

SUSTAINABLE HARVEST CALCULATIONS

PROCESS USED TO DEFINE SUSTAINABLE HARVEST LEVELS

Sustainable harvest calculations are determined by considering several long-term desired conditions (i.e. age class imbalance, species conversion, species retention, extended rotation or old growth forests, etc.) rather than looking at short-term budgetary needs. The Becker County Natural Resources Management Office is committed to incorporating into its forest management planning, the goals, objectives, and strategies of the Minnesota Forest Resources Council Landscape Program as outlined in the *Recommended Desired Outcomes, Goals and Strategies: North Central Landscape Region* of March 25, 2003. The desired future conditions and the objectives, goals, and strategies defined by the North-Central Landscape Committee, when carried out, will ensure the forests of Becker County, and the north-central landscape region, will remain viable and improve in terms of diversity and balance.

Sustainable harvest levels are determined individually for each forest covertype. NRM staff look at the total number of acres of each covertype, the age class distribution, overall landscape goals and objectives for the covertype, the health and productivity of the covertype, and any significant conditions that may affect the overall management of the covertype. This information is contained in the Land Department's *Forest Inventory Database* and as observed knowledge from the field staff.

The information contained in the *Forest Inventory Database* was collected as part of a phase II field inventory in the early 1980's. Much of the data was updated in 1993 when a private consulting firm was hired to digitize the forest covertypes based on new aerial color-infrared photography. Many errors in the original 1982 inventory were corrected using the improved medium, however, individual stand data was generated within an office setting rather than gathered using on site visits. Much of the data, especially in oak and northern hardwood stands should be field checked.

The procedures used to determine sustainable harvest levels for Becker County are appropriate for a department of this size. The Land Department has two field staff and a Land Commissioner.

OBJECTIVES

The Becker County Natural Resources Management Office is committed to providing residents and visitors of the county a healthy, productive, and diverse forest. A diverse forest is better able to adapt to societal pressures.

The general consensus in Minnesota seems to be a desire to reestablish the great pineries of the past. While this may be an overly ambitious goal, the Land Department will consciously strive to increase the acreage of mixed pine forests and increase the amount of conifers in the landscape as a component of hardwood stands.

Oak and northern hardwood forests make up a large portion of Becker County's landscape. Although the quality of these stands is less than ideal for high-value timber products, the quality

may be due more to neglect and mismanagement rather than environmental issues. The overall goals for these species is to evaluate and manage stands with high quality potential for sawlog and veneer production and to establish a listing of Candidate Old Growth stands. Stands with lower site quality will be considered for conversion to pine or a mixed pine/hardwood composition. The Land Department will also work to prevent stands of oak and white birch from converting to other species unless the new species is more suited to the site.

Aspen is by far the most predominant forest covertype in Becker County. Our objective is to reduce the overall acreage of aspen by converting poor quality aspen stands to pine or other more suitable species and to assist stands that are naturally converting to northern hardwoods. A second goal is to correct an age class imbalance and to shorten the overall age class distribution. This will be accomplished through an increased harvest formula designed to greatly reduce the over-mature aspen and shorten the age class structure.

ASSUMPTIONS

There are many assumptions used in determining the numerous harvest levels. Some assumptions are species specific, while some are overall assumptions. Overall assumptions are listed here, while species specific assumptions are listed in the species section.

- One formula will not work for all species. Because each species encompasses its own individual set of circumstances, different formulas have been developed for each species.
- It is assumed that the information contained in the *Forest Inventory Database* is correct and accurate. Although we know that there is a likelihood of information error in the inventory, until updated information is collected we assume the information to be correct.
- Sustainable harvest calculations are developed assuming that there is a suitable market for all forest products derived from Becker County forests.
- Harvest formulas are made under the assumption that insect and disease outbreaks are controlled at the first sign of an outbreak, or that the outbreaks will not drastically change stand dynamics. Any insect and disease outbreak will be evaluated quickly with any necessary changes to harvest formulas addressed at the County Board level.

Ash & Lowland Hardwoods:

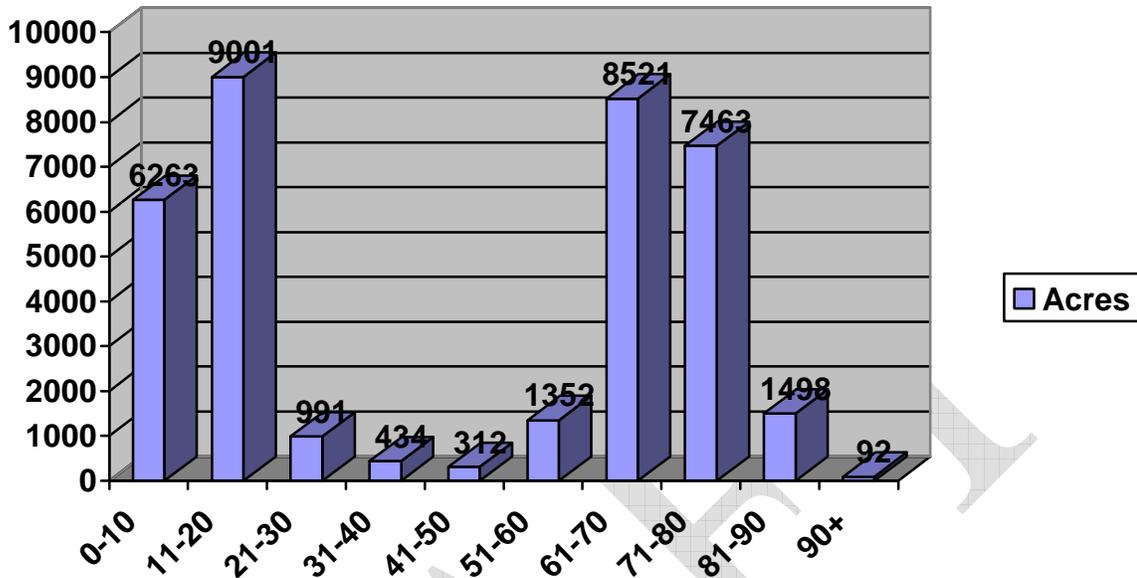
Current Acres: Ash – 558, Lowland Hardwoods – 891

Objectives: The objectives for Ash and Lowland Hardwoods is to identify areas that are 1) the most productive for ash and lowland hardwoods and manage accordingly; and 2) conducive to sawlog production and extended rotation management. Because these stands tend to be small (< 10 acres) and associated with Riparian zones, they should be evaluated as part of adjacent stand management, keeping in mind the overall goals.

Aspen:

Current Acres: 35,927

Current Aspen Age Class Structure



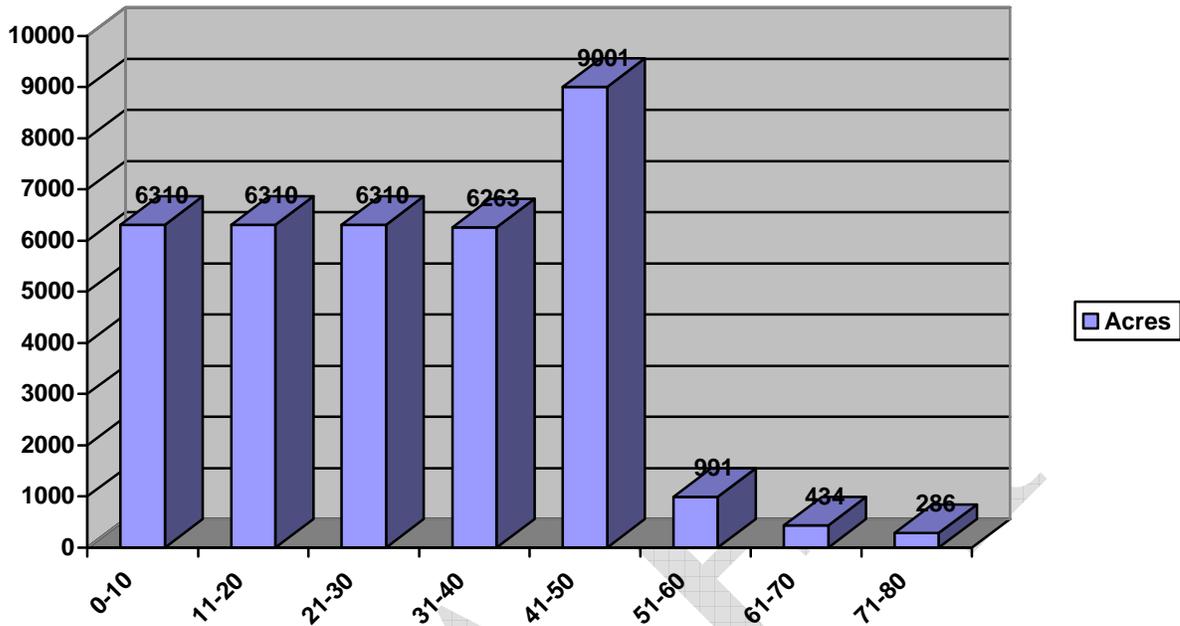
Objectives: The objectives for aspen are to 1) correct the age class imbalance; 2) shorten the age class structure; 3) identify aspen sites for conversion to better suited species; and 4) introduce various conifer species into the understory of differing growth stage stands. Currently, nearly 53 percent (18,926 acres) of our total aspen acreage is considered mature or over-mature (age 50+). Aspen, being an early successional species, matures quickly and begins to decline in health and productivity shortly after it reaches biological maturity (age 40). The Land Department proposes to accomplish its goals by initiating a slightly accelerated harvest formula for the next thirty years.

Harvest Formula: 18,926 acres / 30 years = **631 acres/year**.

Assumptions:

- This harvest calculation assumes no appreciable change in aspen acreage. There may be some conversions from poor aspen sites to other species, however, this may also be offset by like conversions from other species (i.e. birch or northern hardwoods) to aspen.
- This harvest calculation also assumes that all aspen acreage is harvestable. There may be occasions where, because of economics or environmental issues, certain stands of aspen may be considered inaccessible (islands, small isolated areas, land locked, etc.). As these areas are identified they will be noted on the *forest inventory database* and removed from the available harvest pool.
- This harvest calculation assumes that there are no catastrophic events (wind, fire, disease) that greatly affect the resource.

The following graph shows the age class structure for aspen following thirty years of the accelerated harvest formula.



Birch:

Current Acres: 1,074

Objectives: The objectives for Birch are to 1) maintain current acreage levels; 2) correct an age class imbalance similar to that of aspen; 3) re-establish pure, or nearly pure, stands of white birch and to discourage conversion to other species. The difficulty is going to be to regenerate birch without large scale conversion to aspen or other species. Birch tends to develop as a mixed stands, typically with aspen. A regeneration harvest on birch may result in the stand converting to aspen. Birch will likely remain a component of the stand, but will likely be heavily overshadowed by the aspen regeneration. The common, and most effective, method of regenerating birch is through stump sprouts. However, as birch reaches maturity, the number of stump sprouts dramatically decline, reducing the effectiveness of stump sprouts as a regeneration method in older stands. Stumps sprouts are also heavily browsed by deer. Older stands will need to be carefully evaluated and silvicultural treatments prescribed to ensure adequate regeneration. Currently only 7.2% of birch stands are considered less than mature while nearly 93% (997 acres) is 60+ years old, or considered mature. The Land Department will focus management goals on age class imbalance and regeneration of the types.

Harvest Formula: 997 acres / 40 years = **25 acres/year**

Assumptions:

- The goal to maintain current acreage levels assumes that there will be negligible conversion to other species. This may be difficult in older stands of mixed composition. Efforts will be made to reestablish birch in all stands where birch was the main tenant and where birch is a suitable species.

Northern Hardwoods:

Current Acres: 8,593

Objectives: The objectives for northern hardwoods are to 1) manage accessible stands of sugar maple for maple syrup production; 2) promote the conversion of low quality predominantly maple stands to mixed northern hardwood/conifer species; 3) manage northern hardwood stands using uneven-age silvicultural systems; and 4) evaluate the highest site index stands for Candidate Old Growth status. Tapping maple for the production of maple syrup is a common practice every spring. Maintaining viable sites for tapping is essential for social and economic values. Sugar maple is rarely of sufficient quality for high-end timber production, although pulpwood production is becoming more frequent. Low quality sugar maple stands will be considered for conversion to other more productive northern hardwood/conifer stands. Although most local northern hardwood stands were established as even-aged stands, they are beginning to develop some stand age structure. Selective harvesting will continue to promote a move towards uneven-aged management. The sustainable harvest calculation is determined by evaluating all northern hardwood stands over 50 years of age in the next 30 years. These stands will be evaluated for possible classification as Candidate Old Growth stands, movement towards uneven aged management, the underplanting of conifer species, and/or conversion to other, higher quality hardwood species.

Harvest Formula: 7,879 acres / 30 years = 263 acres/year

Assumptions:

- In 1993, Pro-West & Associates, a GIS-based company, updated the original 1982 Phase II forest inventory through color-infrared aerial photography. Many stands that were classified as “aspen” in the 1982 inventory were reclassified as northern hardwoods or oak. There was no actual field visit to these stands to verify stand attributes. Pro-West staff visited a small number of sites to obtain estimates of stand attributes and applied them to stands showing similar characteristics on the aerial photos. Because of the way the forest inventory was developed, the information tends to be rather generic in nature. Information from northern hardwood and oak stands from the 1982 inventory was brought up to date and compared with photo-interpreted stands for comparison. The information for photo-interpreted stands may contain an unusually high number of errors due to the fact that there was no on site visit to these stands.
- The actual acres of stands to be evaluated per year will “float” due to the acreage moving into the 50-year old age class.
- Not all stands evaluated will require immediate management attention. Some stands may not require any silvicultural treatment at the time of evaluation. The inventory information for those stands will be updated and any future treatment schedule will be noted in the inventory.

- This formula assumes that there will be suitable markets for all products, including hardwood pulp. Recent northern hardwood sales that contain adequate amount of aspen have been successfully sold and harvested. Basswood pulp has posed the largest utilization problem. As the price of aspen continues to climb, alternative species, such as basswood pulp, have seen an increase in the pulp market.

Oak

Current Acres: 5,164

Objectives: The objectives for oak are to 1) maintain current acreage on moderate to high site index oak; 2) promote a hardwood/conifer composition on suitable sites; 3) discourage conversion of high site index oak sites to northern hardwoods; 4) evaluate and convert low site index oak stands to pine; and 5) evaluate the highest site index oak stands for Candidate Old Growth status. The sustainable harvest calculation is determined by evaluating all oak stands over 50 years of age in the next 30 years. These stands will be evaluated for possible classification as Candidate Old Growth stands, the underplanting of conifer species, advanced regeneration and silvicultural techniques to establish or improve advanced regeneration, and the conversion of low site quality stands to pine.

Harvest Formula: 5,045 acres / 30 years = 168 acres/year

Assumptions

- In 1993, Pro-West & Associates, a GIS-based company, updated the original 1982 Phase II forest inventory through color-infrared aerial photography. Many stands that were classified as “aspen” in the 1982 inventory were reclassified as northern hardwoods or oak. There was no actual field visit to these stands to verify stand attributes. Pro-West staff visited a small number of sites to obtain estimates of stand attributes and applied them to stands showing similar characteristics on the aerial photos. Because of the way the forest inventory was developed, the information tends to be rather generic in nature. Information from northern hardwood and oak stands from the 1982 inventory was brought up to date and compared with photo-interpreted stands for comparison. The information for photo-interpreted stands may contain an unusually high number of errors due to the fact that there was no on site visit to these stands.
- The actual acres of stands to be evaluated per year will “float” due to the acreage moving into the 50-year old age class.
- Not all stands evaluated will require immediate management attention. Some stands may not require any silvicultural treatment at the time of evaluation. The inventory information for those stands will be updated and any future treatment schedule will be noted in the inventory.

Red and White Pine

Current Acres: White Pine – 40, Red Pine – 2,413

Objectives: The objectives for white and red pine are 1) double the amount of white pine acres within the next ten years by identifying errors in the forest inventory and reclassifying stands and by identifying areas where white pine is predominant in the understory and conducting release harvests to lessen competition on the white pine; 2) Increase red pine acreage by 10% in 10 years by conversion of low quality aspen, hardwood, and oak stands; 3) identify areas where pine can be added to the forest composition through underplantings; 4) manage visually sensitive pine areas for aesthetics as well as forest products; and 5) continue to evaluate the highest quality stands for Candidate Old Growth.

All stands entering the 30-year age class will be evaluated for a first thin. Stands requiring treatment will be thinned based on recommendations found in the *Manager's Handbook for Red Pine in the North Central States*.

Commercial thinning treatments on more mature stands will be conducted as needed to maintain a healthy, productive stand.

Final harvests will only be conducted on stands that fail to meet minimum stocking recommendations in the *Manager's Handbook for Red Pine in the North Central States*, where insect or disease issues require such actions, or when the site quality suggests a conversion to another species, such as jack pine, is warranted.

2% of the total available red and white pine acreage will be evaluated annually for treatment.

Harvest Formula: $2,413 * 2\% = 48 \text{ acres annually}$

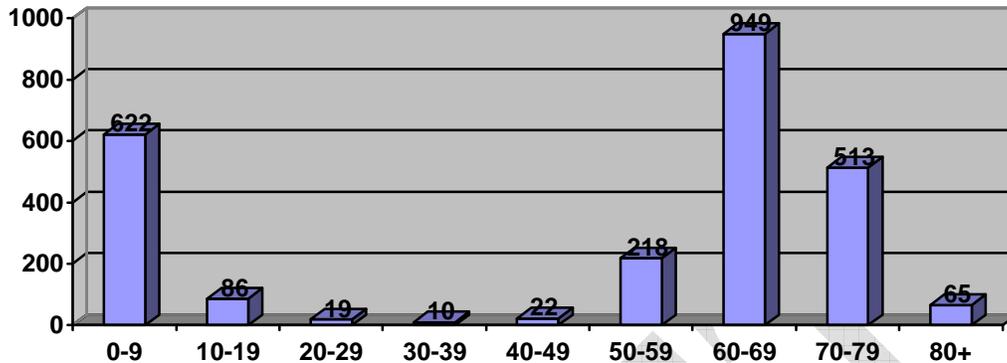
Assumptions:

- Not all stands evaluated will require immediate management attention. Some stands may not require any silvicultural treatment at the time of evaluation. The inventory information for those stands will be updated and any future treatment schedule will be noted in the inventory.
- Stand evaluation will also include evaluation for inclusion as a Candidate Old Growth stand. Stands classified as Candidate Old Growth Stands or as County Preserve Areas will be removed from the Sustainable Harvest Calculation.

Jack Pine

Current Acres: 2,504

Current Jack Pine Age Class Distribution



Objectives: The objectives for jack pine are 1) to increase overall jack pine covertime acres by 10% by the year 2036 through conversion of poor performing species such as aspen and oak (2,504 to 2,754); 2) reduce the mature and over-mature jack pine acreage and lay the ground work for a more balanced age class distribution in the future, and; 3) consider conversion of higher quality sites to red/white pine covertime by planting mixed species of jack, red, and white pine and removing the jack pine during early thinning operations.

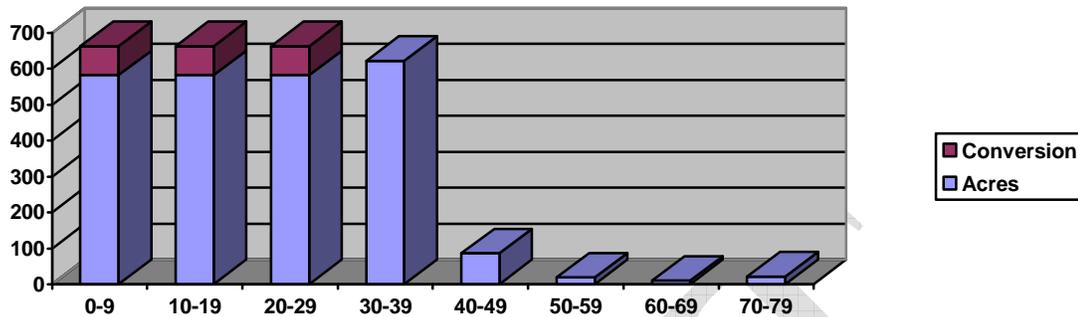
To achieve the primary goal of increasing total jack pine covertime acres by 10% by the year 2036, Natural Resources Management staff will evaluate various stands of aspen and oak for conversion to jack pine. Sites chosen for conversion will be harvested, chemically and/or mechanically treated to control woody and other vegetation, and then planted to jack pine.

Currently, 1,745 acres of jack pine covertime are 50 years of age or older. These acres are unevenly distributed across a forty year age class span. To achieve the second goal of reducing the mature and over-mature jack pine acreage, NRM staff will evaluate and schedule harvests of these acres over the next thirty years. Scheduling will be based on current stand condition and age. Unless selected for conversion to red/white pine, these stands will be regenerated back to jack pine.

NRM staff will accomplish the third objective, consider conversion of high quality jack pine sites to red/white pine, by evaluating jack pine stands for conversion during timber harvest scheduling. The number of acres of jack pine converted to red/white pine will not reduce the primary objective of increasing overall jack pine acreage by 10%. Any jack pine acreage converted to other species will be offset through conversion to jack pine.

Harvest Formula: 1,745 acres / 30 years = 58 acres/year

Jack Pine Age Class Distribution Following 30 Years Planned Harvest Schedule



Assumptions:

- Once jack pine reaches maturity it is much more susceptible to insects, disease, and the ravages of nature and has a tendency to decline very rapidly. Because of the amount of jack pine acres currently considered mature or over-mature, a constant reevaluation of the harvest schedule will need to be completed.
- While approximately 58 acres of jack pine will be harvested every year, on average 66 acres per year will be regenerated back to jack pine over the next 30 years. One consideration in regenerating jack pine is its tendency to suffer from deer browse. Current methods of deer browse control have had mixed success. Regenerating jack pine during periods of high deer populations could prove to be difficult.
- Because of the large percentage of mature and over-mature jack pine currently growing in Becker County, and the high mortality rate of the species once it has reached maturity, the harvest schedule is accelerated to reduce the mature and over-mature acreage quickly. This presents a problem following the thirty-year accelerated harvest program. Since there are currently very few acres in the middle age-classes, there will be approximately a twenty-year gap before harvest of jack pine can resume in earnest.

White Spruce

Current Acres: 87

Objectives: The objectives for white spruce are 1) to double the acreage of white spruce covertime by 2016 (87 to 174 acres) through artificial regeneration, and; 2) encourage white spruce in mixed hardwood and mixed conifer covertypes through selective harvest and underplanting.

Sustainable Harvest Calculations: Existing white spruce stands will be evaluated for intermediate and/or final harvests based on stand conditions. Mature stands, declining in productivity, will be scheduled for final harvest treatments as needed. Younger stands nearing thirty-years old will be evaluated for intermediate treatment and scheduled as needed. Any management deemed necessary should be considered as part of an adjacent stand treatment.

Balsam Fir

Current Acres: 1,020

Objectives: The objectives for this coertype are 1) to manage balsam fir to maintain the current acreage levels, 2) promote balsam fir as a component in mixed hardwood/conifer and mixed conifer stands, and 3) evaluate and retain approximately 10% of the current coertype acreage (102 acres) in an extended or old growth high value conservation status for spruce/fir stands.

Seventy-five percent of the current balsam fir acres are considered mature or over-mature. Harvest scheduling should aim to quickly reduce the amount of over-mature acreage of balsam fir and to promote younger, healthier stands through natural and artificial regeneration. The Sustainable Harvest Calculation aims to evaluate and harvest stands currently 50 years of age, or older, within the next thirty years. Mature and over-mature stands will also be evaluated for high value conservation status and retained as extended rotation or old growth stands.

Harvest Formula: 817 acres / 30 years = 27 acres/year

Assumptions:

- Balsam fir is highly susceptible to various damaging agents such as Spruce Budworm, windthrow, and wildfire. Stands severely affected by these, or other damaging agents, will be managed accordingly.
- All acres of this coertype that are harvested will be regenerated back to balsam fir either naturally or artificially. No efforts will be made to intentionally convert acreage of other species to balsam fir. Balsam fir will be encouraged, either naturally or artificially, in hardwood and associated conifer stands to increase the conifer component in mixed hardwood/conifer stands and mixed conifer stands (i.e. spruce/fir).

Black Spruce and Tamarack

Current Acres: Black Spruce – 608, Tamarack – 2,701

Objectives: The objectives for black spruce and tamarack are 1) maintain current black spruce acreage, 2) look for areas that are conducive to growing merchantable pulp and sawbolt material, and 3) look for opportunities for planting upland black spruce and tamarack.

Harvest Formula: Tamarack – 1960 acres / 60 years = 33 acres/year
Black Spruce – 361 acres / 40 years = 9 acres/year

Assumptions:

- Harvest calculations are based on the assumption that all stands are alive and not flooded to the point of total stand mortality.