding it by 18%.

Other Considerations

Annosum is among the greatest causes of damage to conifer forests throughout the world (Stanosz, 2009). This disease caused by *Heterobasidion annosum* (syn. *Fomes annosus),* can result in root rot, butt rot, reduced growth, and mortality of host trees.

First observed in Wisconsin in 1993, Annosum is now known to occur in 23 counties (as of July, 2011) including Oconto and Forest counties. Annosum has been most commonly observed on red and white pine plantations in Wisconsin (Scanlon, 2010).

Infection most often occurs when spores land and germinate on the surface of a freshly cut stump. Following stump colonization, the fungus spreads through interconnected root systems to attack other trees. Growth is reduced and trees will become susceptible to windthrow and eventually die. The pathogen persists for years in stumps and roots of killed trees (Stanosz, 2009). Seedlings planted on a newly harvested site can be infected with the fungus from contact with infected stumps and roots (Cram, 2009).

Red and white pine are the species in the project area most susceptible to Annosum infections.

The US Forest Service Forest Health Protection pathologists have recommended stump treatment on sites with a moderate to high risk of infection based on distance (within 50 miles of known infection) and where impacts would be high based on management situation. Management situations with potentially high impacts are stands managed for red or white pine and the residual or future stand will also be red or white pine.

Control measures are directed toward preventing establishment of this root rot pathogen in new locations. The chemical, borax, has been used to prevent infection of conifer stumps that are not already colonized (Stanosz, 2009). Treatment will help prevent new infection, but will not stop the growth of the pathogen if the stump is already infected.

To prevent the introduction of Annosum in the Lakewood Southeast Project Area, the following design feature should be included in all red and white pine harvests (with the exception of final removal harvests where the target regeneration is not pine):

- To prevent the introduction and/or spread of Annosum root rot, borax-based products, such as Sporax® or Cellu-Treat® should be applied (in accordance with Special Provision R9-CT6.41#) to all conifer stumps within 24 hours of harvest.

Balsam Fir

Composition

Table 59: Alternative 3 Effects on Balsam Fir Composition							
MA	**Existing Acres**	**Existing %**	**Desired %**	**Alt 3 Acres (short-term)**	**Alt 3 % (long-term)**	**Alt 3 Acres (long-term)**	**Alt 3 % (long-term)**
2C	80	23.7%	0-3%	80	23.7%	80	23.7%
4A	362	2.7%	0-3%	332	2.5%	332	2.5%
4B	181	2.0%	0-3%	181	2.0%	181	2.0%
Areawide*	819	3.0%	n/a	789	2.9%	789	2.9%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the short and long terms, the composition of balsam fir would be reduced by 0.2% in MA 4A (**Table 59**). This would happen when two stands (30 ac) are converted to aspen. Alternative 3 proposes about 303 acres of shelterwood harvests in balsam fir stands in the Lakewood Southeast Project Area. These treatments would regenerate the stands to the same type. Other untreated fir stands throughout the project area would be expected to remain as fir in the short and long term. This is because balsam fir is a very shade tolerant species; even if the parent stand becomes overmature and breaks up, it would be expected to regenerate to the same species.

Structure (Age Class Distribution)

Table 60: Alternative 3 Effects on Balsam Fir Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 3 % Short-term**	**Alt 3 Deviation from DFC (short-term)**	**Alt 3 % Long-term**	**Alt 3 Deviation from DFC (long-term)**
0-10	0%	20%	-20%	0%	-20%	43%	+23%
11-30	17%	40%	-23%	17%	-23%	28%	-12%
31-45	7%	30%	-23%	1%	-29%	15%	-15%
46+	75%	10%	+65%	82%	+72%	14%	+4%
Mean			32.8%		36.0%		13.5%

See **Table 60**. In the short term, there would be no expected change in the age class distribution of balsam fir. While Alternative 3 proposes shelterwood harvests in about 303 acres of balsam fir in the project area, it was assumed that it would take several years before the understory becomes established and the overstory is removed. Thus, the change in balsam age class distribution would not take place until the long term.

In the long term, there would be a large increase in the amount of 0-10 year-old balsam fir. This would result in the 43% of the balsam fir being in the young age class- up from the current 0%. During the 15 year span between 2013 and 2028, much of the balsam in the 0-10 year age class would grow into the 11-30 year class. This would increase that age class to 28%, bringing it closer to the desired condition. Likewise, the 31-45 year acreage would increase and the 46+ year age class would decrease, moving all age classes closer to desired conditions. The long-term effect of Alternative 3 on balsam fir age class distribution would be a substantial movement toward DFC's. The long-term deviation from desired conditions would be reduced to 13.5% from the current 32.8%.

Oak

Composition

Alternative 3 proposes a number of actions that have the potential to affect oak composition and age class distribution. About 1,350 acres of oak are proposed for shelterwood regeneration harvests and about 438 acres have been identified for white pine underplanting. In addition, harvest treatments in other types, such as red pine, white pine, aspen, and mixed hardwoods, have the potential to increase oak as a stand type or secondary component.

Table 61: Alternative 3 Effects on Oak Composition

MA	Existing Acres	Existing %	Desired %	Alt 3 Acres (short term)	Alt 3 % (short-term)	Alt 3 Acres (long-term)	Alt 3 % (long-term)
2C	0	0%	0-10%	0	0%	0	0%
4A	592	4.4%	0-25%	933	7.0%	933	7.0%
4B	1,149	12.8%	10-25%	1,160	12.9%	1,186	13.2%
Areawide*	2,027	7.5%	n/a	2,380	8.8%	2,457	9.0%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the short term, the amount of oak in Management Areas 4A and 4B would be expected to increase (see **Table 61**). This change would occur on nearly 350 acres across the project area. The majority of the change would be expected in overage mixed jack pine stands where thinnings are proposed. This short-term change would be in the direction of desired conditions.

The picture is similar in the long term. There would be no further change to oak composition in MA 4A. In MA 4B, there would be an increase of 77 acres of oak types, due mainly to natural succession of some mixed jack pine/oak stands. Some similar type changes are expected in the long term in MA 8G. The overall effect of Alternative 3 on oak composition as a cover type would be an increase of 2.6% in MA 4A and 0.4% in MA 4B.

As noted earlier, there are about 438 acres of white pine underplanting proposed in oak stands in Alternative 3. There are also numerous areas of prescribed underburning. These actions would not change the forest type designations of the target oak stands. However, they would affect the composition of the oak stands in question by increasing within stand diversity. In the long run, this would certainly be desirable. As discussed in the existing condition section, many of the oak stands within the project area have low levels of within stand diversity and would benefit with the addition of a conifer component. These stands would be less susceptible to pests such as gypsy moth and diseases such as oak wilt. Further, historical evidence suggests that, in the past, these areas were more species diverse than they presently are. Such actions would aid in moving the areas more toward historical conditions.

Structure (Age Class Distribution)

As discussed in the existing condition section, the oak in the project area is skewed heavily to the oldest age class. Alternative 3 responds to this need for more age class diversity by proposing nearly1,360 acres of shelterwood regeneration harvests in the project area. This would be the action most likely to affect oak age class distribution.

Table 62: Alternative 3 Effects on Oak Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 3 Short-term**	**Alt 3 Deviation from DFC (short-term)**	**Alt 3 Long-term**	**Alt 3 Deviation from DFC (long-term)**
0-19	3%	19%	-16%	3%	-16%	56%	+37%
20-59	5%	38%	-33%	10%	-28%	5%	-33%
60-79	20%	19%	+1%	12%	-7%	8%	-11%
80+	72%	24%	+48%	75%	+51%	31%	+7%
			24.5%		25.5%		22.0%

In the short term, few changes would be expected that would directly result from these actions. Rather, most of the expected shifts in the age classes would result from the natural aging of stands in the area. **Table 62** shows that, in the short term, the 20-59 and 80+ year age classes would see some increases as some of the stands would grow into these classes. Some increase in the 20-59 year class would be expected as a result of type conversions. For example, a 50-year-old mixed jack pine stand that is thinned and converted to an oak type would result in an increase to the 20-59 year class.

In the long term, the effects of Alternative 3 would become much more apparent. Because I am assuming that it would take several years for the shelterwood treatment to establish a new cohort, by 2028, we see a major increase in the amount of 0-19 year-old oak. This acreage would come overwhelmingly from the overabundant 80+ year-old age class. As **Table 62** shows, by 2028, the excess of acreage in the 80+ year age class would be transferred to the 0-19 year age class. While this is less than ideal, it would help to move the oak resource towards a more balanced condition in the long term. The long-term deviation from desired conditions would be reduced from 24.5% at present to 22.0%.

While I assumed that it would take about 15 years to establish an oak understory, this would be ideal and would actually vary widely. In reality, most oak stands take longer than 15 years to regenerate. The length of time necessary to regenerate an oak stand is contingent on the establishment of adequate numbers and sizes of oak seedlings in the understory. Oak seedlings can take decades to develop in an understory. Because oaks are slow growing and weak competitors at the seedling stage, they must not be released too early. Doing so will put them at a competitive disadvantage and result in a young stand of hardwood or aspen.

There are many types of shelterwood harvests. Most often, they are done in a series of two to three cuts, but this varies. In the case of oak shelterwood harvests in the Lakewood Southeast Area, the exact type of shelterwood harvest will depend on the amount and condition of understory oak seedlings.

In most stands, insufficient oak seedlings are present. In these cases, we would employ shelterwood *preparatory* (or “prep”) cuts. Prep cuts thin the stand from below to a level similar to a commercial thinning (~80% crown closure). The main difference is that there is an increased emphasis on removing competing vegetation in the understory. This often involves removal of submerchantable trees and shrubs as means to reduce low shade. Low shade is detrimental to developing understory seedlings. High shade results from diffuse light filtering through the high canopy. Mid-tolerant species, such as oak and white pine, are well-adapted to growing under high shade.

Sometimes, repeated prep cuts may be used to weed out undesirable overstory trees and control the amount of light reaching the understory. This depends on both the quality of the overstory trees and the amount of understory oaks that develop as a result of previous treatments.

In stands where sufficient oak seedlings are present, a shelterwood *seed* cut may be employed. The seed cut normally reduces overstory stocking to the best, largest, evenly-spaced trees (to about 60% crown closure). This creates conditions for established seedlings to grow in size and vigor while, at the same time, creating conditions for new seedlings to develop from acorns dropped by overstory parent trees.

Once the understory has reached a predetermined size and density (for example, 5000 seedlings/acre 4+ feet tall), the normal course of action is to conduct a shelterwood *removal* cut (or overstory removal). This is usually done in the winter to minimize understory damage and normally leaves a small number of overstory

trees per acre (≤ 10% crown closure) for future habitat benefits. The removal cut fully releases the understory trees, giving them full sunlight for rapid growth.

In some cases, depending on stand-level objectives, the decision may be made to modify or forego the removal cut. This may result in an eventual two-aged oak stand – or an even-aged young oak stand with a larger residual overstory remnant for habitat needs.

During the course of analysis, the Interdisciplinary Team (IDT) identified a potential concern that the level of oak shelterwood treatments proposed in Alternative 3 could have a negative effect on woodland raptor habitat. This concern was based on the assumption that all of the shelterwood harvests proposed in Alternative 3 would include seed/removal cuts. However, given what we know about the slow process of oak regeneration, it is highly unlikely that removal cuts would be conducted in the majority of the proposed shelterwood areas. In fact, it is probably unlikely that greater than half of the areas will have sufficient established oak seedlings to conduct shelterwood seed cuts. In other words, it is likely that at least half of the shelterwood treatments would be limited to prep cuts.

Nonetheless, as an effort to limit the effects of Alternative 3 on woodland raptor habitat, the IDT identified 1,010 acres of suitable raptor habitat in the vicinity of known nest sites (429 acres oak, 581 acres hardwood) and has agreed to limit shelterwood treatments in these stands to prepatory cuts. While these treatments would probably result in fewer acres of young oak stands over the next fifteen years, they would still move the stands toward long-term desired conditions while ensuring key habitat is maintained.

Other Considerations

Oak wilt is a fungal disease of oak that is present in and around the project area. The primary vector of oak wilt spread is root-to-root grafting. Oaks in the red oak group readily graft their roots with neighboring oaks. When an oak tree is infected by the oak wilt fungus, that tree will die. If there are any nearby oaks, their roots will likely be grafted to the affected tree and, thus, the infection will spread.

New infections begin when oak trees are wounded during the growing season. When oak trees are pruned, cut, or otherwise wounded, the wound site is attractive to a type of beetle for a 48-hour period. The beetle is also attracted to oak wilt fruiting bodies. Since the beetles congregate on oak wilt fungus, they transport spores wherever they go. Thus, if oak trees are wounded during the growing season, oak wilt beetles may transmit the disease to a previously healthy area and start a new infection center.

To prevent the spread of oak wilt, oak stands should not be harvested during the period of April 1 through September 1, the period when the beetles are active. The following design feature should be used in all oak stands proposed for harvest:

- To prevent the spread of oak wilt, limit harvesting or pruning in the red oak group to the period between September 1 and April 1.

This design feature should also be used in mixed stands in which 40% or more of the basal area is in oak species of the red oak group.

Communities of Concern

Northern Dry Forest

Among its stated needs for action, the Lakewood Southeast Project has identified the need to reestablish components and processes in the northern dry forest ecosystem. This is also discussed on page 16 of this report. Alternative 3 proposes many activities that would address this need for action:

- 3,922 acres of commercial thinning harvests in red and white pine stands
- 732 acres of prescribed underburning in red and white pine stands
- 621 acres of underplanting in red and white pine stands
- 238 acres of shelterwood harvests in red and white pine stands
- 223 acres of timber stand improvement in older (not newly-planted) red and white pine stands

The actions listed above would take place specifically in red and white pine types. Here is how these actions would move mostly plantation-origin pine stands toward desired northern dry forest conditions:

Commercial thinning, while also reducing stocking and improving stand vigor, would increase spacing between residual trees and increase their growth, resulting in bigger trees in a shorter timeframe. Small temporary openings would be created in the canopy which would provide improved growing conditions for mid-tolerant and tolerant understory seedlings and saplings. Thinning would also reduce the "corn row"-like appearance of the plantations and result in more naturally-appearing stands. Thinning prescriptions would also have the ability to encourage within-stand diversity and steer the stand toward more variable spacing.

Prescribed underburning would normally be used to reduce the amount of competing understory vegetation by shade-tolerant species such as red maple and hazel. Because of what we know about the fire history of the area, we believe that, historically, there was far less understory brush in the northern dry forests within the Lakewood Southeast area. Prescribing the use of understory fire would reduce these species and create better conditions for the establishment and development of species such as white pine and oak. Since these species respond well to fire, we would be using fire under controlled conditions to emulate historic processes.

Underplanting white pine and hemlock (primarily) in the understories of select stands would speed up the development of northern dry forest components, namely multiple species and age classes. Multi-cohort stands of mixed pine provide much more habitat value and biological diversity than homogenous single species plantations. Planting would be done with varying species, densities, and patterns with an eye on trying to emulate natural northern dry forest ecosystems.

Shelterwood regeneration harvests, while mainly aimed at regenerating new, young pine stands, would be designed to emulate the effects of historic disturbances, such as wind storms, moderate intensity fires, and insect outbreaks. The design of the shelterwood harvests would vary, depending on local conditions, and could result in both evenly-spaced residual trees over a dense understory – or irregularly-spaced residual trees with dense understory clumps in some areas and more sparsely-stocked understories in other areas. As with the other treatments, the shelterwood harvests would be modified in each location to take advantage of unique opportunities. For example, in an area where overstory hemlocks are present, we would tailor the harvest treatment to encourage understory hemlock development.

Timber stand improvement is another tool that would be used to control the development and composition of northern dry forest ecosystems. In most cases, "TSI" would be used to "weed out" competing vegetation around desired understory trees. For example, TSI would often target less desirable and more shade-tolerant red maple so that white pine seedlings are not overtopped and are free to grow up in the understory. Like the other treatments, TSI would be tailored to take advantage of the unique conditions that are present at each site.

Among the alternatives considered in detail, Alternative 3 would rank second in responding to the need to reestablish components and processes in the northern dry forest ecosystem. Using a combination of all these tools, Alternative 3 would move thousands of acres of red, white, and mixed pine forests toward the historic conditions that typified northern dry forests. The Lakewood Southeast Purpose of and Need for

Action does not specify an acreage figure of Northern Dry Forest to be treated, but, rather, simply states that the need exists. Alternative 3 proposes a combined total of 5,736 acres of treatments within red and white pine types that are designed to restore Northern Dry Forest components and processes. This is the second highest amount of treatments among the alternatives considered in detail.

Pine Barrens

For all intents and purposes, Alternative 3 would respond equally well to Alternative 2 in restoring Pine Barrens / Savanna plant communities in the Airport Road Area. In this locale, there is only one difference between the two alternatives: in one 16-acre aspen stand, Alternative 3 elects to clearcut the stand rather than thinning it, as in Alternative 2. This is a minor difference and wouldn't result in a discernable difference in outcome.

Alternative 3 does differ from the Proposed Action in that, in addition to restoring Pine Barrens / Savanna in the Airport Road Area, it also proposes restoration activities in the Twin Pine Road Area.

In response to public concerns about young forests and early-successional habitat, the Forest Service included treatments in Alternative 3 that would be aimed at restoring additional Pine Barrens / Savanna plant communities along Twin Pine Road. This is another area that has been long-recognized for its restoration potential. **Figure 25** at right shows the area the way it looked in 1936. 1938 aerial photography shows thousands of acres of such habitat in the vicinity.

Figure 25. Pine Barrens / Savanna on west side of Twin Pine Road, 1936. Shortly after this photo was taken, the area was planted with jack pine. This site is located about ½ mile north of the barrens restoration activities proposed in Alternative 3.

Figure 26. Prescribed burning within an existing Twin Pine Road opening. This burn took place in October, 2010 and successfully reduced the shrub component with a slow, creeping fire.

In the early 1990's, two areas along Twin Pine totaling 83 acres were clearcut and burned, creating the present-day Twin Pine openings. These two areas, separated by about ¼ mile, have been repeatedly burned in subsequent years (**Figure 26**) with the goal of establishing and maintaining them as grasslands.

Alternative 3 proposes to clearcut 122 acres in 3 pine stands that are adjacent to the existing openings. These areas would then be burned and seeded with native grasses to restore open grassland conditions. The resulting opening would be a 205 acre area that would resemble **Figures 25** and **26** at right.

This would be in excess of the 40-acre limitation on clearcuts established by agency regulations in response to NFMA. The Eastern Region allows this, but only after a regional review. A regional review would be required prior to the selection of Alternative 3.

Of the alternatives considered in detail, Alternative 3 would best respond to the Lakewood Southeast Project's stated need to restore Pine Barrens ecosystems. It would do this by restoring Pine Barrens and Savanna plant communities on about 1,000 acres within the project area.

Alternative 4

Alternative 4 proposes about 6,486 acres of timber harvest to respond to the Purpose and Need for Action. These silvicultural treatments are listed in Chapter 1 of the EIS and are the basis used for effects calculations in a Microsoft Excel® spreadsheet entitled "Lakewood_Southeast.xlsx". The harvest treatments proposed for Alternative 4 are summarized in the following table:

Table 63. Lakewood Southeast Alternative 4 Harvest Treatment Summary

Harvest Treatment	Acres	Stands	Jack Pine	Red Pine	White Pine	Balsam	White Spruce	Paper Birch	Oak	Northern Hardwood	Aspen
Thin	*4,354*	*183*	*11*	*3,474*	*280*	*0*	*20*	*0*	*7*	*118*	*443*
Shelterwood	*1,422*	*51*	*32*	*109*	*49*	*332*	*0*	*128*	*178*	*576*	*19*
Clearcut	*374*	*20*	*197*	*142*	*0*	*0*	*0*	*0*	*0*	*0*	*35*
Special Cut	*272*	*6*	*242*	*30*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Selection	*64*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*64*	*0*
Total	***6,486***	***261***	***482***	***3,755***	***329***	***332***	***20***	***128***	***185***	***759***	***497***

Other Alternative 4 treatments (with approximate acreages) that have the potential to affect vegetative composition and structure are:

Table 64. Lakewood Southeast Alternative 4 Other Treatment Summary

Other Treatment	Acres	Stands
Underburn	2039	*80**
Underplant	948	*36*
TSI	519	*13*
Full Plant	339	*15*
Salmon Blade	97	*3*
Precommercial thin	48	*2*

*approximate

Alternative 4 Development

Alternative 4 was developed to respond to a number of public concerns we received in response to the Lakewood Southeast Proposed Action (Alternative 2). This alternative to the Proposed Action included several features including:

- No harvests within 30 meters of water bodies
- No harvests within 500 meters of hawk nests
- Old aspen (60+ years) would be allowed to succeed to other types
- No aspen would be harvested adjacent to MA 8E, F, or G
- No aspen harvest if all/most or stand falls within selected stream buffers
- No clearcuts or shelterwood harvests in red/white pine stands 80+ years
- No harvests of any kind in red/white pine stands 100+ years
- No harvests in hardwood or oak stands 80+ years

Direct and Indirect effects

Aspen

Composition

Alternative 4 includes 497 acres of harvest treatments in the aspen type.

- 443 acres of thinning
- 35 acres of clearcuts
- 19 acres of shelterwood

These harvests are primarily aimed at converting the aspen stand to other types, usually hardwoods.

In the short term, Alternative 4 would reduce the representation of aspen types across all management areas (see **Table 65**). In the short term, it is estimated that about 139 acres of aspen stands would immediately convert to other upland forest types (mostly hardwood). This would be the result of some of the 443 acres of aspen thinnings. Many older aspen stands contain a strong hardwood or oak component. Thinning these stands would reduce the aspen component and instantly convert them to hardwood, oak, or red pine types.

Table 65: Effects of Alternative 4 on Aspen Composition

MA	Existing Acres	Existing %	Desired %	Alt 4 Acres Short term	Alt 4 % short term	Alt 4 Acres Long term	Alt 4 % Long term
2C	196	57.5%	15-30%	195	57.5%	142	41.7%
4A	3,628	27.2%	10-30%	3,532	26.5%	2,567	19.3%
4B	2,423	27.0%	0-7%	2,381	26.6%	1,842	20.6%
Areawide*	6,987	25.7%	n/a	6,848	25.2%	5,076	18.7%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the long term, the amount of aspen in the project area would be reduced even further. By 2028, (15 years after treatment) it is estimated that Alternative 4 would result in another 1,772 acres of aspen types being converted to other upland forest types. **Table 65** illustrates this trend across all management areas.

In addition to the short-term type conversions discussed above, many other stands in the project area have less of a secondary component or are, otherwise, less advanced in age and stand development. For example, there are about 300 acres of aspen stands which would be thinned in Alternative 4 that would not immediately convert. Some of these (227 ac) would also be underplanted with white pine. In the short term, following treatment, these stands would continue to be dominated by aspen. However, during the next 15 years, the aspen overstory would begin to decline as the white pine understory would take over and becomes the characteristic species.

Aside from the aspen stands that would be actively converted through thinning, about 1,400 additional acres would be expected to convert between 2013 and 2028 through natural succession. These untreated stands would all be 80+ years old by 2028 and would be expected to convert primarily to northern hardwoods.

Of the alternatives, Alternative 4 would be expected to result in the largest reduction in aspen composition. This decrease in aspen composition would be achieved largely by passive management rather than by active management as it does in Alternatives 2 and 3. It would not focus on reducing aspen composition in specific management areas but, rather, would result in reducing aspen wherever it is oldest.

Structure (Age Class Distribution)

As shown in **Table 66**, in the short term, Alternative 4 would result in relatively little change to the aspen age class distribution. Nearly all of the change that would occur in the short term would come as a result of stands aging and growing into the next successive age class. There would be a small addition to the young age class as 35 acres of aspen is clearcut. However, this would be offset by an equal acreage of aspen growing into the 11-20 year age class.

Table 66: Alternative 4 Effects on Aspen Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 4 Short-Term	Alt 4 Deviation from DFC (short-term)	Alt 4 Long-Term	Alt 4 Deviation from DFC (long-term)
0-10	2%	20%	-18%	2%	-18%	0%	-20%
11-20	12%	20%	-8%	4%	-16%	2%	-18%
21-45	52%	50%	+2%	58%	+8%	35%	-15%
46+	35%	10%	+25%	35%	+25%	63%	+53%
Mean			13.3%		16.8%		26.5%

In the long term, the distribution of aspen age classes would become heavily skewed toward the oldest age class. With the small amount of regeneration harvests included in Alternative 4, by 2028, there would only be 2% of the aspen acreage in the 11-20 year age class and 63% of the acreage in the 46+ year age class. This alternative would move the aspen age class distribution further from the desired conditions, doubling the deviation from the DFC (**Table 66**). Of the action alternatives, Alternative 4 would offer the poorest response to the need to modify aspen age class distribution. Only Alternative 1, the No Action Alternative, would respond more poorly.

Paper Birch

Composition

Under Alternative 4, there would be no anticipated change in the composition of paper birch in the short term. As noted in the discussion for the existing condition, there are 128 acres of paper birch within management areas that are open to timber management. All of this acreage falls within Management Area 4A and would be treated with shelterwood harvests designed to regenerate the stands to young paper birch. Thus, in the short term, the percentage of Management Area 4A in paper birch in would remain at about 1%.

In the long term, the newly-regenerated birch stands would remain birch types and the composition of birch would remain the same at 1%.

Structure (Age Class Distribution)

See **Table 67**. In the short term, all paper birch acreage would be in the 61+ year age class. The 128 acres of paper birch proposed for shelterwood regeneration would, in the short term, remain in that age class. Another 51 acres of birch stands, located within Management Areas 8F and G, would be in the 61+ year age class.

Table 67: Alternative 4 Effects on Paper Birch Age Class Distribution

Age Class	Existing	Desired	Alt 4 Short-term	Alt 4 Long-term
0-20	0%	25%	0%	100%
21-40	0%	25%	0%	0%
41-60	4%	25%	0%	0%
61+	96%	25%	100%	0%

In the long term, the 128 acres of shelterwood harvest would be regenerating 15-20 year-old birch. The remaining 51 acres in MA 8F and 8G would be expected to convert to oak types. Thus, 100% of the birch would be in the youngest age class 15 years after implementing Alternative 4.

Northern Hardwoods

Composition

In the short term, under Alternative 4, the composition of northern hardwoods would be expected to change little (**Table 68**). There would be a net increase of about 124 acres (0.4%) of hardwoods across all management areas. This would be due to direct conversions of aspen stands to hardwood resulting from some of the 443 acres of aspen thinning that is part of Alternative 4.

In the long term, the composition of hardwood in the Lakewood Southeast Project Area would be expected to notably increase across all management areas (see **Table 68**). This would result from some of the aspen thinning, but would be mainly from the conversion of many acres of untreated overmature early-successional forests (such as aspen) converting to the more shade-tolerant hardwoods. Some 900+ acres of aspen would convert in MA 4A, increasing the hardwood composition to 22.5%. In MA 4B, hardwood would be increased in the long term by 4.6% (400+ acres), a change that would result in moving the hardwood composition above the range of desired conditions.

Table 68: Effects of Alternative 4 on Northern Hardwood Composition

MA	Existing Acres	Existing %	Desired %	Alt 4 Acres (short-term)	Alt 4 % (short-term)	Alt 4 Acres (long-term)	Alt 4 % (long-term)
2C	29	8.4%	30-50%	29	8.4%	82	24.2%
4A	2,076	15.6%	0-25%	2,172	16.3%	2,998	22.5%
4B	729	8.1%	0-10%	758	8.5%	1,141	12.7%
Areawide*	4,237	15.6%	n/a	4,361	16.0%	5,838	21.5%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Structure (Age Class Distribution)

Alternative 4 proposes the use of about 576 acres of shelterwood harvests to modify hardwood composition and age class distribution. **Table 69** illustrates how the resulting age class distribution would differ from the existing and desired conditions.

In the short term, there would be little change from the existing condition. Mainly, the acreage in the youngest age class would be expected to decrease while the oldest age class would be expected to increase slightly. This is because I assumed that it would take several years for the hardwood regeneration to become established and for the removal cut to take place.

Table 69: Short and Long-term Effects of Alternative 4 on Northern Hardwood Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 4 Short-term	Alt 4 Deviation from DFC (Short-term)	Alt 4 Long-term	Alt 4 Deviation from DFC (Long-term)
0-20	4%	16%	-12%	2%	-14%	11%	-5%
21-60	12%	32%	-20%	11%	-21%	4%	-28%
61-100	80%	32%	+48%	80%	+48%	52%	+20%
101+	5%	20%	-15%	7%	-13%	33%	+13%
Mean			23.8%		24.0%		16.5%

In the long term, as a result of the proposed shelterwood harvests, there would be an input of about 576 acres in the 0-20 year age class. This would increase the 0-20 year age class to 11% which would be an improvement over the existing condition, but still short of the desired 16%. At the same time, the remaining stands would increase by 15 years of age and there would be substantial shifts in age classes. The biggest change would occur between the 61-100 and 101+ year age classes.

As **Table 69** shows, this movement would result in an overall movement toward the desired hardwood age class distribution. While there would still be some substantial differences between desired and Alternative 4 long-term age class distributions, Alternative 4 would greatly reduce the deviation between the existing and desired conditions – overall, it would move it much closer to the DFCs.

Stocking

The preliminary analysis for the Lakewood Southeast Project identified that there are currently about 179 acres of mixed upland hardwood stands that exceed desired stocking levels. Because Alternative 4 limits hardwood treatments to stands less than 80 years of age, this alternative includes 118 acres of thinning treatments that would reduce the stocking levels. Therefore, Alternative 4 would respond to 66% of this need for action.

Uneven-aged Hardwood

The preliminary analysis for the Lakewood Southeast Project identified that that 307 acres in 8 stands should be moved toward an uneven-aged condition. Later, additional review amended that recommendation to 194 acres. With the limitation of treating only hardwood stands less than 80 years old, Alternative 4 proposes selection harvests in only 64 acres. Therefore, Alternative 4 would respond to only 33% of this need for action.

Jack Pine

Composition

In the short term, under Alternative 4, there would be a reduction in the composition of jack pine in all management areas (see **Table 70**). In all, there would be a loss of nearly 450 acres of the jack pine type across the project area.

Table 70: Alternative 4 Effects on Jack Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 4 Acres (short-term)	Alt 4 % (short-term)	Alt 4 Acres (long-term)	Alt 4 % (long-term)
2C	0	0%	0-2%	0	0%	0	0%
4A	1,174	8.8%	0-35%	831	6.2%	795	6.0%
4B	716	8.0%	3-6%	612	6.8%	543	6.1%
Areawide*	1,928	7.1%	n/a	1,481	5.4%	1,353	5.0%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

About half of the conversion would come as a result of clearcutting old jack pine stands and replanting the sites with red and white pine. The remainder of the conversions would come from the use of special cuts, and thinnings. Most of these would take place east of Airport Road and the focus would be on moving older-aged jack pine stands from a closed forest condition to pine barrens/savanna conditions. In these areas, extensive cutting would be used to greatly reduce the stocking levels. The cuts would create a more open, grassland condition with scattered trees and woodlands. In most cases, jack pine would be removed in favor of larger and more fire-tolerant red pines and oak. Then, prescribed fire would be used to reduce woody debris and encourage the development of grasses and forbs. The resulting landscape would resemble the 1936 photograph on the cover of this report.

In the long term, there would be a further reduction of about 70 acres of jack pine within the analysis area. Nearly all of this would be expected to come as a result of natural succession of older mixed jack pine stands. About 11 acres would come as a result of underburning mixed jack pine types. The less fire-tolerant jack pine would be expected to die from cambial scorch; the more fire-tolerant red and white pines would survive and become the dominant type in those locations.

Structure (Age Class Distribution)

In the short term, the amount of jack pine in the 0-10 year-old age class would be expected to rise from 6% to 11%. This compares to a desired condition of 16%. The increase would come from clearcutting and planting 59 acres to jack pine.

In the short term, Alternative 4 would result in most of the 51+ year old jack pine being harvested. As noted above, 59 acres would be clearcut and replanted to jack pine. Another 246 acres would be harvested and converted to other types (discussed above under composition). About 128 acres of 51+ year old jack pine would remain, resulting in 9% left in that age class.

Table 71: Alternative 4 Effects on Jack Pine Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 4 % Short-term	Alt 4 Deviation from DFC (short-term)	Alt 4 % Long-term	Alt 4 Deviation from DFC (long-term)
0-10	6%	16%	-10%	11%	-5%	0%	-16%
11-30	59%	32%	+27%	67%	+35%	12%	-20%
31-50	13%	32%	-19%	14%	-18%	73%	+41%
51+	22%	20%	+2%	9%	-11%	15%	-5%
Mean			14.5%		17.3%		20.5%

Alternative 4 would result in a bulge of jack pine in the 11-30 year age class. In practical terms, there's not much we can do about this at this time, but, in the long term, such a bulge would be viewed by future managers as an opportunity. There would be an overabundance of 31-50 year-old jack pine in 2028. Managers would then have the option of regenerating some of these stands to modify the age class distribution in accordance with DFCs.

This analysis does not assume future long-term treatments however. Therefore, the assumption is that, without future treatments, the long-term age class distribution of jack pine would continue to drift away from the desired conditions. **Table 71** shows a long-term deviation in age class distribution from the desired conditions of 20.5%, an increase over the existing condition of 14.5%.

Red Pine / White Pine

Since the Chequamegon-Nicolet Forest Plan groups red and white pine as a composition objective, these two types will be combined for the discussion of composition. However, since the Forest Plan gives different age glass objectives for each species, age class distribution for the two types will be discussed separately.

Composition

In the short term, Alternative 4 would have the effect of increasing the composition of red and white pine across the project area (**Table 72**).

Table 72: Alternative 4 Effects on Red/White Pine Composition

MA	Existing Acres	Existing %	Desired %	Alt 4 Acres (short-term)	Alt 4 % (short-term)	Alt 4 Acres (long-term)	Alt 4 % (long-term)
2C	33	9.8%	10-30%	33	9.8%	33	9.8%
4A	4,739	35.5%	10-50%	4,822	36.2%	4,937	37.0%
4B	3085	34.4%	45-70%	3,181	35.5%	3,343	37.3%
Areawide*	8,949	32.9%	n/a	9,128	33.6%	9,428	34.7%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In MA 4A, about 83 acres would

be converted from other types. About 45 acres would come from jack pine being clearcut and replanted to red and white pine. The remainder would come from thinning harvests in overmature mixed jack pine and aspen types.

In MA 4B, there would be an increase of nearly 100 acres (1.1%). This would be done mainly by clearcutting older jack pine stands and replanting to red and white pine.

In the long term, the trend would continue. By 2028, an additional 300 acres would convert to red and white pine types. Where, in the short term, the changes would be due to the immediate conversions discussed above, the long-term effects would come mainly from thinning mixed stands, underplanting white pine, or natural white pine regeneration.

In addition to type changes, Alternative 4 would have the effect of improving within-stand diversity in many stands in the project area. While substantially less extensive than the other action alternatives, Alternative 4 includes many acres of underplanting (948), underburning (1,663), timber stand improvement (519), precommercial thinning (48), and mechanical site preparation (97). All of these actions would aid in the establishment and development of more mixed stands-both in terms of composition and structure. For example, the underburning that's included in Alternative 4 would have the effect of controlling less fire-tolerant (but more shade-tolerant) understory red maple. At the same time, it would reduce the duff layer and produce improved seedbeds for white pine regeneration. Timber stand improvement and precommercial thinning would enable managers to control the stocking and composition of regenerating stands and developing understories. Together, the use of all of these tools would move thousands of acres toward desired future conditions.

Structure (Age Class Distribution)

Red Pine

Table 73 shows that in the short term, the age class distribution of red pine would remain nearly static. An incremental shift in acreage would occur in the 61-100 and 101+ year age classes as a result of natural aging. The difference from the desired age class distribution would be reduced from 17.5% to 17.0%.

Table 73: Alternative 4 Effects on Red Pine Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 4 % Short-term	Alt 4 Deviation from DFC (short-term)	Alt 4 % Long-term	Alt 4 Deviation from DFC (long-term)
0-20	4%	15%	-11%	4%	-11%	5%	-10%
21-60	43%	30%	+13%	43%	+13%	37%	+7%
61-100	52%	30%	+22%	51%	+21%	52%	+22%
101+	1%	25%	-24%	2%	-23%	6%	-19%
Mean			17.5%		17.0%		14.5%

In the long term, as a result of a small number of red and white pine shelterwood harvests and a larger amount of white pine underplanting, gains would be made in the youngest age class as red pine regeneration becomes established. The 21-60 year age class would move more in line with desired conditions as some of the stands grow into the 61-100 year class. Due to equal ingrowth and outgrowth, the 61-100 year class would remain at about 52%. Finally, the 101+ year age class would see some movement toward desired conditions as about 360 acres is added through ingrowth. The net result is that, in the long term, the red pine age class distribution would move closer to desired conditions than it currently is. The difference from the desired age class distribution would be reduced from 17.5% to 14.5%.

White Pine

Due to the 948 acres of underplanting, 519 acres of TSI, and 1,663 acres of prescribed underburning, Alternative 4 would result in substantial changes to the age class distribution of white pine in the Lakewood Southeast Project Area.

Table 74: Alternative 4 Effects on White Pine Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 4 % Short-term**	**Alt 4 Deviation from DFC (short-term)**	**Alt 4 % Long-term**	**Alt 4 Deviation from DFC (long-term)**
0-20	6%	12%	-6%	6%	-6%	16%	+4%
21-60	9%	24%	-15%	9%	-15%	7%	-17%
61-120	82%	36%	+46%	81%	+45%	63%	+27%
121+	3%	28%	-25%	3%	-25%	14%	-14%
Mean			23.0%		22.8%		15.5%

In the short term, there would be essentially no immediate changes to the white pine age class distribution that would come as a direct result of Alternative 4 (**Table 74**).

However, in the long term, the effects of the Alternative 4 actions would become much more apparent. As a result of the underplanting, burning, TSI, and shelterwood regeneration harvests listed above, by 2028 there would be about 227 acres of young white pine added the 0-20 year age class (**Table 74**). This would result in a net increase of the young white pine age class by 10%. At the same time, there would be a reduction of 61-120 year-old white pine acreage, putting it more in line with desired conditions. This would result from some stands moving into the next higher age class and also from some stands being regenerated over the next ten years. In the long term, Alternative 4 would make considerable progress in moving the area's white pine age class distribution toward desired conditions. The deviation from desired conditions would be reduced from 23% to 15.5%.

Stocking

Red Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 3,632 acres of red pine in 149 stands that are or soon will be in need of stocking reduction. Alternative 4 proposes 3,474 acres of thinning treatments in red pine that would reduce stocking to desired conditions. Therefore, Alternative 4 would respond to 96% of this need for action.

White Pine

The preliminary analysis for the Lakewood Southeast Project identified that there are about 314 acres of white pine in that are in need of stocking reduction. Alternative 4 proposes 280 acres of thinning treatments in white pine that would reduce stocking to desired conditions. Thus, Alternative 4 would meet 89% of this need for action.

Other Considerations

Annosum is among the greatest causes of damage to conifer forests throughout the world (Stanosz, 2009). This disease caused by *Heterobasidion annosum* (syn. *Fomes annosus),* can result in root rot, butt rot, reduced growth, and mortality of host trees.

First observed in Wisconsin in 1993, Annosum is now known to occur in 23 counties (as of July, 2011) including Oconto and Forest counties. Annosum has been most commonly observed on red and white pine plantations in Wisconsin (Scanlon, 2010).

Infection most often occurs when spores land and germinate on the surface of a freshly cut stump. Following stump colonization, the fungus spreads through interconnected root systems to attack other trees. Growth is reduced and trees will become susceptible to windthrow and eventually die. The pathogen persists for years in stumps and roots of killed trees (Stanosz, 2009). Seedlings planted on a newly harvested site can be infected with the fungus from contact with infected stumps and roots (Cram, 2009).

Red and white pine are the species in the project area most susceptible to Annosum infections.

The US Forest Service Forest Health Protection pathologists have recommended stump treatment on sites with a moderate to high risk of infection based on distance (within 50 miles of known infection) and where impacts would be high based on management situation. Management situations with potentially high impacts are stands managed for red or white pine and the residual or future stand will also be red or white pine.

Control measures are directed toward preventing establishment of this root rot pathogen in new locations. The chemical, borax, has been used to prevent infection of conifer stumps that are not already colonized (Stanosz, 2009). Treatment will help prevent new infection, but will not stop the growth of the pathogen if the stump is already infected.

To prevent the introduction of Annosum in the Lakewood Southeast Project Area, the following design feature should be included in all red and white pine harvests (with the exception of final removal harvests where the target regeneration is not pine):

- To prevent the introduction and/or spread of Annosum root rot, borax-based products, such as Sporax® or Cellu-Treat® should be applied (in accordance with Special Provision R9-CT6.41#) to all conifer stumps within 24 hours of harvest.

Balsam Fir

Composition

Table 75: Alternative 4 Effects on Balsam Fir Composition

MA	Existing Acres	Existing %	Desired %	Alt 4 Acres (short-term)	Alt 4 % (long-term)	Alt 4 Acres (long-term)	Alt 4 % (long-term)
2C	80	23.7%	0-3%	80	23.7%	80	23.7%
4A	362	2.7%	0-3%	362	2.7%	362	2.7%
4B	181	2.0%	0-3%	181	2.0%	181	2.0%
Areawide*	819	3.0%	n/a	819	3.0%	819	3.0%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the short and long terms, there would be no expected changes in the composition of balsam fir under Alternative 4. This would be the same effect expected for Alternative 3. Alternative 4 proposes about 332 acres of shelterwood harvests in balsam fir stands in the Lakewood Southeast Project Area. These treatments would be expected to regenerate the stands to the same type. Other untreated fir stands throughout the project area would be expected to remain as fir in the short and long term. This is because balsam fir is a very shade tolerant species; even if the parent stand becomes overmature and breaks up, it would be expected to regenerate to the same species.

Structure (Age Class Distribution)

Table 76: Alternative 4 Effects on Balsam Fir Age Class Distribution							
Age Class	**Existing**	**Desired**	**Existing Deviation from DFC**	**Alt 4 % Short-term**	**Alt 4 Deviation from DFC (short-term)**	**Alt 4 % Long-term**	**Alt 4 Deviation from DFC (long-term)**
0-10	0%	20%	-20%	0%	-20%	43%	+23%
11-30	17%	40%	-23%	17%	-23%	28%	-12%
31-45	7%	30%	-23%	1%	-29%	15%	-15%
46+	75%	10%	+65%	82%	+72%	14%	+4%
Mean			32.8%		36.0%		13.5%

See **Table 76**. In the short term, there would be no expected change in the age class distribution of balsam fir resulting from Alternative 4 actions. There would be some shift in acreage from the 31-45 to the 46+ year age classes that would result from natural aging. While Alternative 4 proposes shelterwood harvests in about 332 acres of balsam fir in the project area, it was assumed that it would take several years before the understory becomes established and the overstory is removed. In the short term, therefore, the age class distribution would actually drift further from desired conditions.

In the long term, there would be a large increase in the amount of 0-10 year-old balsam fir. This would result in the 43% of the balsam fir being in the young age class- up from the current 0%. During the 15 year span between 2013 and 2028, much of the balsam in the 0-10 year age class would grow into the 11-30 year class. This would increase that age class to 28%, bringing it closer to the desired condition. Likewise, the 31-45 year acreage would increase and the 46+ year age class would decrease, moving all age classes closer to desired conditions. The long-term effect of Alternative 3 on balsam fir age class distribution would be a substantial movement toward DFC's. The long-term deviation from desired conditions would be reduced to 13.5% from the current 32.8%. This would be the same effect expected for Alternative 3.

Oak

Composition

Alternative 4 proposes a number of actions that have the potential to affect oak composition and age class distribution. However, compared to the other action alternatives, the extent of these actions is far less. About 178 acres of oak are proposed for shelterwood regeneration harvests and only about 4 acres have been identified for white pine underplanting. Harvest treatments in other types, such as red pine, white pine, aspen, and mixed hardwoods, have the potential to increase oak as a stand type or secondary component.

Table 77: Alternative 4 Effects on Oak Composition							
MA	**Existing Acres**	**Existing %**	**Desired %**	**Alt 4 Acres (short term)**	**Alt 4 % (short-term)**	**Alt 4 Acres (long-term)**	**Alt 4 % (long-term)**
2C	0	0%	0-10%	0	0%	0	0%
4A	592	4.4%	0-25%	852	6.4%	911	6.8%
4B	1,149	12.8%	10-25%	1,171	13.1%	1,234	13.8%
Areawide*	2,027	7.5%	n/a	2,309	8.5%	2,482	9.1%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In the short term, the amount of oak in Management Areas 4A and 4B would be expected to increase (see **Table 77**). This change would occur on almost 300 acres across the project area. The majority of the change would be expected in overage mixed aspen stands where thinnings are proposed. This short-term change would be in the direction of desired conditions.

The picture is similar in the long term. There would be a slight additional increase (59 ac) in oak composition in MA 4A. In MA 4B, there would be an increase of 63 acres of oak types, due mainly to natural succession of some mixed jack pine/oak stands. Some similar type changes are expected in the long term in MA 8G. The overall effect of Alternative 4 on oak composition as a cover type would be an increase of 2.2% in MA 4A and 1.0% in MA 4B.

As noted earlier, Alternative 4 has only 4 acres of white pine underplanting proposed in oak stands. There is 1,664 acres of prescribed underburning proposed. The effect of the underplanting would be nominal, given its extent. However, the underburning, while less than the other action alternatives, would treat considerable acreage under this alternative. This action would not change the forest type designations of the target oak stands. However, it would affect the composition of the oak stands in question by increasing within stand diversity. In the long run, this would certainly be desirable. As discussed in the existing condition section, many of the oak stands within the project area have low levels of within stand diversity and would benefit with the addition of a conifer component. These stands would be less susceptible to pests such as gypsy moth and diseases such as oak wilt. Further, historical evidence suggests that, in the past, these areas were more species diverse than they presently are. Such actions would aid in moving the areas more toward historical conditions.

Structure (Age Class Distribution)

As discussed in the existing condition section, the oak in the project area is skewed heavily to the oldest age class. With only 178 acres of shelterwood harvest proposed, Alternative 4 doesn't offer a strong response to the need for more age class diversity. However, as noted above, there would be an addition of oak stands as a result of thinning other types. Thus, as a consequence, there would also be resulting changes to oak age class distribution.

Table 78: Alternative 4 Effects on Oak Age Class Distribution

Age Class	Existing	Desired	Existing Deviation from DFC	Alt 4 Short-term	Alt 4 Deviation from DFC (short-term)	Alt 4 Long-term	Alt 4 Deviation from DFC (long-term)
0-19	3%	19%	-16%	3%	-16%	9%	-10%
20-59	5%	38%	-33%	11%	-27%	5%	-33%
60-79	20%	19%	+1%	11%	-8%	8%	-11%
80+	72%	24%	+48%	75%	+51%	78%	+54%
			24.5%		25.5%		27.0%

In the short term, Alternative 4 would result in some modifications to the oak age class distribution. The 0-19 year age class would be expected to remain at 3%. While there would be some younger oak stands created as a result of aspen and jack pine thinnings, an equal acreage would grow from that age class and into the 20-59 year class. At the same time, much of nearly 300 acres of mixed jack pine types would be converted to oak with a shelterwood, special cut, or thinning. The new oak stands would result in additional acreage in the 20-59 year age class. Also, because of the overall increased acreage in oak, the percentage in the 60-79 year age class would be reduced, both as some of the stands move into the 80+ year class and also, as the real acreage in the 60-79 drops in value relative to the total. The short-term result of all these shifts would be a small shift away from the desired age class distribution. The deviation from the desired conditions would increase from 24.5 to 25.5% (**Table 78**).

In the long term, the effects of Alternative 4 would become more apparent. Because I am assuming that it would take several years for the shelterwood treatment to establish a new cohort, by 2028, we see an increase in the amount of 0-19 year-old oak. This acreage would come overwhelmingly from the overabundant 60-79 year-old age class.

Remember that a feature of this alternative, proposed by a public interest group, is that no hardwood or oak stands greater than 80 years would be harvested. This feature would have noteworthy consequences on the

ability of the Forest Service to regulate and maintain oak age class distribution in accordance with Forest Plan direction. As **Table 78** shows, in the long term, the amount of oak in the 80+ age class would continue to increase, resulting in a deviation of 54% off of what is desired for that age class. Overall, in the long term, Alternative 4 would result in the oak age class distribution drifting further from desired conditions – going from the current deviation of 24.5% to 27.0%.

While I assumed that it would take about 15 years to establish an oak understory, this would be ideal and would actually vary widely. In reality, most oak stands take longer than 15 years to regenerate. The length of time necessary to regenerate an oak stand is contingent on the establishment of adequate numbers and sizes of oak seedlings in the understory. Oak seedlings can take decades to develop in an understory. Because oaks are slow growing and weak competitors at the seedling stage, they must not be released too early. Doing so will put them at a competitive disadvantage and result in a young stand of hardwood or aspen.

There are many types of shelterwood harvests. Most often, they are done in a series of two to three cuts, but this varies. In the case of oak shelterwood harvests in the Lakewood Southeast Area, the exact type of shelterwood harvest will depend on the amount and condition of understory oak seedlings.

In most stands, insufficient oak seedlings are present. In these cases, we would employ shelterwood *preparatory* (or "prep") cuts. Prep cuts thin the stand from below to a level similar to a commercial thinning (~80% crown closure). The main difference is that there is an increased emphasis on removing competing vegetation in the understory. This often involves removal of submerchantable trees and shrubs as means to reduce low shade. Low shade is detrimental to developing understory seedlings. High shade results from diffuse light filtering through the high canopy. Mid-tolerant species, such as oak and white pine, are well-adapted to growing under high shade.

Sometimes, repeated prep cuts may be used to weed out undesirable overstory trees and control the amount of light reaching the understory. This depends on both the quality of the overstory trees and the amount of understory oaks that develop as a result of previous treatments.

In stands where sufficient oak seedlings are present, a shelterwood *seed* cut may be employed. The seed cut normally reduces overstory stocking to the best, largest, evenly-spaced trees (to about 60% crown closure). This creates conditions for established seedlings to grow in size and vigor while, at the same time, creating conditions for new seedlings to develop from acorns dropped by overstory parent trees.

Once the understory has reached a predetermined size and density (for example, 5000 seedlings/acre 4+ feet tall), the normal course of action is to conduct a shelterwood *removal* cut (or overstory removal). This is usually done in the winter to minimize understory damage and normally leaves a small number of overstory trees per acre ($\leq$ 10% crown closure) for future habitat benefits. The removal cut fully releases the understory trees, giving them full sunlight for rapid growth.

In some cases, depending on stand-level objectives, the decision may be made to modify or forego the removal cut. This may result in an eventual two-aged oak stand – or an even-aged young oak stand with a larger residual overstory remnant for habitat needs.

During the course of analysis, the Interdisciplinary Team (IDT) identified a potential concern that oak shelterwood treatments proposed in Alternative 4 could have a negative effect on woodland raptor habitat. This concern was based on the assumption that all of the shelterwood harvests proposed in Alternative 4 would include seed/removal cuts. However, given what we know about the slow process of oak regeneration, it is highly unlikely that removal cuts would be conducted in the majority of the proposed shelterwood areas. In fact, it is probably unlikely that greater than half of the areas will have sufficient established oak seedlings to conduct shelterwood seed cuts. In other words, it is likely that at least half of the shelterwood treatments would be limited to prep cuts.

Nonetheless, as an effort to limit the effects of the Lakewood Southeast Project on woodland raptor habitat, the IDT identified 109 acres of suitable raptor habitat in the vicinity of known nest sites (0 acres oak, 109 acres hardwood) and has agreed to limit shelterwood treatments in these stands to prepatory cuts. This would have no effect on the acreage of oak regeneration anticipated as a result of Alternative 4.

Other Considerations

Oak wilt is a fungal disease of oak that is present in and around the project area. The primary vector of oak wilt spread is root-to-root grafting. Oaks in the red oak group readily graft their roots with neighboring oaks. When an oak tree is infected by the oak wilt fungus, that tree will die. If there are any nearby oaks, their roots will likely be grafted to the affected tree and, thus, the infection will spread.

New infections begin when oak trees are wounded during the growing season. When oak trees are pruned, cut, or otherwise wounded, the wound site is attractive to a type of beetle for a 48-hour period. The beetle is also attracted to oak wilt fruiting bodies. Since the beetles congregate on oak wilt fungus, they transport spores wherever they go. Thus, if oak trees are wounded during the growing season, oak wilt beetles may transmit the disease to a previously healthy area and start a new infection center.

To prevent the spread of oak wilt, oak stands should not be harvested during the period of April 1 through September 1, the period when the beetles are active. The following design feature should be used in all oak stands proposed for harvest:

- To prevent the spread of oak wilt, limit harvesting or pruning in the red oak group to the period between September 1 and April 1.

This design feature should also be used in mixed stands in which 40% or more of the basal area is in oak species of the red oak group.

Communities of Concern

Northern Dry Forest

Among its stated needs for action, the Lakewood Southeast Project has identified the need to reestablish components and processes in the northern dry forest ecosystem. This is also discussed on page 16 of this report. Alternative 4 proposes many activities that would address this need for action:

- 3,754 acres of commercial thinning harvests in red and white pine stands
- 726 acres of prescribed underburning in red and white pine stands
- 417 acres of underplanting in red and white pine stands
- 158 acres of shelterwood harvests in red and white pine stands
- 199 acres of timber stand improvement in older (not newly-planted) red and white pine stands

The actions listed above would take place specifically in red and white pine types. Here is how these actions would move mostly plantation-origin pine stands toward desired northern dry forest conditions:

Commercial thinning, while also reducing stocking and improving stand vigor, would increase spacing between residual trees and increase their growth, resulting in bigger trees in a shorter timeframe. Small temporary openings would be created in the canopy which would provide improved growing conditions for mid-tolerant and tolerant understory seedlings and saplings. Thinning would also reduce the “corn row”-like appearance of the plantations and result in more naturally-appearing stands. Thinning prescriptions would also have the ability to encourage within-stand diversity and steer the stand toward more variable spacing.

Prescribed underburning would normally be used to reduce the amount of competing understory vegetation by shade-tolerant species such as red maple and hazel. Because of what we know about the fire history of the area, we believe that, historically, there was far less understory brush in the northern dry forests within the Lakewood Southeast area. Prescribing the use of understory fire would reduce these species and create better conditions for the establishment and development of species such as white pine and oak. Since these species respond well to fire, we would be using fire under controlled conditions to emulate historic processes.

Underplanting white pine and hemlock (primarily) in the understories of select stands would speed up the development of northern dry forest components, namely multiple species and age classes. Multi-cohort stands of mixed pine provide much more habitat value and biological diversity than homogenous single

species plantations. Planting would be done with varying species, densities, and patterns with an eye on trying to emulate natural northern dry forest ecosystems.

Shelterwood regeneration harvests, while mainly aimed at regenerating new, young pine stands, would be designed to emulate the effects of historic disturbances, such as wind storms, moderate intensity fires, and insect outbreaks. The design of the shelterwood harvests would vary, depending on local conditions, and could result in both evenly-spaced residual trees over a dense understory – or irregularly-spaced residual trees with dense understory clumps in some areas and more sparsely-stocked understories in other areas. As with the other treatments, the shelterwood harvests would be modified in each location to take advantage of unique opportunities. For example, in an area where overstory hemlocks are present, we would tailor the harvest treatment to encourage understory hemlock development.

Timber stand improvement is another tool that would be used to control the development and composition of northern dry forest ecosystems. In most cases, "TSI" would be used to "weed out" competing vegetation around desired understory trees. For example, TSI would often target less desirable and more shade-tolerant red maple so that white pine seedlings are not overtopped and are free to grow up in the understory. Like the other treatments, TSI would be tailored to take advantage of the unique conditions that are present at each site.

Among the alternatives considered in detail, Alternative 4 would rank third in responding to the need to reestablish components and processes in the northern dry forest ecosystem. Using a combination of all these tools, Alternative 4 would move thousands of acres of red, white, and mixed pine forests toward the historic conditions that typified northern dry forests. The Lakewood Southeast Purpose of and Need for Action does not specify an acreage figure of Northern Dry Forest to be treated, but, rather, simply states that the need exists. Alternative 4 proposes a combined total of 5,254 acres of treatments within red and white pine types that are designed to restore Northern Dry Forest components and processes. This is the third highest amount of treatments among the alternatives considered in detail.

Pine Barrens

Alternative 4 responds to the need to restore Pine Barrens / Savanna plant communities by proposing 267 acres of special cuts and 469 acres of prescribed burning in the Airport Road Area. This is considerably less than what is proposed for the area in Alternatives 2 and 3.

The reason for this is that, in Alternative 4, harvests in hardwood and oak stands were limited to those stands that are less than 80 years of age. Further, harvests are not proposed in any stands that fall within a half mile of a current or historic goshawk/red-shouldered hawk territory. Finally, other features, such as aspen stands greater than 60 years being left to convert to other types, further limit the amount of area that would be managed for Pine Barrens restoration.

While being considerably limited compared to Alternatives 2 and 3, Alternative 4 would, nonetheless, succeed in restoring some Pine Barrens / Savanna plant communities in the Airport Road Area. Generally speaking, about 300 acres of the area south of West Butler Rock Road would be restored to barrens / savanna under this alternative. However, one drawback of Alternative 4 is that nearly 200 acres of forested stands would interrupt the barrens / savanna habitat, about half of which is mature forest. This presents two problems. First, since they break up and reduce the size of open areas, the large forested areas run counter to the objectives of barrens management. Second, although they would also be burned, trying to treat the remaining stands with prescribed fire would be very problematic, due to the fuel loading and the difficulty of establishing fire lines.

Of the alternatives considered in detail, Alternative 4 would be the third best in responding to the Lakewood Southeast Project's stated need to restore Pine Barrens ecosystems. It would do this by restoring Pine Barrens and Savanna plant communities on about 300 acres within the project area.

Cumulative Effects of Alternatives 2, 3, and 4

Methods

Composition

The geographical area of consideration for cumulative impacts on vegetative composition includes those portions of the Chequamegon-Nicolet National Forest that are designated Management Area 4A and 4B. This is because forest plan management area composition objectives are on a forestwide basis. Since Management Area designations and objectives only apply to CNNF lands, the cumulative effects analysis is therefore bound only to CNNF lands.

Management Area 2C has not been included in this analysis since that portion of MA 2C that is located within the Lakewood Southeast Project represents such a tiny fraction of the overall management area. Within the Lakewood Southeast Project Area, there are only 340 of the total 216,250 upland acres in MA 2C on the forest. This represents 0.16%of the upland acreage in MA 2C. The largest change to MA 2C composition resulting from the Lakewood Southeast Project (Alternative 2 – aspen) is about 70 acres – or a 0.03% modification of the forestwide total. Given such a tiny incremental direct effect at the forest level, I concluded that a detailed cumulative impact analysis of the compositional changes to MA 2C would provide no meaningful information.

This cumulative effects analysis is also limited to only those forest types in which the Lakewood Southeast Project would result in direct and indirect effects. For the purposes of this analysis, the long-term direct and indirect effects of the Lakewood Southeast Alternatives were combined with other projects' effects. I opted to use the long-term effects in order identify the greatest potential cumulative effects that might be expected.

Past, present, and reasonably foreseeable actions that are considered in this analysis include: 1) past actions that have resulted in compositional changes (of the listed types) within MA 4A and MA 4B (these are already reflected in the existing condition); 2) all currently planned actions that would result in similar composition modifications; 3) future actions in which measurable changes to the aforementioned types are anticipated.

In conducting this analysis, a spreadsheet (named "LKSE_PPRF_Actions.xlsx") was created that includes all projects on the forest with the potential to have additive effects. A preliminary review of 384 projects eliminated most of these projects from detailed analysis because they had no similar effects or because their effects would not overlap with the effects of the Lakewood Southeast Project in time and space. This left a list of 8 projects, in addition to Lakewood Southeast, that have the potential to cumulatively affect forest composition within MA 4A/4B on the Chequamegon-Nicolet National Forest. The combined effects of these projects were summarized in the above spreadsheet and will be discussed below.

Structure

The geographical area of consideration for cumulative impacts on vegetative structure (age class distribution) is the area covered by National Forest lands that are in the upland portion of the Lakewood Southeast Project Area. Forest-level guidance recommends analysis of age class distribution at the project area level. This provides a consistent and discrete method of analysis that is useful for comparison. This area is further limited to the area occupied by those cover types in which the age class distribution would be directly or indirectly affected (no direct/indirect effect means no cumulative effect).

Past actions considered in this analysis include all actions which have already taken place. Some of these actions have resulted in changes to age class distribution. The existing condition reflects those changes.

There is one ongoing present action in the analysis area that would have effects on age class distribution. This is the Flower Lake Stewardship Project, located in the northern third of the Lakewood Southeast Project Area.

Reasonably foreseeable future actions considered in this analysis include any actions that would result in changes to age class structure in the project area. At this time, the only foreseeable future projects within the project area are pine thinning timber sales from the Plantation 2 Thinning Project (2008). Thinning red pine would have no effects on age class distribution since this would be an intermediate treatment.

Findings

Composition

Management Area 4A

There are a number of other projects on the forest that are taking place in Management Area 4A. I discussed them with my counterparts on the other districts and obtained information on how each of the projects would affect MA 4A upland composition. In total, these projects are projected to result in measureable changes to composition – most notably, losses to aspen, paper birch, and jack pine and gains to red pine/white pine and northern hardwoods. **Table 79**, below, displays the cumulative changes in the vegetative composition of Management Area 4A that would be expected as a result of each of the Lakewood Southeast alternatives and other past, present, and reasonably foreseeable projects.

Table 79: Summary of Cumulative Effects to Composition of MA 4A Forest Types

Upland Type	Forestwide Existing Condition (acres)	Existing	Desired	Alt 2 Change (acres)	Alt 2 (%)	Alt 3 Change (acres)	Alt 3 (%)	Alt 4 Change (acres)	Alt 3 (%)
Aspen	32,870	28.6%	10-30%	-1,599	27.2%	-1,297	27.4%	-2,084	26.8%
Balsam Fir	1,547	1.3%	0-3%	-310	1.1%	-340	1.0%	-310	1.1%
Paper Birch	2,425	2.1%	0-5%	-528	1.6%	-528	1.6%	-528	1.6%
Jack Pine	13,413	11.7%	0-35%	-530	11.2%	-453	11.3%	-530	11.2%
Red Pine/ White Pine	41,755	36.3%	10-50%	+2,127	38.1%	1,861	37.9%	2,037	38.1%
Northern Hardwoods	9,188	8.0%	0-25%	+685	8.6%	535	8.4%	1,336	9.1%
Oak	9,349	8.1%	0-25%	+248	8.3%	173	8.3%	151	8.3%
Permanent Openings	3,094	2.7%	1-6%	-71	2.6%	51	2.7%	-71	2.6%
Other Types	1,443	1.3%	0-5%	-23	1.2%	-3	1.3%	-3	1.3%
Summary Uplands	115,083	**100.0%**		0	**100.0%**	0	**100.0%**	0	**100.0%**

Management Area 4B

There is only one other past, present, or reasonably foreseeable project occurring in MA 4B on the forest which would result in vegetative compositional changes. And, as it happens, the Flower Lake Stewardship Project is located within the bounds of the Lakewood Southeast Project Area. The project is ongoing and includes mainly intermediate harvests and fuel reduction treatments. A conversion of only 23 acres will result from that project. Thus, the cumulative effects to vegetative composition in MA 4B will be very limited. **Table 80** summarizes those changes. It is limited only to the red pine/white pine and jack pine types since there would be no cumulative effects in other types.

Table 80: Summary of Cumulative Effects to Composition of MA 4B Forest Types									
Upland Type	**Forestwide Existing Condition (acres)**	**Existing**	**Desired**	**Alt 2 Change (acres)**	**Alt 2 (%)**	**Alt 3 Change (acres)**	**Alt 3 (%)**	**Alt 4 Change (acres)**	**Alt 3 (%)**
Jack Pine	2,212	8.4%	3-6%	-196	7.6%	-189	7.6%	-196	7.6%
Red Pine/ White Pine	7,508	28.3%	45-70%	+54	28.6%	+153	28.9%	+281	29.4%
All Uplands	26,488								

Structure

The only past, present, or reasonably foreseeable project that would result in incremental effects on age class distribution would be the Flower Lake Stewardship Project. This project includes 23 acres of jack pine removal that would release mixed red pine-oak. Thus, there would be some incremental changes to the jack pine and red pine age class distributions. **Tables 81** and **82** give a concise summary of the cumulative effects that would be expected for jack pine and jack pine age class distribution.

The cumulative effects to jack pine age class distribution would be almost identical to the direct and indirect effects.

The cumulative effects to red pine age class distribution would be identical to direct and indirect effects since the percentages would not change.

Table 81: Alternative 3 Effects on Jack Pine Age Class Distribution					
Age Class	**Existing**	**Desired**	**Alt 2 % Long-term**	**Alt 3 % Long-term**	**Alt 4 % Long-term**
0-10	6%	16%	0%	0%	0%
11-30	59%	32%	19%	16%	12%
31-50	13%	32%	81%	84%	74%
51+	22%	20%	0%	0%	14%

Table 82: Cumulative Effects on Red Pine Age Class Distribution					
Age Class	**Existing**	**Desired**	**Alt 2 % Long-term**	**Alt 3 % Long-term**	**Alt 4 % Long-term**
0-20	4%	15%	8%	8%	5%
21-60	43%	30%	36%	36%	37%
61-100	52%	30%	50%	50%	52%
101+	1%	25%	6%	6%	6%

CONCLUSIONS

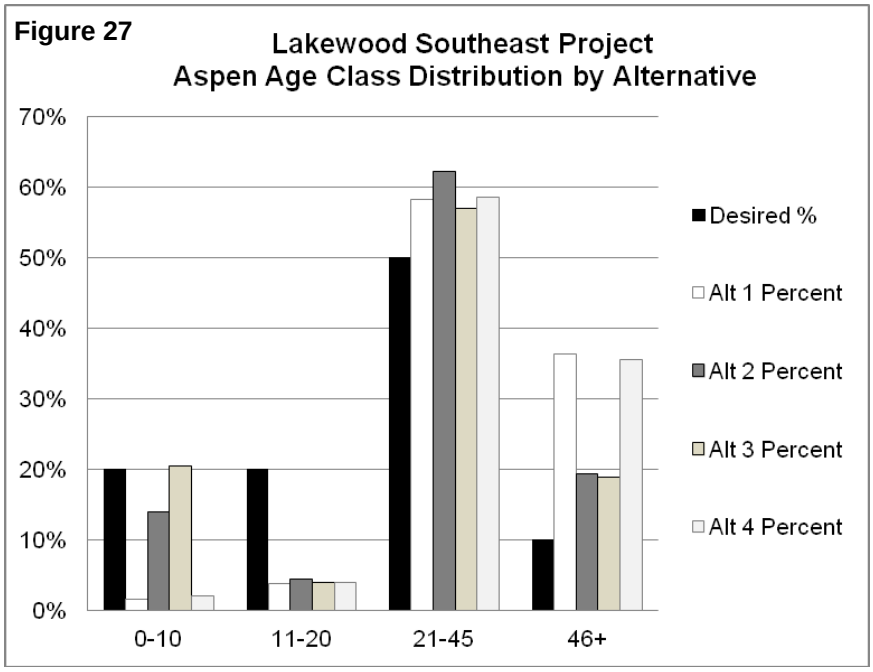
The following is a summary of how the alternatives respond to the Purpose of and Need for Action and key issues of the Lakewood Southeast Project. For more detailed discussion, see the Findings section (pp. 29-77).

Species Age Class Distribution

Aspen Age Class Distribution

Table 83: Lakewood Southeast Project Effects on Aspen Age Class Distribution						
Age Class	**Existing**	**Desired**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
0-10	2%	20%	2%	14%	20%	2%
11-20	12%	20%	4%	4%	4%	4%
21-45	52%	50%	58%	62%	57%	58%
46+	35%	10%	36%	19%	19%	35%
Average deviation from DFC:			17.0%	10.8%	8.0%	16.8%

Figure 27



See **Table 83** and **Figure 27.** Alternative 3 would be the most effective alternative for moving the aspen age classes toward desired conditions. Alternative 2 would be the second most effective, followed by Alternative 4 and Alternative 1.

Oak Age Class Distribution

Table 84: Lakewood Southeast Project Effects on Oak Age Class Distribution						
Age Class	**Existing**	**Desired**	**Alt 1 Long-term**	**Alt 2 Long-term**	**Alt 3 Long-term**	**Alt 4 Long-term**
0-19	3%	19%	16%	59%	56%	9%
20-59	5%	38%	4%	5%	5%	5%
60-79	20%	19%	2%	9%	8%	8%
80+	72%	24%	77%	27%	31%	78%
Average deviation from DFC:			53.0%	21.5%	22.0%	27.0%

See **Table 84**. Alternative 2 would be the most effective alternative for moving the oak age classes toward desired conditions. Alternative 3 would be almost as effective, followed by Alternative 4 and Alternative 1.

Red Pine Class Distribution

Table 84: Lakewood Southeast Project Effects on Red Pine Age Class Distribution						
Age Class	**Existing**	**Desired**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
0-20	4%	15%	1%	7%	7%	4%
21-60	43%	30%	44%	42%	42%	43%
61-100	52%	30%	54%	50%	50%	51%
101+	1%	25%	2%	2%	2%	2%
Average deviation from DFC:			18.8%	15.8%	15.8%	17.0%

See **Table 84**. Alternatives 2 and 3 would be equally most effective alternative for moving the red pine age classes toward desired conditions. Alternative 4 would be the next most effective, followed by Alternative 1.

White Pine Class Distribution

Table 85: Lakewood Southeast Project Effects on White Pine Age Class Distribution						
Age Class	**Existing**	**Desired**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**
0-20	6%	12%	0%	34%	11%	16%
21-60	9%	24%	8%	6%	8%	7%
61-120	82%	36%	75%	47%	65%	63%
121+	3%	28%	16%	12%	15%	14%
Average deviation from DFC:			19.8%	16.8%	14.8%	15.5%

See **Table 85**. Alternative 3 would be the most effective alternative for moving the white pine age classes toward desired conditions. In my opinion, Alternative 2 would be the second most effective alternative for modifying white pine age class distribution. I say this because, while it results in a higher deviation from the DFC than Alternative 4, I believe the age class structure would be modified to better regulate the 0-20 and 21-60 year age classes in the long run. Alternative 1 would be the least effective alternative as it would not respond to the need to modify white pine age class distribution.

Species Composition

Aspen Composition

Table 86: Lakewood Southeast Project Effects on Aspen Composition

MA	Existing Acres	Existing %	Desired %	Alt 1 % (short-term)	Alt 1 % (long-term)	Alt 2 % (short-term)	Alt 2 % (long-term)	Alt 3 % (short-term)	Alt 3 % (long-term)	Alt 4 % (short-term)	Alt 4 % (long-term)
2C	196	57.5%	15-30%	57.5%	41.7%	52.0%	37.1%	57.5%	41.7%	57.5%	41.7%
4A	3,628	27.2%	10-30%	27.2%	21.5%	25.0%	22.9%	26.7%	25.2%	26.5%	19.3%
4B	2,423	27.0%	0-7%	27.0%	22.8%	20.2%	16.7%	26.9%	24.3%	26.6%	20.6%
Areawide *	6,987	25.7%	n/a	25.7%	20.5%	22.3%	19.1%	25.4%	22.8%	25.2%	18.7%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

In terms of moving aspen composition toward desired conditions, Alternative 2 would be the most effective in both the short and long term. Alternative 4 would be the second most effective alternative in both the short and long term. Alternative 1 would be the third most effective overall. Alternative 3, which attempts to maintain as much aspen as possible, is the least effective in reducing aspen in MA 4B.

In terms of responding to the concern about the loss of aspen, Alternative 3 would be the most effective. However, it should be noted that, even with this alternative, there would still be a reduction of aspen in both the short and long term. Alternative 1 would be the second best choice in responding to the concern of aspen loss. Alternative 4 would be the third best choice in responding to this concern and Alternative 2 would be the least responsive alternative in terms of aspen maintenance.

In doing this analysis, I identified two clear tradeoffs related to aspen management. First, Forest Plan composition objectives for MA 4A and 4B are clearly at odds with the concern voiced by many about the loss of aspen on the landscape. In order to move towards the desired compositions objectives, aspen would clearly be reduced. On the other hand, if aspen maintenance is a direction we wish to go, we would be going counter to the Forest Plan's desired composition objectives.

Second, Forest Plan Standards and Guidelines make it effectively impossible to maintain the current level of aspen on the landscape (in response to the aspen issue). In order to comply with Forest Plan standards and guidelines related to beaver management (p. 2-17), scenery management (p. 2-29), and Special Area management (pp. 3-51, 54, and 58), the harvests needed to maintain aspen composition are not allowed. Conversely, in order to maintain the current aspen composition, harvests would have to take place within said areas. Therefore, in the Lakewood Southeast Area there is a clear tradeoff between aspen management and Forest Plan Standards and Guidelines

Jack Pine Composition

Table 87: Lakewood Southeast Project Effects on Jack Pine Composition											
MA	**Existing Acres**	**Existing %**	**Desired %**	**Alt 1 % (short-term)**	**Alt 1 % (long-term)**	**Alt 2 % (short-term)**	**Alt 2 % (long-term)**	**Alt 3 % (short-term)**	**Alt 3 % (long-term)**	**Alt 4 % (short-term)**	**Alt 4 % (long-term)**
2C	0	0%	0-2%	0%	0%	0%	0%	0%	0%	0%	0%
4A	1,174	8.8%	0-35%	8.8%	7.3%	6.0%	6.0%	6.5%	6.5%	6.2%	6.0%
4B	716	8.0%	3-6%	8.0%	6.1%	6.4%	6.1%	6.4%	6.1%	6.8%	6.1%
Areawide *	1,928	7.1%	n/a	7.1%	5.6%	5.2%	5.0%	5.5%	5.3%	5.4%	5.0%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

See **Table 87**. In the short term, Alternatives 2 and 3 would respond equally well, reducing the amount of jack pine in MA 4B better than the other alternatives. Alternative 4 would be second best in the short term, followed by Alternative 1.

In the long term, all of the alternatives would respond equally well with a MA 4B jack pine composition of 6.1%. This is just one-tenth of a percent higher than the upper end of the desired range.

Red/White Pine Composition

Table 88: Lakewood Southeast Project Effects on Red/White Pine Composition											
MA	**Existing Acres**	**Existing %**	**Desired %**	**Alt 1 % (short-term)**	**Alt 1 % (long-term)**	**Alt 2 % (short-term)**	**Alt 2 % (long-term)**	**Alt 3 % (short-term)**	**Alt 3 % (long-term)**	**Alt 4 % (short-term)**	**Alt 4 % (long-term)**
2C	33	9.8%	10-30%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%	9.8%
4A	4,739	35.5%	10-50%	35.5%	35.5%	36.7%	37.7%	35.2%	35.7%	36.2%	37.0%
4B	3,085	34.4%	45-70%	34.4%	34.8%	37.7%	40.7%	35.9%	35.9%	35.5%	37.3%
Areawide *	8,949	32.9%	n/a	32.9%	32.9%	34.6%	36.1%	33.3%	33.6%	33.6%	34.7%

*All MA's, including MA 8E, 8F, and 8G, which are off limits to timber management.

Alternative 2 goes the farthest in responding to the need of increasing red/white pine composition in the project area. In the short term, this alternative would increase the red and white pine component by 3.3%; in the long term, red and white pine would be increased 6.3%.

Alternative 3 would be the second best in responding to this need in the short term. However, in the long term, Alternative 4 would be the second most effective option for increasing the red and white pine component.

The Need for Stocking Control

***Table 89**: Lakewood Southeast Project – Alternative Responses to Need for Stocking Control*

Need	Current Condition	Desired Condition	Alt 1	Alt 2	Alt 3	Alt 4
Move Hardwood Stands to Uneven-aged Conditions	194 acres overstocked and even-aged hardwood	194 acres of uneven-aged hardwood	**No progress** toward Desired Condition	**Fully meets**. 100% (194 acres) moved toward Desired Condition	**Fully meets**. 100% (194 acres) moved toward Desired Condition	**Partially meets**. 33% (64 acres) moved toward Desired Condition
Reduced stocking levels in even-aged hardwood stands	179 acres overstocked even-aged hardwood stands	179 acres of even-aged hardwood stands with desired stocking levels	**No progress** toward Desired Condition	**Fully meets**. 100% (179 acres) moved toward Desired Condition	**Fully meets**. 100% (179 acres) moved toward Desired Condition	**Partially meets**. 66% (118 acres) moved toward Desired Condition
Reduced stocking levels in red pine stands	Approximately 3,632 acres of overstocked red pine stands	3,632 acres of red pine stands with desired stocking levels	**No progress** toward Desired Condition	**Fully meets**. 100% (3712 acres) moved toward Desired Condition**	**Partially meets**. 98% (3550 acres) moved toward Desired Condition	**Partially meets**. 96% (3474 acres) moved toward Desired Condition
Reduced stocking levels in white pine stands	Approximately 314 acres of overstocked white pine stands	314 acres of white pine stands with desired stocking levels	**No progress** toward Desired Condition	**Fully meets**. 100% (314 acres) moved toward Desired Condition	**Fully meets**. 100% (372 acres) moved toward Desired Condition**	**Partially meets**. 89% (280 acres) moved toward Desired Condition

**For explanation, see detailed discussion in findings section

Overall, Alternative 2 best responds for the needs related to density management, fully meeting the stated needs. Alternative 3 responds nearly as well, treating only slightly fewer pine stands. Alternative 4 partially meets the needs for action, but ranks third overall. Alternative 1 does not respond to the needs for action.

Communities of Concern

***Table 90**: Lakewood Southeast Project – Alternative Responses to Need Restore Communities of Concern*

Need	Current Condition	Desired Condition	Alt 1	Alt 2	Alt 3	Alt 4
Reestablish components and processes in **Northern Dry Forest** ecosystem	red / white pine stands with limited species, structural diversity	Increased species and structural diversity in area's red / white pine stands	**No progress** toward Desired Condition	Best in meeting need for action – 6,185 total acres of beneficial treatments	Second best in meeting need for action – 5,736 total acres of beneficial treatments.	Third best in meeting need for action – 5,254 total acres of beneficial treatments.
Pine Barrens / Savanna ecosystem restoration	Closed forest conditions in formerly open barrens / savanna areas	Open, grassy conditions with open and variably stocked forests	**No progress** toward Desired Condition	**Ranks second highest** by moving about 800 acres toward barrens / savanna conditions	**Ranks highest** by moving about 1,000 acres toward barrens / savanna conditions	**Ranks third highest** by moving about 300 acres toward barrens / savanna conditions

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