APPENDIX B. ANALYSIS PROCESSES

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Introduction and Summary

The purpose of Forest Plan Revision is to identify and select for implementation a Forest Plan alternative that provides maximum net public benefits. Forest plans must provide for multiple use and sustained yield of products and services from the Forest; particularly, coordination of outdoor recreation, timber, wildlife, fish and wilderness. This must be done in a way that maximizes long-term net public benefits in an environmentally sound manner.

This appendix shares important points on the modeling that developed benchmarks, analyzed alternatives, and provided information for the Environmental Impact Statement.

The Dualplan Model developed by the University of Minnesota was used for vegetation and included timber outputs with associated costs and benefits. Dualplan allowed tracking the vegetation condition on each polygon through ten decades.

Spatial analysis was done using Geographic Information Systems (GIS) after inputting values determined by Dualplan.

The economic analysis used the Forest Economic Analysis Spreadsheet Tool (FEAST). FEAST incorporated information from IMPLAN to estimated effects of each alternative on income and employment. Net present value was determined using a spreadsheet.

Stand level information in our Combined Data System (CDS) was updated as needed prior to running Dualplan. Stand information was checked and updated where necessary. This included reviewing the productivity of lands identified as suitable for timber management using Forest Inventory Assessment (FIA) standards and insuring regeneration was feasible after harvesting. A review of current market conditions necessitated updating our northern hardwood forest types on the Superior National Forest to recognize they are now economical to harvest for pulpwood to make paper.

Social and economic assessments were conducted to provide information for this analysis.

Modeling Ecosystems

Management Scheduling Model

The analyses for plan revision for the National Forests in Minnesota used the Dualplan model. This model uses specialized modeling techniques designed to take advantage of specific aspects of forestry problems. These techniques were developed at the University of Minnesota.

Dualplan is very similar to the more traditional Forplan model in that it solves formulations that are equivalent to linear programming formulations like those used with Forplan. Dualplan has few if any limits on the number of analysis areas (management units) in the forest. This helps overcome problems associated with first aggregating data into analysis areas and then disaggregating model solutions into schedules of activities that can be easily mapped and interpreted. Therefore, Dualplan allows analyses to recognize enormous detail. This is especially valuable when considering the multi-faceted aspect of the modeling problem. Most any "stand" is unique when considering both its environmental and economic characteristics, further increasing the complexity of modeling ecosystems.

Dualplan can consider many analysis areas because it utilizes decomposition techniques and duality theory in its solution approach (Hoganson and Rose 1984). This approach received strong support in a recent forest management text (Davis and Johnson 1987, pp 669-672). A modified version of Dualplan served as the basis for analysis for the Minnesota Generic Environmental Impact Statement on Timber Harvesting and Management (Rose et al. 1992).

Management scheduling modeling was coupled with spatial modeling for Modified Alternative E for the Final EIS. Spatial objectives in this modeling effort focused on explicitly valuing the production of older forest interior space over time. Model output for Modified Alternative E was examined using GIS tools for the indicators analyzed in Chapter 3.2.2 in the Final EIS.

References

Davis, L. and K. Johnson. 1987. Forest Management. McGraw-Hill, New York, NY. 790 p.

Hoganson, H. and D. Rose. 1984. A simulation approach for optimal timber management scheduling. Forest Science, 30(1):220-238.

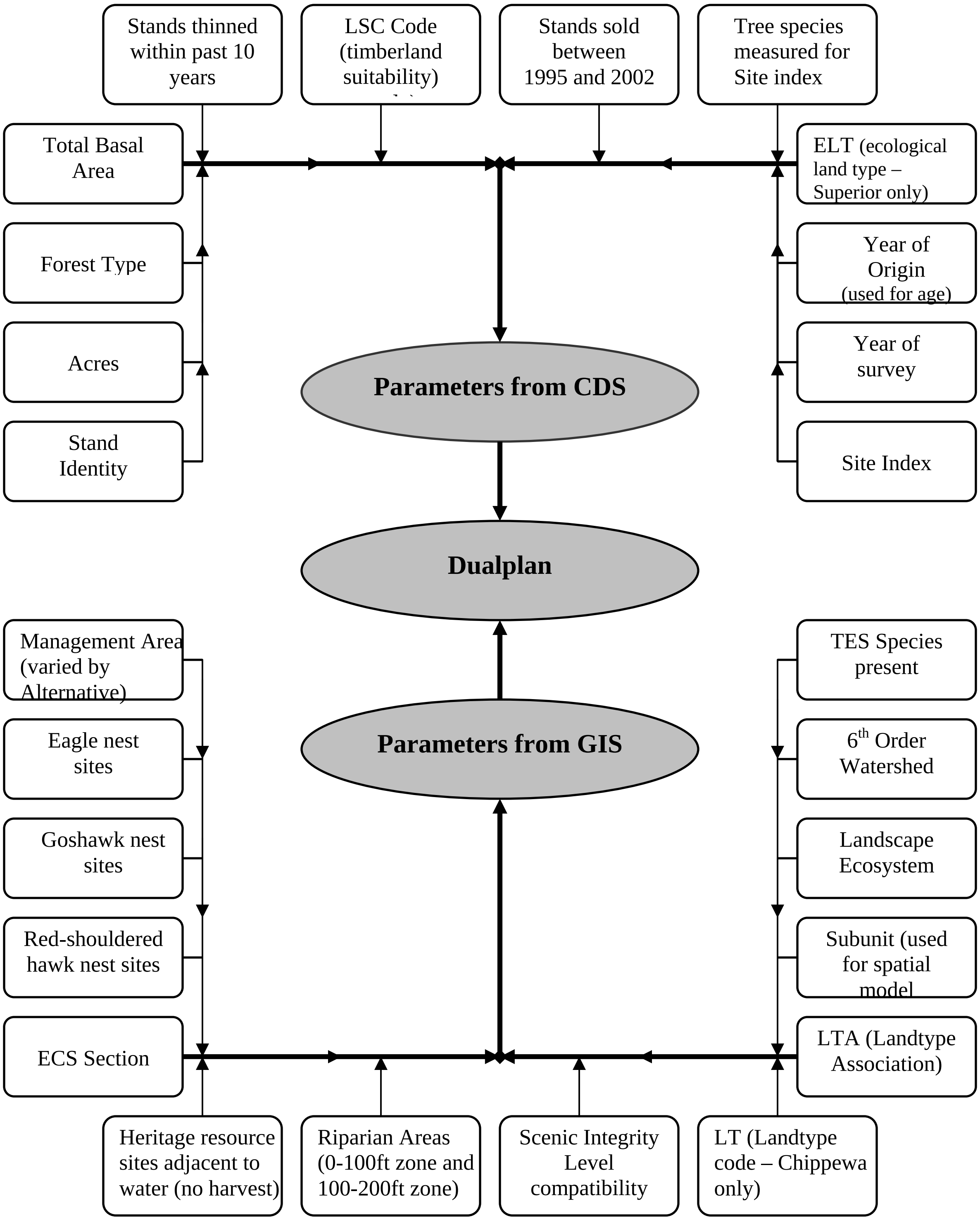
Hoganson, H. and J. Borges. 1998. Using Dynamic Programming and Overlapping Subproblems to address adjacency in large harvest scheduling problems. Forest Science: 44(4):526-538.

Rose, D., H.Hoganson, A.Ek, M.McDill, D.Walters and T.E. Burk. 1992. Maintaining Productivity and the forest resource base. A technical paper for a generic environmental impact statement on timber harvesting and forest management in Minnesota. Jaakko Pöyry Consulting, Inc., Tarrytown, NY. 405 p.

Data Preparation for Analysis with Dualplan

The data used in Dualplan consists of parameters tied to a polygon identity. The polygon identified started out as a stand in our combined database (CDS) inventory. Various needs resulted in the stand polygon being divided into smaller polygons using Geographic Information Systems (GIS). The following figure (Figure BEIS-1) describes in brief format, the parameters that were identified for each polygon and used in the model and the data source.

Figure BEIS-1



Timber Yield Tables and Model Use

Introduction

The yield tables have two objectives:

1. The first is to provide the information necessary to display volume and stumpage value differences for each alternative analyzed in the Forest Plan Revision EIS.
2. The second objective is to document the volume yields used in the analysis for comparison with actual yields obtained during implementation of the revised Forest Plan. Monitoring and evaluation will determine if the projected yields are being realized.

Forest Inventory Analysis (FIA) plots (managed by North Central Research Station in St. Paul, Minnesota) were used because our national forest inventory, identified as Combined Data System (CDS), was not adequate for projecting growth.

The national forest inventory contains stand-level summary data, which serves as the basis for describing the national forest system land. Data include the following information for each stand: cover type, age, site index species, site index value, acres, land suitability class (timber), and numerous other fields. The BWCA Wilderness is not included in the Superior National Forest CDS inventory.

FIA plots were obtained for the three counties present within the Chippewa National Forest (Beltrami, Itasca and Cass) and for the three counties within the Superior National Forest (Cook, Lake and St. Louis). Since FIA plots occur on all ownerships, plots were available from both National Forest system lands and other ownerships. The FIA forest type was used to relate the plots to the national forest system forest type classifications. FIA plots are normally re-measured every ten years; the 1979 and 1990 data were obtained and each measurement was used as an independent sample.

Since the FIA plots are not necessarily located within one forest type, but may occur on the boundary between forest types, the plots were reviewed in an attempt to delete plots that were not representative of the forest type for which a yield table was being developed. FIA forest type codes are assigned to the forest type that dominates the stocking of the plot.

The National Forests' forest type codes generally separate uplands from lowlands, but the FIA forest type codes do not make this distinction; therefore, physiographic classes were used in addition to forest type to relate the two forest type codes. Physiographic classes identify the moisture regime of each FIA plot (xeric through hydric).

Treatment Types

Yields estimates were developed for the different types of proposed harvest treatments. Harvest treatments varied by forest type and are shown in section of this document titled: Treatment Types Modeled. Yield table for the partial cut retaining 60 sq ft of basal area in aspen and aspen/spruce-fir types were not developed. Instead, yields for this treatment were determined by prorating the basal area from existing yield tables with the 60 basal area retention treatments.

Methods Used to Develop Yield Tables

The Washington Office Service Center in Ft. Collins, Colorado supplied the software and expert advice used to create the yield tables. Three major software programs were used:

- PreSuppose
- Suppose

- FVSStand.

PreSuppose groups the FIA plots and converts them into data the Suppose program can read. Plots can be grouped in almost any manner. PreSuppose also displays a summary of the plot groupings with associated forestry attributes (average trees/acre, total basal area, volume, diameter, etc). Standard error percents are also given for each attribute.

Suppose is the Windows version of the Forest Vegetation Simulator (FVS). This is a distance-independent, individual-tree-growing model. The Lakes States variant of this model uses The Woodsman's Ideal Growth Projection System (TWIGS) equations, modified to work in FVS, to estimate tree growth. It requires plot data with individual trees identified by species and diameter at breast height (dbh). Important variables include the average dbh, site species, and site index for the plot, and crown ratio and diameter growth increment for individual trees. Growth cycles were set at ten-year intervals as needed by FVSStand to create yield tables.

FVSStand takes output from Suppose and groups it as needed for the desired yield tables. FVSStand allowed grouping the individual species and size classes together that comprise one market species group, such as mixed-hardwood pulpwood and mixed-hardwood sawtimber. Thus, it was possible to identify the species and product combinations for which we have market-based stumpage values.

The FVSStand option of creating "age dependent" yield tables was used with 10-year age classes. The 10-year age classes range from X1 to X0 (for example, age 61 to 70, 71 to 80, etc.). Since the plot groupings created in PreSuppose and processed with Suppose include plots with a range of age classes, only those plots that met the age class range or younger, contributed to the volume yield table for that age class. If the age class for which a volume is calculated is 61 to 70, all plots younger than 71 years contribute to the yield. For example, the 31-to 40-year old plots were grown by the model into the 61-to 70-age class and harvest was simulated. The plots that were in this 61-to 70-age class at the time of measurement were not grown — only the harvest was simulated.

Suppose volumes are shown in cubic feet per acre, cords and Scribner board feet per acre in the yield tables. The volume equations and merchantability are those used in the Region 9 cruise program (based on Gevorkiantz and Olsen, 1955). Minimum diameter at breast height to qualify as sawlogs is 11.0 inches for hardwoods and 9.0 inches for softwoods. Associated minimum top diameters, inside the bark, are 9.6 and 7.6 inches, respectively. Pulpwood size material has a minimum diameter at breast height of 5.0 inches for softwoods and 6.0 inches for hardwoods. Minimum top diameter (inside the bark) for pulpwood is 4.0 inches. Cordwood volumes were calculated by dividing the cubic foot volume by 79.3 (cubic feet per cord).

Modifying Yields

Several modifiers were available to improve the volume projections from FVSStand. The following modifiers were used to improve the growth projections. Readcord and Biamult are modifiers that change the diameter growth of individual trees. Mortmult and Fixmort are modifiers that change the rate of mortality for individual tree species.

Yields were modified until projections approximated the standing inventory data from empirical yield tables (existing measurements, not modeled). Growth projections had to be modified differently for both National Forests, which indicates how growth on each Forest varies from the Lakes States average growth determined by the TWIGS equations. These modifiers are not perfect and further work could improve the projections. Modifiers were developed until reasonable values were achieved, with an emphasis on the forest type groups dominating the landscapes on the two Forests.

Throughout the revision process, the Chippewa and Superior National Forests worked on the difficult task of modeling ecological landscape change resulting from land management activities such as timber harvesting. One outcome of these land management activities is timber volume, recognized as important in the economic sustainability of the region. Another outcome is the acres of forest in different age classes and with different species growing on them, as needed by various species of plants and animals. The Forest Service manages land in units or "stands" which may be harvested in a timber sale. When timber sale boundaries are laid out on the ground, all of the stand may not be actually used because in some places, for many reasons, there are not merchantable trees growing. In order to formulate a broad scale programmatic plan using a timber harvest scheduling model, in this case the University of Minnesota Dualplan model, various assumptions are made. In this case, the assumption was made that the model would treat entire stands while in reality, something less than 100% would actually be marked in a timber sale. The forests accounted for this difference by reducing per-acre yields to reflect the model harvesting entire stands instead of small cutting blocks.

Public comment on the draft included questions on the per-acre future yield estimates of timber. In some cases, yields in the drafts appeared to be much less than yields reported in recent timber sales, and this was reflected in some public comments. The public noted that if we predicted low future yields, we would reach the ASQ ceiling before treating sufficient acres to achieve the desired age class and species mix outcomes described in the plan. In response, the forests looked at their modeled yields and took the following actions for the newly modeled "alternative Mod E":

Elimination of a reduction applied to clearcut yields on both Forests (approximately 5%). This reduction was intended to reflect actual situations in the field, but it was determined that these situations were already accounted for in the yield tables.

The Chippewa National Forest examined harvest records from 80 aspen stands, site index 70 to 79, clearcut between 2000 and 2004. The volume per acre resulting from these harvested stands was similar to that estimated in the clearcut yield tables used in Dualplan. Therefore the downward adjustment applied in to modeled yields in the Draft EIS was determined to not be necessary.

The Superior compared both clearcut and other treatment modeled yields to recent harvest records. While non-clearcut modeled yields match recent harvest record yields closely, modeled clearcut yields were considerably lower than harvest record yields in a random sample of 90 stands. Building on information found in the Chippewa's comparison of modeled yields and harvest records, the Superior decided to add 25% to all modeled yields from acres treated with clearcutting harvest prescriptions.

More complete information is available in the project record.

Use of Yield Tables

The yield tables were used in modeling efforts to project the volumes harvested and stumpage values received for both the benchmark runs and each alternative selected for analysis. The DualPlan model determined if a polygon (GIS term for stand or portion of stand which equates to an analysis area) was to be harvested and which harvest type was to be used based on management area direction and constraints. The existing cover type and harvest method identifies the choice of yield table.

When yield tables were divided into productivity classes, the polygon site index and site species identified the correct productivity class to use. Once the cover type, harvest type, and productivity class were determined, the appropriate yield table was identified. To determine the volume of each species and product with its associated value, the stand age was used to correctly identify the appropriate value.

DualPlan incorporated the use of the identified polygon age, site index, and basal area and interpolated a more site-specific harvest volume for each polygon, rather than using the ten-year average value shown in the table. That necessitated the use of the survey year to properly project the current basal area at the time of harvest.

The yield tables were created for a specific cover type or group of cover types. When management area direction indicated stand conversion to another cover type was necessary, the new cover type would identify the successive yields. Natural succession from a seral cover type to a later stage was identified by the native plant community information. This information also identified the ecologically appropriate cover types that should occur on the site.

Technical Specifications for Duplicating Yield Tables

Software is available from the Ft. Collin's Washington Office Service Center of the USDA Forest Service at http://fsweb.ftcol.wo.fs.fed.us/tm/. The following table (Table BEIS-1) displays yield table software by size, and by version.

Table BEIS-1

PreSuppose	616KB	4/5/99
Ls.exe version 1.10	1,284KB	8/6/99 (newer version exists)
FVSStand.exe	316KB	4/8/00
Suppose (FVS Setup Program)	397KB	3/30/00
Y2c.exe	19KB	2/19/99
PressSlf.exe	20KB	6/1/00

Numerous additional keyword files are available by contacting Chippewa National Forest, Cass Lake, Minnesota (218) 335-8600

The actual yield tables are part of the record and available upon request.

Costs used in Vegetation Management and Model Use

The costs shown in the following table are in 1998 dollar values. These are the activities that were combined to harvest and/or establish trees to meet the Landscape Ecosystem objectives. The basis for these values is found in the project record in document "veg_costs_basis.rtf". The following table (Table BEIS-2) describes a variety of forest management activities and associated costs.

Table BEIS-2. Forest Management Activities and Costs

Activity	Costs per acre
Sale Preparation and Administration: clearcutting	$119
Sale Preparation and Administration: thinning, shelterwood, partial cutting,	152
Stocking survey	6
Site Preparation – combined mechanical and prescribed fire	115
Site Preparation – prescribed fire	143
Planting	218
Inter-planting	119
Seeding	36
Release (normal is 2.5 releases)	332
One Release	133
Browse protection for planted white pine	133
Browse protection for natural white pine	53
Pruning for blister rust in white pine	124

The following table displays the regeneration of the existing forest type and includes the following activities and total costs.

Table BEIS-3. Establishing an Existing Forest Type and Costs

Forest Type	Activities	Total Cost
jack pine	cc; half of sites require site prep; nat. regen.; 20% interplant	$206
jack pine	pc; same as above with partial cut costs rather than cc	239
red pine	cc; site prep; plant; release	790
red pine	sh; site prep; plant; release	823
red pine	pc; site prep - burn; nat regen; release	633
white pine	sh&pc; site prep; nat regen; release; browse prot; prune	782
spruce/fir	cc; site prep; plant; release	790
spruce/fir	Pc; site prep; nat regen	273
aspen & aspen-s/f	cc; nat regen	125
aspen & aspen-s/f	pc; nat regen	158
paper birch	cc; nat regen	125
paper birch	pc; site prep; nat regen	273
northern hdwd	sh; nat regen	158
northern hdwd	pc; nat regen	158
oak	cc; nat regen; one release	258
oak	sh&pc; site prep; nat regen; one release	406
lowland hdwd	pc; nat regen	158
lowland spruce & tamarack	cc; nat regen	125
lowland spruce & tamarack	pc; nat regen	158

Site prep(aration): preparing an forest area for regeneration
Nat(ural) regen(eration): seedlings have not been planted by people
Release: removal of unwanted vegetation to promote growth of targeted species
Browse prot(ection): a means of protecting and limiting animal consumption of the plant
Prune: to cut back portions of unwanted sections of a selected tree
cc- clearcut
pc- partial cut (in this context includes treatments 5 thru 12 – see "Treatment Methods Used in Modeling")
sh- shelterwood
hdwd- hardwood

The following table displays activities included when establishing a different forest type.

Table BEIS-4. Establishing a Different Forest Type by Activity and Cost

Forest type established	Activities	Total Cost ($)
jack pine	cc; site prep; plant; release	790
jack pine	sh&pc; site prep; plant; release	823
red pine	cc; site prep; plant; release	790
red pine	pc; site prep; plant; release	823
white pine	cc; site prep; plant; release, browse prot; prune	1047
white pine	sh&pc; site prep; plant, release, browse prot; prune	1080

Forest type established	Activities	Total Cost ($)
spruce/fir	cc; site prep; plant; release	790
spruce/fir	sh&pc; site prep; plant, release	823
aspen & aspen-s/f	cc; nat regen	125
aspen & aspen-s/f	pc; nat regen	158
paper birch	cc; site prep; plant; release	790
paper birch	pc; site prep; plant; release	823
n. hardwoods	cc; one release(requires nh present- assume by LE)	258
n. hardwoods	pc; one release(requires nh present- assume by LE)	291
oak	cc; site prep; plant; release	790
oak	pc; site prep; plant; release	823
lowland spruce	not applicable	9999
tamarack	cc; site prep; plant; release	790
tamarack	pc; site prep; plant; release	823
lowland hardwoods	not applicable	9999
cedar	cc; site prep; plant; release; browse prot	923
cedar	pc; site prep; plant; release, browse prot	956

Treatment not applicable uses costs of 9999
nh- northern hardwoods
cc- clearcut
pc- partial cut (in this context includes treatments 5 thru 12 – see “Treatment Methods Used in Modeling”)
sh- shelterwood
s/f- spruce-fir

The following table displays activities associated with the establishment of white pine without harvest**.**

Table BEIS-5. Establishment of White Pine and Cost

Forest type established	Activities	Total Cost
white pine	pc; site prep, plant, release, browse prot; prune	$928

pc- partial cut (in this context includes treatments 5 thru 12 – see “Treatment Methods Used in Modeling”)

The following table displays activities associated with a thinning harvest without regeneration.

Table BEIS-6. Thinning Activities and Cost

Forest Type	Activities	Total Cost
not applicable	not applicable	$152

Revenues of Vegetation Management

Stumpage Values used in Analyses

The following table (BEIS-7) displays data prepared by Larry Leefers (while on detail to our Regional Office in Milwaukee, Wis.) from historical Forest Service timber sale information. Values are in 1998 dollar values and related to product and diameter.

Table BEIS-7. Stumpage Values Used in Analysis

FOREST	SPECIES/GROUP	PRODUCT	1996-98 AVERAGE VOLUME SOLD (MBF)	1996-98 AVERAGE PRICE PER MBF (1998 $)
Chippewa	Aspen (740)	PULPWOOD	32,119	$59.30
Chippewa	Mixed Hardwoods (4, 375)	PULPWOOD	4,435	$28.13
Chippewa	Mixed Hardwoods (4, 375)	SAWTIMBER	1,451	$54.12
Chippewa	Balsam fir (25)	PULPWOOD	3,599	$61.96
Chippewa	Spruce (90)	PULPWOOD	806	$64.38
Chippewa	Spruce (90)	SAWTIMBER	345	$75.41
Chippewa	Tamarack (70)	PULPWOOD	232	$28.50
Chippewa	Pine (100, 105, 125, 160)	PULPWOOD	9,180	$60.09
Chippewa	Jack Pine (105)	SAWTIMBER	1,365	$127.13
Chippewa	Red/White Pine (100, 125, 129, 160)	SAWTIMBER	2,642	$238.63
Superior	Aspen (740)	PULPWOOD	34,428	$55.46
Superior	Mixed Hardwoods (4, 375)	PULPWOOD	9,079	$21.78
Superior	Mixed Hardwoods (4, 375)	SAWTIMBER	781	$23.87
Superior	Balsam fir (25)	PULPWOOD	4,205	$29.90
Superior	Spruce (90)	PULPWOOD	3,555	$45.90
Superior	Spruce (90)	SAWTIMBER	1,140	$65.83
Superior	Tamarack (70)	PULPWOOD	0.3	$24.76
Superior	Pine (100, 105, 125, 160)	PULPWOOD	8,589	$65.40
Superior	Jack Pine (105)	SAWTIMBER	2,290	$99.41
Superior	Red/White Pine (100, 125, 129, 160)	SAWTIMBER	2,294	$175.19

Note on Small-diameter (100) vs. Large-diameter (125, 129, 160) Pine Sawtimber for 1996-98:

Chip-Small	$	228.23
Chip-Large	$	243.03
Sup-Small	$	173.09
Sup-Large	$	180.84

Types of Treatment Methods used in Modeling Alternatives

Introduction

This section describes treatment methods to be used in modeling harvests and vegetative composition in the Dualplan model. The purpose of these rules is to provide an estimate of probable treatments, vegetative composition, and timber volumes to be used for analysis in the Final EIS for Revised Forest Plans of the Chippewa and Superior National Forests**.** These treatment methods are described for modeling purposes only and will not necessarily be carried into management direction in the Revised Forest Plans.

The Model

The results of the Dualplan model will display how the Forests will look, in terms of species composition and age class distribution, for each alternative. The model will display a set of treatment methods that could be used to reach the desired conditions in each Management Area.

The model has choices. From one treatment type (e.g., clear cut with previous thinning) the model can choose multiple stand treatments (e.g., clear cut in decade 2 versus clear cut in decade 10). The model can choose how long each rotation will be.

The treatment modeled for one stand can be a sequence of treatment types. For instance, for a specific aspen stand, the outcome of the model, in terms of what treatment is appropriate, might be to:

1. Initially apply a treatment from the “Partial cut” group of treatments (number 5 in the table below). This might be the first harvest in decade 2 then restore the stand to white pine.
2. Then apply treatment number 6 in decade 8, which creates a multi-aged white pine stand.

Table BEIS-8 (at the end of this section) lists the treatment types, not the specific treatments. In the model, each treatment type is assigned a number (1-17).

For what areas will harvesting be modeled?

Harvest will be modeled for areas where cutting is physically and legally feasible.

The alternatives will determine which Management Area direction will be used and therefore which treatment type(s) may apply. Each Management Area has a different suite of acceptable treatment types (see modeling rules for Management Areas).

Minimum Basal Area for Harvesting

The minimum harvest is 20 ft^2 basal area per acre (BA) for all treatment types, except spruce/fir. We planned to use this minimum for spruce/fir, however, discovered few stands would be selected for harvest, thus lowered the spruce/fir minimum to 15 $ft.^2$ BA.

Resetting Stand Age

“Resetting Stand Age” refers to the model changing the stand age at the time of harvest. (In the table, “Y” is yes and “N” is no.)

In the partial cut treatments with regeneration (treatments 7 - 12, 15, 16,) “**Y delay**” means resetting the age of a stand when the initial overstory is no longer present. This would be either after a second harvest that removes the overstory or after the overstory breaks up. The age is reset to the age of the new forest type that replaces the initial forest type.

Restoration – change in the forest type

Restoration of conifers and northern hardwoods will be modeled with clear cuts, shelterwoods, and partial cuts by including the appropriate site preparation, planting, and similar activities. Treatments 13-16 restore conifers or northern hardwoods by changing to a different forest type without harvesting.

Clear Cuts

Clear cuts retain nine trees per acre. These reserve trees are selected from trees with the largest 50% of diameters in the stand.

Shelterwoods

In shelterwoods, overstory removals occur ten years after the initial shelterwood cut. The overstory removal also retains nine reserve trees per acre that are selected from trees with the largest 50% of diameters in the stand.

Partial Cuts

We have little experience on the ground with partial cut techniques. However, this type of treatment can facilitate achieving desired stand conditions as well as producing timber volume in White Pine, Northern Hardwood, Oak, and Black Ash forest types. We have the ability to create the conditions necessary for regenerating these species in an understory while maintaining a healthy overstory.

Reaching multi-age conditions in jack pine, red pine, aspen, paper birch, spruce-fir, and lowland conifers through harvesting entails more risk than in other forest types. The short-lived species, susceptibility to wind damage, insect epidemics and diseases will contribute to increased mortality.

Partial cut and Multi-aged management (6)

Prescription 6 is “Partial cut and multi-aged management”.

Red Pine A 40 ft^2 BA retention in the partial cut/multi-aged management would allow enough light for red pine survival and growth, creating a stand with two age classes. Subsequent harvest would not be scheduled in red pine treated with this forest type.

White Pine The partial cut with 60 ft^2 BA retention in the partial cut/multi-aged management treatment allows for white pine to regenerate. Subsequent harvests would be every 30 years, retaining 60 ft^2 BA.

Spruce-fir In Spruce-fir, the 60 ft^2 BA retained in the partial cut/multi-aged management treatment should retain a forested condition without serious wind damage. A multi-aged stand of spruce-fir would be created. Subsequent harvests would be every 30 years, again retaining 60 ft^2 BA. An initial stocking of 75 ft^2 is necessary to apply this treatment.

Northern Hardwoods In northern hardwoods, the partial cut/multi-aged management treatment would be selection harvesting retaining 80 ft^2 BA. Subsequent harvest intervals would be every 20 years.

Oak (Chippewa NF only) In the Oak forest type, the partial cut in treatment 6 retains 50 ft^2 BA, creating a multi-aged stand. This would allow subsequent harvest every 30 years, retaining 50 ft^2 BA. Harvest would be in both age classes that were previously established. There would be no harvest after age 100.

Black Ash The only harvest option for the Black Ash forest type is the partial cut/multi-aged management treatment that retains 40 ft^2 BA. Subsequent harvest is every 40 years, retaining 40 ft^2 BA.

Partial Cut and Regeneration (7-12)

These are treatments applied to Aspen or Aspen/Spruce-fir forest types with the intent of regenerating/restoring the stands to a different cover type while providing canopy closure for wildlife or visual reasons. A pre-harvest condition of 80 ft^2 BA or more is required prior to implementing this treatment (ensures a minimum volume for harvesting).

When applied to healthy, vigorous stands the trees retained are expected to be wind-firm and continue to grow. In young aspen stands this is thinning. However, thinning would not include planting a different species in the understory.

Applying this treatment to aspen or aspen/Spruce-fir forest types that are declining in health can hasten the onset of stand break-up. Stands declining in health are frequently identified as older stands due to short-lived nature of aspen. Forest pathologists suggest that this stand break-up is due to root diseases, primarily *Armillaria* species.

Overstory removal is modeled to occur three decades after the initial partial cut, but only for stands considered healthy at the time of the harvest. “Health” is determined by age. The initial partial cut may occur at ages 40 to 90 years. Overstory removal would not occur in stands older than 90 years. Defects and mortality may not allow a commercial harvest beyond this age.

When white pine is established in the understory and an overstory removal is possible, it will only occur half of the time to reflect concerns for damage to the residual white pine.

Treatments 13 & 14

These treatments are establishing white pine under the existing canopy without a harvest. The stand is prepared for planting and planted while protecting as much of the existing stand as practical. Treatment 13 allows harvesting after the white pine matures. Treatment 14 does not allow harvesting in later years.

Harvesting the Regenerated Stands from Treatments 7-16

These regenerated polygons will only be treated with prescription 6. Only white pine, spruce-fir or northern hardwoods were regenerated with these treatment

Table BEIS-8. Proposed Treatment Methods for modeling in Dualplan

Treatment Type		Reset Age to Zero	Forest Type Basal Area Retained with Shelterwood and Partial Cut (ft^2)										
			JP	RP	WP	SF	Asp	Asp SF	PB	NH	Oak	Blk Ash	Low Con
1	Clearcut with thin	Y		X									
2	Clearcut without thin	Y	X	X		X	X	X	X		X*		X
3	Shelterwood cut with thin	Y		X 40	X 60								
4	Shelterwood cut without thin	Y		X 40	X 60					X 60	X* 50		
5	Partial cut	Y	X 30			X 30	X 30	X 30	X 30				X 35
6	Partial cut, multi-aged mgt	N		X 40	X 60	X 60				X 80	X* 50	X 40	
7	Partial cut restore WP harvest later	Y delay					X 60	X 60					
8	Partial Cut restore WP No later harvest	Y delay					X 60	X 60					
9	Partial cut Restore SF Harvest later	Y delay					X 60	X 60					
10	Partial cut restore SF No later harvest	Y delay					X 60	X 60					
11	Partial cut Restore NH Harvest later	Y delay					X 60						
12	Partial cut Restore NH no later harvest	Y delay					X 60						
13	Restore WP harvest later	Y					X	X					
14	Restore WP no later harvest	Y					X	X					
15	Partial cut SF After Succession.	N	X 60				X 60	X 60	X 60				
16	Partial cut NH After Succession.	N					X 80		X 80				
17	No harvest	N	X	X	X	X	X	X	X	X	X	X	X

*Applies to Chippewa NF only. Not applicable to Superior NF

Rules for Modeling Harvests in Management Areas

These are the rules used for modeling harvests in the Dualplan model. The purpose for these rules was to give reasonable choices to the model and to provide an estimate of probable treatments and subsequent vegetative composition and timber volumes to be used for analysis in the Final EIS. These were modeling rules only and will not necessarily be carried into management direction for the Management Areas (MAs). The Proposed Treatment Methods are summarized at the end of this document. Treatment types 7 through 14 only apply to existing stands. Once a stand is regenerated to a given forest type, it stays that forest type. Forest type changes only occur during the first rotation.

Pristine Wilderness, Primitive Wilderness, Semi-Primitive Non-motorized Wilderness and Semi-Primitive Motorized Wilderness
These MAs are not suited for timber production. Harvesting was not modeled.

Semi-Primitive Motorized Recreation and Semi-Primitive Non-motorized Recreation
All partial cut and restoration treatments (5-16) were used to model harvesting. Rotation ages were extended 1.5 times the culmination of mean annual increment (CMAI) in treatments 5-16. Treatment 5 was not modeled for the aspen/spruce-fir type on the Superior NF and for the aspen type on the Chippewa NF. Clearcut and shelterwood treatments (1-4) were not used to model harvesting in these two MAs.

Semi Primitive Motorized and Non-motorized Recreation
This MA occurs only in Alternative D which has a theme of restoring the original composition of landscape. The partial cutting treatments (5, 8, and 14) that allow forest type changes to pine types and no additional treatment will be used during the first two decades. After the first two decades, only sufficient harvest was modeled to maintain 10% of high end of youngest vegetation growth stage (Rx5).

Recreation Use in a Scenic Landscape
All treatment types were modeled in this MA. However, Red and White Pine forest types will be managed as multi-aged stands when harvested (treatment 6). Rotation age will be extended 1.5 times CMAI (culmination of the mean annual increment) in clearcutting and shelterwood treatments.

Eligible Wild, Scenic, and Recreational Rivers
Clearcut treatments (1-2) shelterwood, partial cut, restoration, and no harvest treatments (3-17) modeled in this MA. Red and White Pine forest types were modeled as multi-aged stands when harvested (treatment 6). No harvest was modeled in Alternative D.

Experimental Forest
The North Central Forest Experiment Station maintains a research program to conduct research of forest management activities in Experimental Forests. Management activities are not modeled in DualPlan.

Research Natural Areas and Candidate Research Areas
These MAs are not suited for timber production. Harvesting was not modeled.

Unique Biologic, Aquatic, Geologic, or Historical Areas
Land suited to harvest was modeled for restoration purposes. Treatments 5, 6, 8, 10, 12, 14, and 17 were used in modeling where lands are suited to providing older vegetative growth stages for applicable landscape ecosystems. Stands were not allowed to regenerate to aspen or aspen/spruce-fir type. No second rotation options were given to the model.

Special Management Complexes
Treatments 5-17 were used to model harvesting in the 1st rotation where the land is suited to providing older

vegetative growth stages for the applicable landscape ecosystem. Treatments 6 and 17 were the only treatments available for modeling beyond the 1st rotation.

Minimum Management Natural Areas
This MA is not suited for timber production. Harvesting was not modeled.

Riparian Emphasis Areas
Treatments 5-17 were modeled in the 1st rotation where the land is suited to providing older vegetative growth stages for applicable landscape ecosystems. Only multi-aged and no harvest treatments (6 & 17) were available for modeling after the first rotation. Only the no harvesting treatment (17) was modeled.

General Forest
All treatments were available to the model in the 1st rotation.

Longer Rotation
All treatments were available in the 1st rotation. However, the rotation age will be extended 1.5 times CMAI in all even-aged treatments (1 through 5); this does not apply to Alternative F, as Vegetation Objectives for age class guided the age of harvest.

Succession Modeling Rules for the Dualplan Harvest Model

Forest Service and State foresters were contacted to determine the estimated age range when the short-lived forest types (aspen, paper birch and jack pine) would begin reducing volumes and ultimately no longer have sufficient volume for a commercial harvest. Information was also obtained on longevity of the short-lived trees from Heinselman's The Boundary Waters Wilderness Ecosystem, 1996; memo on longevity of aspen from Obrien & Katovich, 2001; and Lee Frelich's papers on Range of Natural Variation for the two Sections (Minnesota Drift and Lake Plains, Northern Superior Uplands), 1999 & 2000.

In this context, succession is defined as: The age identified for changing the forest type from a short-lived forest type to a longer-lived forest type in the dualplan model.

The longer-lived forest type was derived from Landscape Ecosystem (LE) information.

The aspen type commonly has a spruce-fir component, which is recognized by using the aspen/spruce-fir forest type code in our inventory. Aspen forest types with conifers present, as visible on satellite imagery, were changed to the aspen/spruce-fir forest type code. The Natural Resources Research Institute, Univ. of Minn., Duluth, assisted in updating stands inventoried as aspen forest type. These stands were modeled to succeed to spruce-fir forest type, regardless of the LE identified.

The following tables depict the age and long-lived forest type modeled to occur when the short-lived aspen, aspen/spruce-fir, paper birch and jack pine forest type reached succession age.

Table BEIS-9. Chippewa NF LEs: Dry Pine, Dry Mesic Pine, Upland Forest Types within Lowland

Forest type	Age 90	Age 100
Jack pine		Spruce-fir age 10
Aspen	Spruce-fir age 10	
Aspen/spruce-fir	Spruce-fir age 70	
Paper birch		Spruce-fir age 10

Table BEIS-10. Chippewa NF LEs: Northern Hardwood, Boreal Hardwood/Conifer, Dry Mesic Pine-Oak

Forest type	Age 90	Age 100
Jack pine		Northern Hardwoods age 10
Aspen	Northern Hardwoods age 70	
Aspen/spruce-fir	Spruce-fir age 70	
Paper birch		Northern Hardwoods age 80

Table BEIS-11. Superior NF LEs: Jack Pine-Black Spruce, Dry Mesic Red & White Pine, Mesic Red & White Pine, Birch-Aspen-Spruce-Fir, Upland within Lowland conifer

Forest type	Age 110	Age 120
Jack pine		Spruce-fir age 10
Aspen	Spruce-fir age 10	
Aspen/spruce-fir	Spruce-fir age 90	
Paper birch		Spruce-fir age 10

Table BEIS-12. Superior NF LE: Sugar Maple

Forest type	Age 110	Age 120
Jack pine		Spruce-fir age 10
Aspen	Northern Hardwoods age 90	
Aspen/spruce-fir	Spruce-fir age 90	
Paper birch		Northern Hardwoods age 100

The Northern Hardwoods forest type includes red maple forest type, which is shown on some Landscape Ecosystems to be the oldest vegetation growth stage (Chippewa NF).

When spruce-fir or northern Hardwoods were estimated to occur under the short-lived species canopy, the resulting succession age was reduced to reflect the shorter trees commonly found in this condition.

When the succeeding species were not estimated to be present below the main canopy, the age was reduced to age 10 and the species assumed to be present as saplings representative of a 10-19 year old stand.

The model included treatments to establish white pine, spruce-fir or northern Hardwoods under aspen and aspen-fir forest type using a partial harvest treatment. When this treatment occured the succession age was shown as in above tables, however, the planted tree species would become the forest type and the associated age would relate to the time of planting.

Benchmarks

Benchmark analyses are included as part of the ``analysis of the management situation" (AMS). The purpose of the AMS is to ``*provide a basis for formulating a broad range of reasonable alternatives".* The benchmark analyses ``define the range within which alternatives can be constructed". Hence, there is an emphasis on minimum and maximum conditions for national forests (e.g., minimum level of management, maximum timber potential, etc.). Benchmarks do not constitute alternatives (alternatives are designed to consider integrated management of all resources).

To address these benchmarks in the first round of National Forest Management Act (NFMA) planning, the Forest Service developed detailed guidelines on what was required. This was accomplished through the Forest Service Manual (FSM) and the Forest Service Handbook (FSH). In order to be more responsive to local conditions, the detailed prescriptions for analysis have been removed from the FSM and FSH and Forests must decide on how to address the remaining benchmark requirements in the regulations (36 CFR 219.12).

A minimum management benchmark would include zero timber harvest, as occurred in a ‘no harvest’ Dualplan run.

Direction for Benchmark Analysis in Regulations

The Code of Federal Regulations provides direction for benchmark analysis in forest planning (36 CFR 219).

Maximum Biological Benchmark

> *219.12(e)(1)(iii)(D) Estimates for paragraphs (e)(1)(iii) (A) and (B) of this section shall be developed both with and without other constraints when needed to address major public issues, management concerns, or resource opportunities identified during the planning process.*

The *Maximum Biological Benchmark* in attached flow chart (Figure BEIS-2) serves as a basis to compare volumes under no constraints to the outcomes under various constraints needed to meet resource protection, economic interests, and sustainability requirements. The analysis is based on the existing inventory and yield tables. Culmination of mean annual increment was applied and the model was not allowed to grow trees where they currently do not exist.

Maximum Volume Benchmark for Suitable Acres and Viability

> Section 219.12(e)(1) *As a minimum, the analysis of the management situation shall include the following: Benchmark analyses to define the range within which alternatives can be constructed. Budgets shall not be a constraint. The following benchmark analyses shall be consistent with the minimum applicable management requirements of Sec. 219.27…*
>
> Section 219.12 (e)(1) (ii) *The maximum physical and biological production potentials of significant individual goods and services together with associated costs and benefits...*

Within the purpose of the analysis of the management situation, the reason for this benchmark is to determine what the minimum management requirements would be. Here, forests must decide, using the notion of “reasonable alternatives,” which individual goods and services to analyze. Public issues, management concerns, and resource opportunities should guide the decisions about identifying goods and services. This process began with Chippewa and Superior NF analysis of the management situation, lead to the Need for Change analysis, and is stated in the Notice of Intent. The scope of issues to be addressed by the alternatives was expanded based on the response to the Notice of Intent and refined in Final EIS analysis. New information was considered in the benchmark analysis.

Section 219.27 essentially requires that the Forest Service be a good steward and comply with all relevant federal regulations. This section deals with resource protection, vegetative manipulation, silvicultural practices, even-aged management, riparian areas, soil and water, and diversity. Largely these requirements are handled through standards and guidelines in current forest plans and plan implementation rather than through quantitative analysis.

A “stepped-down approach” was taken to the benchmarks with additional resource management constraints to address existing known populations of threatened, endangered and sensitive species. The benchmark identified in the following flow chart as *Maximum Volume Benchmark – Suitable Acres* includes regulatory constraints. The benchmark illustrated in the flow chart as *Maximum Volume Benchmark – Viability* includes constraints to meet minimum regulatory requirements that reflect Forest Service direction. These constraints are coarse assumptions applied to maintain habitat for some Threatened, Endangered and Sensitive (TES) species. A comprehensive evaluation of effects of Alternatives on TES species is found in the Biological Evaluation.

Maximum Net Present Value (NPV) Benchmark with Minimum Management Requirements (MMRs) and Non-declining Even Flow

> Section 219.12 (e)(1)(iii) *Monetary benchmarks which estimate the maximum present net value of those resources having an established market value or an assigned value; (A) For forest planning areas with major resource outputs that have an established market price, monetary benchmarks shall include an estimate of the mix of resource uses, combined with a schedule of outputs and costs, which will maximize the present net value of those major outputs that have an established market price;…*

This monetary benchmark is represented in the attached flow chart as *Max NPV Benchmark with minimum management requirements.* Production of aspen is emphasized in this benchmark due to the efficiency of growing aspen on these Forests.

> *Section 219.12(e)(1) (iii)(C) For forest planning areas with a significant timber resource, estimates for paragraphs (e)(1)(iii) (A) and (B) of this section shall be developed both with and without meeting the requirements for compliance with a base sale schedule of timber harvest, as described in Sec. 219.16(a)(1), and with and without scheduling the harvest of even-aged stands generally at or beyond culmination of mean annual increment of growth, as described in Sec. 219.16(a)(2)(iii).*

This section of 219.12 relates to non-declining timber flows and sustained-yield capacity (one view of sustainability) and with culmination of mean annual increment as a basis for timber harvest. The "without" option mentioned will likely add little to developing a reasonable range of alternatives unless departure from even-flow policies or timber harvest at young ages are expected.

The *Maximum NPV Benchmark with MMRs and Non-declining Even Flow* on the flow chart illustrates the benchmark with the greatest number of constraints. It is important to note that even for Alternative C, which departs from non-declining even-flow, a "floor" of 70 MMBF was applied on the Chippewa NF and 110 MMBF on the Superior NF.

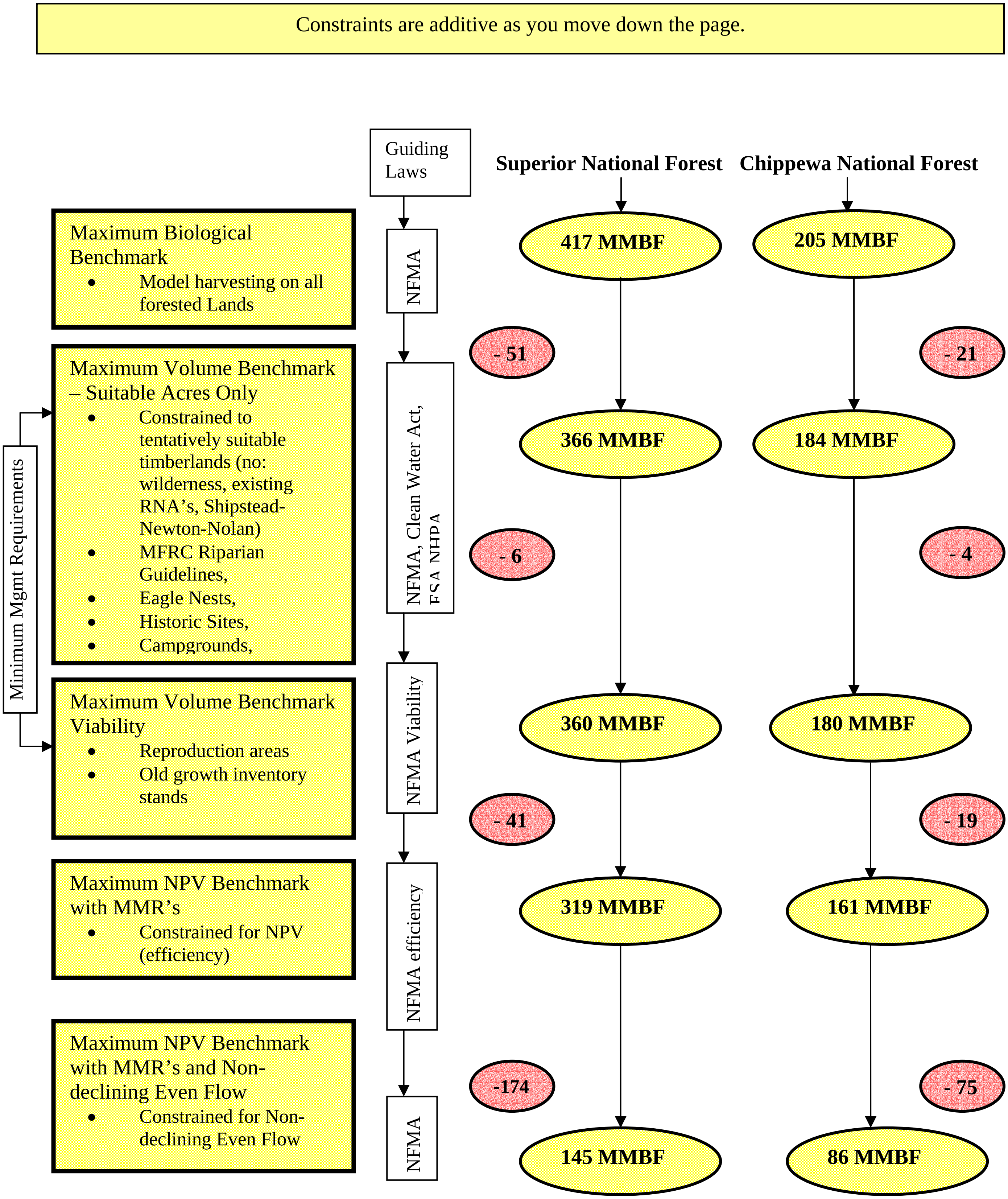
Maximum Recreation and Other Benchmarks

The 1986 Forest Plan benchmarks were considered sufficient for all resources other than timber, where we saw the need to prepare new benchmarks. Recreation capacity was analyzed and found to exceed demand. See Social and Economic Section, Wilderness in Special Area Section, and the Recreation Section for additional information on Recreation.

Summary

The timber benchmarks were recently verified through computer modeling. These benchmarks were considered sufficient to meet our analyses needs. With the benchmarks defined, the planning team finalized alternatives for the DEIS.

Figure BEIS-2. Decade 1 Benchmarks Analysis



Spatial Analysis

The analysis of forest spatial patterns for the Chippewa and Superior National Forests was conducted using GIS covers, forest stand data, and Dual Plan harvest model output by alternative for existing conditions and decades 2, 5, and 10 for federal ownership only. As outlined earlier in this appendix, Dual Plan projects changes in forest types and age based on modeling rules to achieve desired objectives. For spatial analysis, National Forest System land within the proclamation boundary of each forest were categorized as follows for each time period analyzed:

- Forested land vs. non-forest was determined;
- For each decade by alternative, forested land was placed in one of five age groupings (see Wildlife Appendix H, Table HEIS-2. Management Indicator Habitats: age groupings for forest types) reflecting changes predicted by Dual Plan;
- Forest patches were created by merging contiguous upland forest polygons in the Young age group, Sapling/Pole age group, and for Mature/Old/Old Growth Multi-aged;
- Age-based forest patches were then grouped into 8 size classes (0-40 acres, 41-100 acres, 101-300 acres, 301-500 acres, 501-1000 acres, 1001-5,000 acres, 5001-10,000 acres, 10,000 acres or greater).

Using similar methods, an analysis of inherent spatial patterns was conducted on each National Forest (federal land only) to display a theoretical maximum amount of contiguous upland habitat if all forest was similarly aged. Patches of contiguous upland forest were grouped into the same eight size classes for analysis. The inherent spatial patterns were assumed to remain the same among alternatives and over time and, thus, provide a common reference point for comparison of effects.

This analysis framework allows us to examine the four spatial indicators analyzed. More detailed information is in the project record on forest spatial patterns than is reported in the EIS. More detailed information was used to help set objectives and formulate standards and guides. This includes assessing lowland forest patches and forest patches based on species (*e.g.*, northern hardwoods, spruce/fir).

Spatial Indicators 1 and 2 in the Final EIS examine changes to upland forest patches greater than 300 acres, one for mature/older forest and the other for young forest. Spatial Indicator 3 examines changes to interior forest habitat across all mature/old/old growth/multi-aged upland forest patches. Forest patches were buffered inwardly with a 300 foot buffer. The resulting area, interior forest habitat, was summed forest-wide for that time period and alternative.

Spatial Indicator 4 examines the differences of management-induced edge (edge that results from direct, but usually short-term, management practices that fragment habitats) between alternatives and time periods. Edge density (perimeter miles per square mile) of young (age 0-9) was measured and reported for both upland and lowland forest.

Riparian Management Zones

This section address how Riparian Management Zones (RMZ) were modeled in Dualplan.

Alternatives B, D, Modified E and G employ the proactive approach to riparian management. These alternatives were modeled using a two-tiered riparian management zone (RMZ) along all mapped lakes, streams and open water wetlands. Each tier was modeled as 100 feet wide.

- The inner (nearbank) 100 foot zone along mapped waters was modeled as not suited for timber production. The model was allowed to choose only treatment types #14 (underplanting of white pine) or #17 (no harvest) in the inner zone.
- The outer 100 foot zone along mapped waters was modeled as suited for timber production, but model choices were limited to partial cut or no harvest treatments (treatment types #5 through #17).

Alternatives A, C, and F employ the mitigative approach to riparian management. These alternatives were modeled using a single 100 foot wide RMZ along all mapped lakes, streams and open water wetlands. This RMZ was modeled as suited for timber production, but model choices were limited to partial cut or no harvest treatments (treatment types #5 through #17). This choice of treatment types is thought to best represent the riparian management zone treatments recommended in the MFRC Voluntary Site Level Forest Management Guidelines. Outside (landward from) the single 100 foot RMZ, the models' selection of treatment types #1 through #17 was unconstrained by factors related to riparian management.

For all alternatives, this process for modeling RMZs is subject to any additional modeling constraints that may apply to specific Management Areas in which a given RMZ is located. (See *Rules for Modeling Harvests in Management Areas* earlier in the Appendix). The Management Area modeling rules take precedence in all situations where they are more constraining than the RMZ modeling rules described immediately above.

Wildlife

Potential effects of plan revision alternatives on wildlife species and habitats are addressed in the EIS, and other plan record documents such as the Biological Assessment and Biological Evaluation, through the analysis of at least 15 broad indicator habitats and at least 114 indicator species or groups of species. This section describes the process used to identify and analyze the indicators. This section includes information on:

- **Wildlife analysis framework**: summary of legal requirements, policy, and public participation relevant to addressing and analyzing plant and animal diversity.
- **Identification of wildlife management indicators species and habitats:** summary of how specific habitats and species were selected as analysis indicators.
- **Species viability evaluation process:** summary of how species of viability concern were identified, how relevant information on species was collected, and how information was incorporated into plan alternatives.
- **Analysis methods**
    - Forest Type and Age Management Indicator Habitats (Indicators 1-10)
    - Forest Spatial Patterns Management Indicator Habitats (Indicators 11-13)
    - Lake and River Health Management Indicator Habitats (Indicators 14)
    - Threatened, Sensitive, and Other Species of Management Concern (Indicators 15-23)
    - Non-native invasive species (Indicator 24)

Wildlife Analysis Framework

The Forest Service developed alternatives to address the legal and policy requirements and address the public's interest in and need for aquatic and terrestrial wildlife. Each alternative was designed so that:

> Aquatic and terrestrial wildlife habitats on National Forest lands contribute to ecosystem sustainability and biological diversity of Northern Minnesota and, for wide-ranging species, larger landscape scales.
>
> Habitats contribute to supporting populations of wildlife that address peoples' current and future need for and interest in the many aesthetic, commercial, subsistence, recreational, cultural, wildlife watching, hunting, fishing, and scientific uses and values of wildlife.
>
> Habitats are present in quantity, quality, and distributions that maintain viable populations for all existing native and desired non-native species.
>
> Increased emphasis on health, quality, and ecological function of aquatic ecosystems provides improved habitat conditions for fish, mollusk, invertebrate, plant, and other aquatic species.

Legal and policy framework:

The legal and policy framework for the development of alternatives is provided primarily by the following regulations:

> 36 CFR 219.19: "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area."
>
> Departmental Regulation 9500-4: Manage "habitats for all existing native and desired non-native plants, fish,

and wildlife species in order to maintain at least viable populations of such species."

36 CFR 219.19: "For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained habitat must be provided to support at least a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.

36 CFR 219.26: "…provide for diversity of plant and animal communities and tree species consistent with the overall multiple use objectives of the planning area."

36 CFR 219.6 (2) "Ensure that the Forest Service understands the needs, concerns, and values of the public." In addition to the regulations cited above, Forest Service policy (FSM 2600) and other applicable laws (including those documented in Appendix I and Chapter 3.3.0) also form the planning framework for wildlife.

Public participation:

The National Forests considered the public's interest in and need for wildlife resources through scoping described in Appendix A and the planning record. This included:

- Public's comments on their values, needs, and concerns for wildlife resources
- Coordination with other public planning efforts
- Communication with other governmental units with interest in or responsibility for wildlife or their habitats, including formal consultation with the USDA Fish and Wildlife Service on threatened and endangered species.

Identification of wildlife management indicator species and habitats

Regulations and policy require the Forest Service to be concerned with all species of wildlife on the National Forests. Because it is impossible to address the thousands of species that occur on the National Forests, forest plan revision uses a simplified approach that is guided by regulations (36CFR 219.19) and applicable science and includes coarse filter and fine filter management approaches. This section will summarize the steps we took to identify management indicators:

1) Identified species and habitats of management concern
2) Developed groupings of all species of management concern based on broad general (or coarse filter) habitats
3) Screened species and habitats to select management indicator species and habitats.

1. Our first step was to identify those species or habitats for which there was a management concern:

We identified species in two general categories: (Species status is provided in Appendix D, Tables DEIS-8 for animals and DEIS-11 for plants.)

Threatened, endangered, and sensitive species

The U.S. Fish and Wildlife Service provided a listing of threatened, endangered, proposed and candidate species that may occur in the planning areas along with a description of designated and proposed critical habitat found in the planning areas (letter received from the Twin Cities Field Office on October 5, 2001, most recently updated on April 6, 2004). Both National Forests have three listed species, all threatened: Canada lynx, gray wolf, and bald eagle.

Sensitive species were identified through the Forest Service – Region 9 Regional Forester's Sensitive Species designation process (FSM 2672, R9 Supplement No. 2600-2000-1). Hundreds of species were evaluated, including those recommended by the Region 9 process as well as species recommended by species experts (defined as persons who are recognized by peers as having species expertise gained through research, education, study, or experience) and other interested public. Risk evaluations used to identify species and to maintain the list are on file at the Supervisor's Offices (Duluth and Cass Lake, MN). Current list of sensitive species is documented in the Biological Evaluation (USDA Forest Service 2004e, planning record), Chapter 3.3.5 Tables WSS-1 and WSS-2, and on the Region 9 website (http://www.fs.fed.us/r9/wildlife/tes/index.html).

Other species and habitats of management concern

Guided by regulations (36CFR 219.19) and public and interagency scoping (Appendix A), we identified these additional species and ecological conditions of management concern and high public interest:
:

- Public scoping process and public comments on the development of the Forest Plan and individual projects (Appendix A).
- State of Minnesota species hunted, fished, and trapped (Minnesota DNR 2004a, 2004b) and on website http://www.dnr.state.mn.us/regulations/index.html
- Plant species commonly harvested commercially
- U.S. Fish and Wildlife Service Birds of Conservation Concern 2002 http://migratorybirds.fws.gov/reports/BCC2002.pdf
- All breeding and migratory birds known to occur on the National Forests including those of special concern:
    - U.S Fish and Wildlife Service Migratory Birds (http://migratorybirds.fws.gov/intrnltr/mbta/mbtintro.html)
    - Partners in Flight 2001 scores ≥ 19 (range of scores 8-27); Partners in Flight Priority Species for the Boreal Hardwood Transition Physiographic Region (http://www.abcbirds.org/nabci/borealhardwood.htm)
    - Priority Species/ Habitat MN-Audubon priority species on Watch List 2002
    - http://audubon2.org/webapp/watchlist/viewWatchlist.jsp
    - Species with significant population changes detected through Fish and Wildlife Service Breeding Bird Survey or Natural Resources Research Institute's Forest Songbird Monitoring Program (http://www.nrri.umn.edu/mnbirds/reports.htm)
- Leech Lake Band of Ojibwe list of rare sensitive and culturally sensitive species
- Species whose population status and trends would provide insight to the integrity of the larger ecological system to which it belongs (Mighton *et al.*, 2000, Appendix Q)
- Non-native invasive species that pose moderate to severe risk to ecosystems (Minnesota DNR 1991, USDA Forest Service 2003a)
- Ecosystems of concern (Jaakko Poyry Consulting, Inc. 1992 Biodiversity Technical Paper; Noss, *et al.*, 1995, Minnesota DNR 1999c, USDA Forest Service 1996b, 2002d, planning record)

2. We developed species groupings of all species of management concern based on general ecosystem or habitat types.

Grouping of species was based primarily on vegetation or aquatic ecosystems that helped represent the full range of ecosystems or major biological communities on the National Forests. See Appendix D Tables DEIS-1, -2, -9, -11-13.

We also grouped species based on risk factors such as human access (roads and trails) and recreation impacts, habitat loss, alternation of hydrology, and others (planning record).

3. We screened species and habitat groupings to select management indicator species and habitats to meet 36 CFR 219.19 (a)(1) regulations.

36 CFR Sec. 219.19 (a)(1) states: In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as management indicator species and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities. In the selection of management indicator species, the following categories shall be represented where appropriate:

1. Endangered and threatened plant and animal species identified on State and Federal lists for the planning area;
2. species with special habitat needs that may be influenced significantly by planned management programs;
3. species commonly hunted, fished, or trapped; and
4. non-game species of special interest.
5. Additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

Further direction is provided in the Forest Service Manual (FSM 2620.5, WO amendment 2600- 91-5): Management Indicators are defined as "plant and animal species, communities, or special habitats selected for their emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent". Management indicators provide a means of monitoring and evaluating the effects of actions on biotic resources, including specific species, communities, habitats, and interrelationships among organisms. By selecting a limited but appropriate set of Management Indicators, resources for inventory and monitoring activity can be focused where needed. In addition, the planning regulations require us to consider the use of management indicator species:

Selection process

As part of the planning process, the Forest Service is directed to "select management indicators that best represent the issues, concerns, and opportunities to support recovery of Federally-listed species, provide continued viability of sensitive species, and enhance management of wildlife and fish for commercial, recreational, scientific, subsistence, or aesthetic values or uses. Management indicators representing overall objectives for wildlife, fish, and plants may include species, groups of species with similar habitat relationships, or habitats that are of high concern (FSM 2621.1)".

The process of making a final selection of management indicators that address the 36 CFR 219.19 requirements took into account the limitations of using single species to represent a wide range of habitats and associated species. The concept of indicator species has been used widely and critiqued in management activities (Landres *et al.*. 1988, USDA Forest Service 1997e, Appendix B). As discussed by Landres (1988), the idea of indicator species is a relatively old concept and is intuitively pleasing because management for many species may be simplified and made more cost-effective by considering only a small group of indicator species. Unfortunately, as further discussed by Landres *et al.* (1988), the implicit assumption in the use of indicator species is that habitat quality maintained for the indicator will be suitable for other species. Because these assumptions fail on both conceptual and empirical grounds, Landres *et al.* (1988) suggest, "this approach should be avoided." Neimi *et al.* (1997) found that the use of and monitoring MIS in the Chequamegon National Forest with a large database was not useful, and recommend that monitoring be focused on key habitat types instead of a few "representative" species. Partly in response to criticisms such as those above, the Committee of Scientists (1999), which was assembled to assist in revising the planning regulations, recommended that the NFMA regulations be rewritten to replace management indicator species.

The overall approach chosen by the National Forests was to use a limited number of species, together with management indicator "habitats". We favored the use of management indicator habitats over individual management indicator species because of the limitations of using single species outlined above and because we determined that management indicator habitats:

- Best reflect the broad spectrum of major management issues and challenges because they represent the major biological communities on the National Forests that are affected by management.
- Better facilitate evaluation of alternatives and provide indication of the effects of management
- Monitor management.
- Can be practically and efficiently monitored indicators to evaluate compliance of management activities with plan direction and effectiveness of prescribed management, including evaluating cumulative effects.
- Can be monitored and in association with ongoing monitoring of species (such as forest songbirds, raptors, threatened, endangered, and sensitive species, and game species) the validity of information used in habitat evaluation and planning can be evaluated.

We recognize that habitat indicators also have some of the same limitations for indicating the effects of resource management activities as species. However, using management indicators habitats is designed to provide a coarse filter approach that will provide us with a measure of quality and quantity of restoration and management of broad habitats on the National Forests. Such knowledge provides us the capacity to adjust management practices so as to preserve and facilitate the biological integrity of existing and restored habitat and communities and also to ensure that potentially detrimental activities or projects are conducted or designed in an environmentally sensitive manner.

Selected 36 CFR 21.19(a)(1) Management Indicators and Management Indicator Species

Evaluation of species and habitats for management indicators was an iterative process and is documented in the planning record in documents (USDA Forest Service 1998f; Shedd *et al.* 1998; USDA Forest Service 2002b, 2002d) that provide rationale for selection or non-selection of species. A summary of the rationale for selected indicators is also found under the individual indicator descriptions in Chapter 3.3.1 through 3.3.6. The EIS employs the following as indicators to fulfill 36 CFR 219.19(a)(1) regulations:

- Forest Type and Age Management Indicator Habitats (Indicators 1-10)
- Forest Spatial Patterns Management Indicator Habitats (Indicators 11-13)
- Lake and River Health Management Indicator Habitats (Indicators 14)
- Gray wolf (Indicator 16)
- Bald eagle (Indicator 17)
- Northern goshawk (Indicator 19)
- White pine (Indicator 20)

Chapter 4 of the Forest Plans outlines the broad and strategic monitoring objectives for these management indicator species and habitats.

4. We identified Other Species of Management Concern to use as management indicators that are not designated under 36 CFR 219.19 regulations.

Some species fall through the coarse filter approach of employing management indicator habitats and species because of their specialized habitat requirements, because of their high public concern, or because of concern for their continued viability on the planning area. Therefore we selected additional species as indicators that, although not designated as “management indicator species” per 36 CFR219.19, allow us to address important wildlife species not adequately addressed by “management indicator species and habitats”.

We used the same identification and selection process described in #3 above and documented in the planning record. We selected Canada lynx (Indicator 15), 107 sensitive plants and animals (Indicator 18), American woodcock (Indicator 21), white-tailed deer (Indicator 22), and ruffed grouse (Indicator 23) because they allow us to evaluate individual species identified during scoping as species of high public concern because of their social, economic, or ecological importance. These include commonly hunted species, watchable wildlife, species associated with special habitats, and species of viability concern (threatened and sensitive species).

Species viability evaluation process

We prepared for the analysis of impacts to wildlife by collecting information about species. Of particular concern were those species of viability concern. Minnesota and Wisconsin National Forests convened a species viability evaluation (SVE – formerly called population viability assessment or PVA in the planning record) team led by Steve Mighton, R9 threatened, endangered, and sensitive species coordinator, to develop and implement a process for addressing maintenance of viable populations in the forest planning process. Region 9, Minnesota and Wisconsin worked closely together on implementation of process through data collection and initial data synthesis and analysis. The species viability evaluation process is documented in Mighton *et al.* (2000) and Schenk *et al.* (2002). The key actions of the species viability evaluation process have been:

- Identification of species of viability concern
- Collection and solicitation of information and expert opinions about species occurrences on the National Forests, habitat needs, biology, population, landscape structure, risk factors, management impacts of preliminary alternatives, and potential mitigations for species of viability concern through:
    - Literature reviews
    - Minnesota Natural Heritage, National Forests, and herbaria data base searches
    - Species expert panels held in Jan-March 2000 and April-May 2002.
- Compilation of information. This included the creation of a database that allowed queries to develop grouping of species by ecosystem (compositional, structural or functional), habitat feature, risk factors, or other features. This was the primary tool used to develop the association of species of viability concern to management indicator habitats.
- Delivery of information to planning teams for incorporation into management direction for plan alternatives. Through coarse and fine filter management approaches the alternatives were designed to provide a programmatic conservation approach for all species and promote a range of conditions that would, at a minimum, provide a likelihood of maintaining viability.
- Analysis and determination of effects of alternatives by Forest Service biologists

Analysis methods

Impacts of plan alternatives are assessed through evaluation of habitats and species in two interrelated categories:

- Management indicators: habitats (Indicators 1-14)
- Management indicators: species (Indicators 15-23)

Management indicators: habitats (Indicators 1-14)

Management indicator habitats 1-13 are forest vegetation type- and age-based indicators that are combinations of forest type, age, and forest spatial patterns. The descriptions of each of these indicators are found under each individual indictor in Chapters 3.3.1 and 3.3. and Appendix D, Tables DEIS-1 and 2.

The analysis of impacts to management indicator habitats 1-13 was conducted using GIS covers, forest stand data, and Dual Plan harvest model outcomes by alternative for existing conditions and decades 2, 5, and 10 for National Forest lands. Forest Spatial indicators 11-13 also used Decade 1. Data on Decade 1 is also analyzed for Forest Type and Age indicators 1-10 and found in the planning record. As outlined in the *Modeling Ecosystems* section above in this appendix, Dual Plan projects changes in forest types and age based on modeling rules to achieve vegetation objectives by Landscape Ecosystem and Management Area.

For the Superior, management indicators 1-9 and 11-13 included measurements of forest stand types and ages in the Boundary Waters Canoe Area Wilderness (BWCAW). Existing vegetation conditions in the BWCAW were classified through satellite imagery, aerial photos, historical fire records, and other sources. Future conditions are a prediction of the Fire Effects Tradeoff model (FETM), described in detail in the Final Environmental Impact Statement for the July 4, 1999 storm recovery (USDA Forest Service 2001e). FETM is based on both natural disturbance and objectives for prescribed burning in the BWCAW Fire Plan (USDA Forest Service 2001d). The analyses were conducted at the Landscape Ecosystem scale (described in Appendix G and documented in the planning record), but Figures WLD 1-19 in Chapter 3.3.1 provide data and analysis aggregated to the Forest-wide scale.

The estimated range of natural variability (RNV) for forested ecosystems of the Northern Superior Uplands and Drift and Lake Plains Sections within which the National Forests lie is used as tool to compare existing and projected conditions of the alternatives to the past. The rationale and scientific basis for using RNV as a tool, along with assumptions and limitations relevant to its use, are documented in: Chapter 3.1.3: Range of Natural Variability; Appendix G; the Notice of Intent to revise forest plans (USDA Forest Service 1997a); Report of the Committee of Scientists (USDA Forest Service, Committee of Scientists1999); and other sources in the planning record.

The RNV was estimated by the Forest Service for each of the forest type and age management habitat indicators 1-9. The estimate was based on consideration of potential conditions on National Forest lands. We recognized that RNV is most applicable at Landscape Ecosystem scales of the ecological sections, but assumed that across all ownerships landscape elements such as vegetative growth stages were similar enough to those on National Forest lands to allow us to employ an estimated RNV at smaller landscape scales. In other words, acknowledging its limitations and for purposes of comparison of the alternatives, we assumed that the RNV developed for Landscape Ecosystems was valid at the National Forest scale. We used Dualplan and Dr. Lee Frelich's vegetation and forest disturbance models (Frelich 1999, 2000; Host *et al.* 2001)), coupled with vegetation management parameters that included objectives and constraints to estimate RNV for finer scale ecosystem elements (such as forest types) than could be predicted by the use of one model alone. Our estimate combined model predictions with expert opinion to inform predictions on amounts of forest types and ages.

Management indicators habitats 11, 12, and 13 are also indicators for vegetation in EIS Chapter 3.2.2 Forest Vegetation Spatial Patterns. Analysis methods are described in Appendix B *Spatial Analysis* section above.

Management Indicator 14 is lake and stream health. These included indicators such as water accesses, road and trail miles, stream crossings, conditions of vegetation in watersheds and riparian zones, and other management practices that effect watershed health. Analysis methods for these are addressed in Chapter 3.6 Watershed Health and the planning record, with additional information on modeling in riparian zones in this appendix in *Riparian Management Zones* section above.

Management indicators (Indicators 15-24): threatened species, management indicator species, sensitive species, other species of interest, and non-native invasive species.

Many species were evaluated using management indicator habitats 1-14 described above and in Appendix D Tables DEIS-1 and DEIS-2. Many other quantitative or qualitative analysis indicators, however, were also used.

For the three threatened species (EIS Chapter 3.3.4), selected indicators are described in detail in the Biological Assessment (USDA Forest Service 2004b, 2004c, planning record). For the 107 sensitive species (EIS Chapter 3.3.5), selected indicators are described in further detail in the Biological Evaluation (USDA Forest Service 2004e, planning record). The indicators used for threatened and sensitive species include, but are not limited to:

- Recreational motorized and non-motorized trails and water accesses (refer to Chapter 3.8.3)
- Roads (refer to Appendix F)
- Non-forested lands, habitats such as cliffs, bare soil, and bedrock outcrops, and lowland forest vegetation types not included in management indicators habitats: white cedar and black ash
- Vegetation management practices such as timber harvest, prescribed fire, management of insect and disease occurrences, natural vegetation succession
- Stream crossings, watershed vegetation conditions
- Habitat conditions for lynx and wolf prey species
- Management activities and plan direction

For management indicator species (EIS 3.3.6.1 – northern goshawk and 3.3.6.2 – white pine) and for other species of management concern (3.3.6.3 – American woodcock; 3.3.6.4 – white-tailed deer; and 3.3.6.5 -ruffed grouse), selected indicators are described in each respective section and summarized in EIS Appendix D Table DEIS-3.

Refer to EIS Chapter 3.3.7 for description of indicators of impacts to non-native invasive species.

Recreation

The portion of Appendix B discusses the analysis process and Dualplan modeling requirements of the Scenic analysis and the application of the Recreation Opportunity Spectrum.

Scenic Analysis Process

1. Introduction

Both Forests used a nationally recognized systematic inventory process to describe the existing scenic conditions and to assign scenic integrity levels to the alternatives. Agriculture Handbook Number 701, Landscape Aesthetics, A Handbook for Scenery Management, provided the primary direction for the scenic inventory. The system used is referred to as the Scenery Management System (SMS).

The inventory process combines Inherent Scenic Attractiveness with Distance Zones/Concern Levels to define a Scenic Class for the federal portions of the Forests. Scenic Integrity Levels were assigned to each alternative using the inventoried scenic class along with the theme of the alternative. The Final Selected Alternative adopts the assigned Scenic Integrity Levels as Scenic Integrity Objectives for use in project level planning.

2. Inventory

Inherent Scenic Attractiveness

Inherent Scenic Attractiveness of a landscape was analyzed at the Landtype Association (LTA) scale using landform, vegetation, water, and cultural features. It describes the relative scenic quality of lands as Class A: Distinctive, Class B: Typical, and Class C: Indistinctive. The following Table (Table DIES-13) chart summarizes descriptions of how this information was developed.

Table DEIS-13

Category	A: Distinctive	B: Common	C: Indistinctive
Landform	Rolling to steep ridge terrain, escarpments, bedrock escarpments, irregular hilly terrain, hilly steep terrain, rolling with steep short slopes. Distinct orientation of landforms.	Rolling terrain, gently sloping to rolling terrain. Ground moraine and outwash plain.	Nearly level. Outwash plain, lake plain, peatlands
Vegetation	Red Pine White Pine Northern Hardwoods	Boreal Hardwoods Aspen/birch Spruce-fir Jack Pine	Lowland Conifer Lowland Hardwood
Lakes	Large Size High density Clear Color	Average density Dark Color	Low density Dark Color
Rivers	Gorges and waterfalls Distinct orientation of pattern High density	Branching pattern or regular pattern Average density	No pattern Low density
Wetlands	Lowland opening over 10 %	Lowland opening from 3 to 10 %	Lowland opening less than 3 %

Concern Levels

Concern Levels describe the relative importance of scenery to the public. Initial Concern Level assignments for roads were based on a cooperative, statewide Visual Quality BMP planning process that included State and county personnel, local tourism and forest products industry representatives, Forest Ranger District staff, and National Forest resource specialists. Final Concern Level assignments were based upon Forest Service staff review of the initial assignments. Assignments to trails, developed recreation sites, many lakes, and the Potential Wild, Scenic, and Recreation Rivers were based upon input from Forest Ranger District staff and National Forest resource specialists.

Roads, trails, developed recreation sites, many lakes, and the Potential Wild, Scenic, and Recreation Rivers were assigned Concern Levels of 1, 2, or 3. Concern level assignments were based on the geographic scope of a viewing area's importance, the volume of use, and the perceived degree of sensitivity of users at a site. The following criteria were used for assigning Concern Levels to trails, roads, and lakes.

Trails:
Generally, Concern Level assignments were based upon the geographic scope of a trail's importance or significance.

- Concern Level 1 trails have national or regional significance.
- Concern Level 2 trails have local significance.

A trail was also assigned Concern Level 1 if it met one of the following criteria:

- Link into a system or complex of Concern Level 1 trails.
- Associated with a Concern Level 1 use area (i.e. an interpretive trail at a campground).
- Trailhead located on a Concern Level 1 road.
- The segments of long-distance trails outside the BWCAW boundary.
- Special trails or places identified through constituent input.

Roads:
Generally, Concern Levels were assigned based upon the volume of use on a road and upon the perceived degree of sensitivity of users of a road. Concern Levels apply to public highways and local roads from which the Forest may be viewed.

- Concern Level 1 roads have significant public use and visual quality is of high concern to typical users.
- Concern Level 2 roads have either a high volume of use but a lower degree of concern for scenic quality, or moderate use but a high degree of concern for scenic quality.
- Concern Level 3 roads are those where scenic quality is of less concern to typical users.

Lakes and Rivers:
Generally, Concern Level assignments on the CNF were based primarily on the public use of a lake or river. For example, lakes and rivers with high public fishing and use were assigned Concern Level 1 and those with moderate public fishing and use were assigned Concern Level 2.
Generally, Concern Level assignments on the SNF were based on the lake's size, if it were named, and its distance from Concern Level 1 and 2 roads and trails. The SNF assigned Concern Level 1 to the Potential Wild and Scenic Rivers.

The following Concern Level 1 roads and trails have regional or national designations. The list is not intended as an exhaustive inventory of Concern Level 1 features on the Forests.

National Scenic Trails:

Chippewa NF: North Country Trail

National Recreation Trails:

Chippewa NF: Simpson Creek Trail
Shingobee Trails
Superior NF: Oberg Mountain Trail
Superior Hiking Trail
Taconite Snowmobile Trail

Scenic Byways and All American Roads:

Chippewa NF: Highway 38, Edge of the Wilderness National Scenic Byway
Highway 46, Avenue of the Pines State Scenic Byway
County Road 10, State Scenic Highway Scenic Byway
Highway 371, Lake Country State Scenic Byway
Great River Road National Scenic Byway

Superior NF: Gunflint Trail State Scenic Byway
Superior National Forest State Scenic Byway (Forest Highway 11)
North Shore Scenic Drive All American Road (U.S. Highway 61)

Distance Zones

Distance zones were mapped from Concern Level 1, 2, and 3 routes and areas to determine the relative sensitivity of scenes based on their distance from an observer. These zones were identified as Foreground (up to ¼ mile), Middleground (1/4 to 3 miles), and Background (three or more miles).

Scenic Classes

The end result of the inventory process was the assignment and mapping of Scenic Classes, a classification that is used as a measure of the value of scenery in the National Forest. The higher the Scenic Class, the more important it is to maintain the highest possible scenic value. Scenic Classes combine the Inherent Scenic Attractiveness assignments with the Distance Zone/Concern Level assignment. For example, Foreground Concern Level 1 areas with Distinctive Scenic Attractiveness were assigned Scenic Class 1, and Background Concern Level 2 areas with Indistinctive Scenic Attractiveness were assigned Scenic Class 7.

3. Scenic Integrity Levels for Alternatives

Scenic Integrity indicates the degree of intactness and wholeness of the landscape character. Human alterations can sometimes raise, maintain, or lower scenic integrity depending on the degree of deviation from landscape character valued for its aesthetic appeal.

Scenic Integrity is measure by levels using a continuum ranging from very high (VH) to high (H) to moderate (M) to low (L) to very low (VL). Definitions can be found in the EIS and the glossary.

Scenic Integrity Levels (SILs) were assigned to the alternatives based on the relative management concern placed on scenery. No VL assignments were in the alternatives. The assignment of SILs to alternatives, based on the existing Scenic Classes, is found in the EIS Table SQL-2.

The Final Selected Alternative adopts the SILs as Scenic Integrity Objectives (SIOs). A map and standards and guidelines are included in the Forest Plans to guide implementation of the Final Plan SIOs. Information in the SMS handbook also provides guidance to implement SIOs.

Modeling

Scenic integrity was considered in the vegetation modeling by using Concern Level 1 and 2 corridors (1/4 mile on land each side of the facility or feature) to estimate timber volume modifications due to scenery management. It is important to note that the constraints for the model described in the next paragraphs were used only to provide estimates. The actual Forest Plan management direction allows all silvicultural prescriptions to be used as long as they meet the SIOs.

The model could choose among various prescriptions within those corridors, depending on the assigned SIL. Alternatives B and D assigned a "very high" SIL to the more important corridors, with "high" and "moderate" assigned to others. Alternatives A, C, E, F, and G assigned the corridors to "high" or "moderate".

The model constraint for "very high" designation only allowed harvest treatments that retained a forested appearance (treatments 6 through 17 – see Treatment Methods used in modeling). Model constraints for a "high" designation allowed shelterwood treatments and partial cut treatments, but not clear-cuts. The "moderate" designation allowed the model to select from all treatment types, including clear-cuts.

Recreation Opportunity Spectrum

Introduction

The Forests used a national recognized classification system called the Recreation Opportunity Spectrum (ROS) to describe different recreation settings, opportunities, and experiences. The system is used to inventory existing conditions as well as to describe objectives for alternatives.

Inventory Process

Appendix B of the Forest Plan describes the inventory process used by the Forests.

Recreation Opportunity Objectives for Alternatives

ROS class objectives were developed considering management area (MA) descriptions and alternative themes. Some MAs would have the same ROS class in all alternatives and some MAs differ based on the alternative theme. The mapping protocol can be found in Table ROS-7 of the FEIS. ROS objectives for alternatives were not a factor used in the vegetation model.

Forest Plans include a map and standards and guidelines to guide implementation of the ROS objectives for the Final Selected Alternative.

All General Forest and Longer Rotation MAs in all alternatives and Recreation Use in a Scenic Environment MAs in Alternatives C and E would have a roaded natural ROS class objective. However, because these areas have a large percent of MN National Forest ROS inventoried inclusions of semi-primitive opportunities, and because part of the National Forests' niche or desired condition is to provide remote recreation opportunities, the following guideline was developed:

Project level planning will generally use the MN NF ROS inventory criteria. Inventoried semi-primitive motorized and non-motorized portions of the project areas will generally be managed to retain remote character. Management activities to retain remote character may include:

- Close some existing and all new roads to motorized vehicles. Construct only temporary and OML 1 roads.
- Emphasize semi-primitive recreation activities and opportunities.
- Manage forest settings using roaded natural ROS criteria along with the Scenic Integrity Objectives.

Social and Economic Resiliency Analysis

The purpose of this portion of Appendix B is to provide interested readers with additional details regarding the social and economic analyses. This section does not provide sufficient information to replicate the analysis. For that level of detail, the specialist reports contained in the administrative record should be consulted.

This portion of the appendix is composed of three parts:

1. Defining the Economic Impact Analysis Areas in the Eastern Region
2. Economic Impact Analysis
3. Social and Economic Analysis

Defining Economic Impact Analysis Areas in the Eastern Region

Introduction

Defining impact areas for use with IMPLAN (economic input-output model) is a blend of art and science. Due to the complex economic interactions between individuals, firms, and governments, no impact area perfectly represents these interactions. Rather an impact area embodies a set of decisions that offer the best answers to questions that publics, decision-makers, and economists ask. Relevant questions for delineation of impact areas for forest planning include considerations for functional economies, state/local planning regions, national forest supply-based regions, Forest Service expenditures, and other factors (see Table 1). The questions in Table 1 are generally listed in the order that they were asked. The process of delineating impact areas, however, is not linear, so early questions are revisited when answers later questions provide new insights about economic activities. A final review of all questions is desirable once an impact area is proposed.

To answer these questions, various data are required. Some data are quantitative and mapable using geographic information systems, while others are anecdotal and qualitative. Whether quantitative or qualitative, both are important and must be used together. “Soft” data obtained through discussions with knowledgeable people are often more insightful than “hard” data - simply because of the limited availability of “hard” data and lack of interpretation. Data sources considered for each question are provided in Table BEIS-14.

Once data are available, important discussions among economists, analysts, forest planners, and resource specialists take place. Data interpretation and modeling implications are considered in depth. It is important that technical correctness, practical time and staffing requirements, and public acceptance of procedures and results be incorporated into the modeling decision. The process and results must adequately stand up to criticism from interested publics, elected officials, discipline experts, and the media.

The process discussed in this paper is a recommendation for impact area delineation across all of the Eastern Region of the USDA-Forest Service, with application to Minnesota and Wisconsin national forests. It may also serve as a template for consideration in other parts of the National Forest System.

Process

Impact areas for the Chippewa-Superior National Forests (NF) and the Chequamegon-Nicolet NF were defined in June 1999. Counties in Minnesota, Wisconsin, and Michigan were the building blocks for constructing the impact areas – traditionally, counties have been the building blocks for IMPLAN models. The questions, data sources, and discussions are listed in the following table. Impact area delineations follow the table.

Table BEIS-14. Factors and questions considered in defining economic impact areas.

Considerations/Questions	Data Sources	Discussion
Contiguous Areas • *Can results from non-contiguous impact areas be interpreted for ease of understanding?*		A contiguous, place-oriented area is usually more easily understood than several non-contiguous areas. The latter may be technically valid, but may be difficult to explain and understand.
Functional Economies • *Should all counties in a BEA Component Economic Area be included to fully & fairly represent indirect effects?* • *Should all counties in an ERS Labor Market Area be included to fully & fairly represent induced effects?*	• Bureau of Economic Analysis Component Economic Areas – Great Lakes Ecological Assessment • Economic Research Service Labor Market Areas – Great Lakes Ecological Assessment	The BEA and ERS are recognized experts in delineating functional economies. These delineations consider influence of all industries and labor supply in the economy, not just those related to NF. Separating counties the BEA and ERS have recognized as joined should be done thoughtfully. In both MN & WI, these areas were initially considered for impact area delineation.
State/Local Planning Regions • *Are state-defined regions for economic development or planning meaningful for NF impact analysis purposes?*	• Discussions with MN & WI tourism agencies.	Some states have stable & economically designed planning areas that are used by state and local government agencies alike. This is not strongly the case in WI, and less so in MN. The areas may be changeable, driven by state/local politics, and/or vary by state/local government agency. They serve purposes not in line with economic modeling of NF activities.
NF Supply-Based Regions • *What counties are affected by the "sale" of NF goods and services?*	See individual resource (Recreation, Timber/Minerals)	Include only those counties where recreation visitor local purchases are made, timber/minerals are removed and processed, and where important labor supplies for these industries reside. Grazing is normally considered as well, but it is not a use of NF in the Great Lakes states.
Timber/Mineral Resources • *Where are the commodity removal firms & employees based?* • *Where are the mills?*	• Forest product mills by type, size, location – Great Lakes Ecological Assessment • Discussions with NF timber specialists	Only those loggers removing and mills processing NF timber are relevant. Recent history and anticipated future log/pulp flows were considered. Location of the logging firms, mills, and general residence of employees is important. In MN, all are included in one model; in WI, all are included in one of two models.

Considerations/Questions	Data Sources	Discussion
Recreation Resources • *Who is the overnight visitor?* • *What is the visit-related perimeter for local expenditures?*	--30-mile "buffer" around the NF boundary (Stynes' visitor studies) – Great Lakes Ecological Assessment --50-mile "buffer" around the NF boundary (PARVES recreation surveys) – Great Lakes Ecological Assessment --MN and WI Office of Tourism studies --Discussions with NF recreation specialists --Major travel routes	Only non-local visitor expenditures (e.g., overnight accommodations) are relevant for supporting local economies from an export-base perspective. If the area is within convenient proximity to large population centers, non-local day use may also be important. Only trip-related expenditures in the local area are relevant. All counties receiving visit-related expenditures are included in the Chippewa-Superior NF and Chequamegon-Nicolet NF impact areas.
FS Expenditures • *Where are the agency offices?* • *Where do the employees live & spend?*	• Discussions with NF personnel • Forest Service directory	Often the largest effect of FS presence is personal expenditures by FS personnel. Counties where FS personnel live have been included in all MN & WI models.
Urban Areas • *Would the inclusion of urban areas dilute impacts so that they no longer represent their importance to local rural areas that surround the NF?*	• Cities with populations > 1,000 and their boundaries – Great Lakes Ecological Assessment	Metropolitan areas, large or small, should be added only if they are unavoidably tied by data boundaries (counties) or if they are important resource-processing sites. To avoid dilution of local rural areas, separate models should be considered. In MN, the Duluth-Superior metro area could not be separated from rural northern MN. In WI, the Duluth-Superior, Wausau-Stephens Point-Wisconsin Rapids, and Green Bay-Appleton metro areas were separated from the "local," more rural areas of northern WI.
Local Impacts • *What do the interested publics regard as local?*	• Discussions with Forest & RO planners and specialists.	To be credible with many interested publics, the impact area must be generally consistent with their perceptions of what constitutes "local". In MN this area included all economic activities, while in WI many mill centers were mostly outside the area generally regarded by northern Wisconsinites as "local".

Considerations/Questions	Data Sources	Discussion
One Broad Area v. Multiple Specific Areas • *What counties are common to all resource impact questions?* • *What counties are included to assess only one resource?* • *Would inclusion or exclusion of single-resource-related counties distort answers for other resources?*	No additional data.	Where counties are in common with all resources there is no issue. Where a county is important to one resource and not related to another, the positive value of including it for one resource must be weighed against the negative dilution effect for the second resource.
Additive Potential of Multiple Impact Areas • Would publics or agency officials desire or expect to add the results from multiple impact areas? • *Can results be presented and interpreted collectively without distortion to facilitate their proper use by publics?*	No additional data.	If multiple impact areas are overlapping to any great extent, then results from multiple models may not be added because of the high potential for double counting. Mutually exclusive impact areas are generally more conducive to adding results. The FS generally wants to add results, when larger scale analysis is conducted and consistency with Forest-level analysis is desired. All MN & WI areas are mutually exclusive.
Sub-areas • *Are there important sub-areas within a larger area that merit consideration for either separate models or distribution considerations within the larger area?*	• Discussions with forest planner and specialists.	The area around a NF sometimes embodies distinct sub-cultures and economies that are important and related to the spatial distribution of NF activities & impacts. None of these were identified for NFs in MN & WI.

Conclusions

Three impact areas were identified for the purposes of describing the contributions of current national forest activities and evaluating the consequences of possible changes in national forest activities on relevant economies. Specifics and rationale for delineating these areas are presented below; resulting areas are shown in Figure BEIS-2.

For recreation, timber and other impacts associated with Minnesota national forest activities, a 13-county impact area is recommended. For “local” recreation- and timber-related activities on the Wisconsin national forest, a 15-county impact area centered on the national forests is recommended. However, timber processing impacts farther from the Wisconsin national forest require two additional impact areas: a 9-county Metro/Pulp/Paper area and the 13-county Minnesota area. Impacts in these areas must be added to “local” impacts to estimate total economic impacts.

Minnesota Economic Impact Area

Chippewa-Superior NF Area (13 counties)

MN Aitkin, Beltrami, Carlton, Cass, Clearwater, Cook, Crow Wing, Hubbard, Itasca, Koochiching, Lake, St. Louis

WI Douglas

Rationale for one impact area: Due to their close proximity and overlapping economic activities (i.e., BEA and ERS areas, recreation activities, and timber supply regions), one economic impact area encompassing both the Chippewa and Superior NFs is recommended.

Rationale for including perimeter counties that do not contain or are not adjacent to NFs: The inclusion of Clearwater and Crow Wing Counties is based on two factors. First, they contain mills that may process a small amount of NF timber. Second, they are part of the same ERS Labor Market Area and BEA Component Economic Area as Beltrami, Cass, and Hubbard Counties. The inclusion of Carlton County is based on its close economic association with Duluth (BEA & ERS areas) and a large pulp mill in Cloquet that processes a sizable portion of NF timber. Douglas County was included primarily for its close economic association with Duluth.

Wisconsin Economic Impact Areas

Chequamegon-Nicolet NF Area (15 counties)

WI Ashland, Bayfield, Forest, Florence, Langlade, Lincoln, Marinette, Oconto, Oneida, Price, Sawyer, Taylor, Vilas

MI Dickinson, Iron

Rationale for including perimeter counties that do not contain or are not adjacent to NF land: Lincoln County, WI is part of the central access corridor to both Forests, and was identified by both recreation and timber specialists as being associated with activities on the NF. Dickinson County and Iron County, MI are included because the ERS, BEA, Forest recreation and timber specialists agreed that the ties to northern WI forests are very close. Menominee County, MI is excluded on the recommendation of NF recreation and timber specialists, despite being associated with the same ERS and BEA areas as Iron and Dickinson Counties.

Rationale for excluding perimeter counties that do contain or are adjacent to NF land: Rusk County, although adjacent to the Chequamegon, is not identified by either recreation or timber specialists as associated with activities on the NF. Iron County, WI is more culturally and economically tied with the MI Upper Peninsula. ERS and BEA areas, as well as all NF personnel were in agreement to exclude this county.

WI Metro Pulp/Paper Area (9 counties)

WI Brown, Calumet, Marathon, Outagamie, Portage, Shawano, Waupaca, Winnebago, Wood

Rationale for area delineation: This area is mostly urban and contains the largest complex of pulp and paper mills in the world. It includes both the Wisconsin River and Fox River valleys. Much NF timber is processed here, but the area is clearly not a part of the smaller and more rural communities that are closely associated with NF recreation and timber. Thus, a separate model was deemed necessary to account for the processing impacts in WI of NF timber. Shawano and Waupaca Counties are included to make the area contiguous and for labor supply reasons. Winnebago and Calumet Counties were included because both the ERS and BEA consider these counties integral to the Fox River valley economy.

Rationale for inclusion of area: For the Chequamegon-Nicolet NF timber processed in the Duluth-Superior area, the same impact area used for the Minnesota national forests is recommended (rationale for area delineation is presented above). Total economic impacts associated with timber processing on this area would include those based on contributions from Minnesota and Wisconsin national forests. But only the WI portion will be attributed to the Chequamegon-Nicolet NF Forest Plan alternatives.

Three IMPLAN models, one for each of the distinct geographic areas, will be developed. Economic relationships generated within IMPLAN will be extracted and used in the newly developed Forest Economic Analysis Spreadsheet Tool (FEAST) models. The FEAST models will be used at the Forest-level to analyze the impacts of Forest Plan alternatives.

Broader, more diverse impact areas, such as those recommended, provide a truer picture of economic interactions within a regional economy. There is strong interest by local government units and others to look at the finest economic scale possible (e.g., the county level). However, this finer scale misrepresents the interactions among many local areas and underestimates total impacts associated with the national forests. In addition, finer-scale impact areas require resource specialists to disaggregate recreation and timber activities to the finer scale – this is likely beyond the level of precision available in Forest Plan alternatives.

These areas are defined using historic and anticipated effects of National Forest management in the Lake States (economic impact areas for Michigan are currently being developed). However, there is no guarantee that they will provide the best fit for assessing future effects. Effects of future National Forest management should be monitored to see whether the criteria for impact area definition discussed above and their application are providing the most credible and useful estimates of local economic impacts. If monitoring reveals a good fit for these purposes, the process could serve as candidate for other National Forests across the U.S.

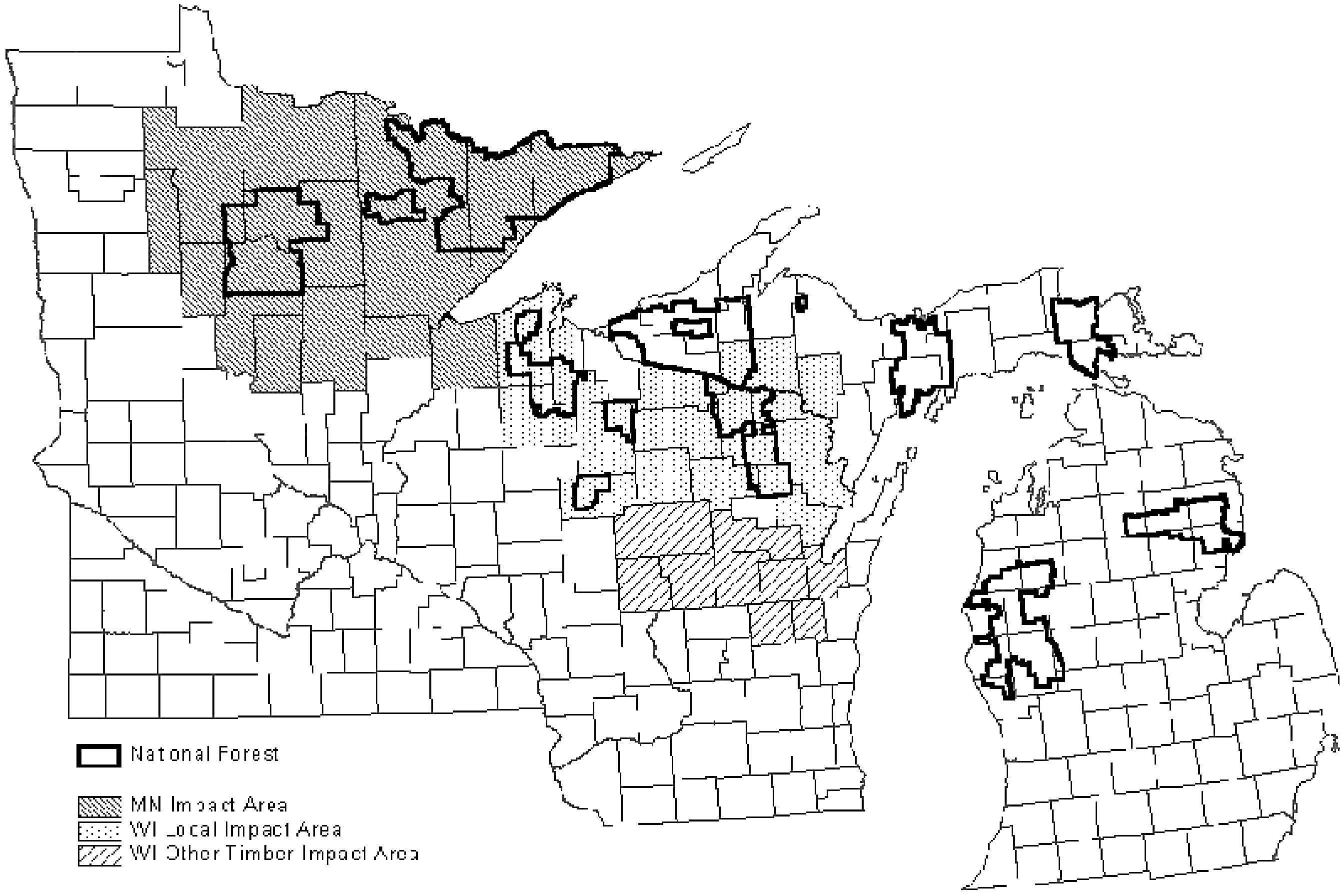


Figure BEIS-2. Economic Impact Areas for Lake States' National Forests in Minnesota and Wisconsin.

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Economic Impact Analysis

Model

Economic effects to local counties were estimated using an economic input-output model developed with IMPLAN Professional 2.0.1017 (IMPLAN). IMPLAN is a software package for personal computers that uses the latest national input-output tables from the Bureau of Economic Analysis, secondary economic data at the county level from a variety of public sources, and proprietary procedures to develop an input-output model for a study area. The model was originally developed by the USDA-Forest Service and is now the property of the Minnesota IMPLAN Group (MIG, Inc.).

The Chippewa and Superior NFs model was developed using 1999 IMPLAN data. These were the most recent data available at the time the model was developed. One model was developed which included the following counties:

MN Aitkin, Beltrami, Carlton, Cass, Clearwater, Cook, Crow Wing, Hubbard, Itasca, Koochiching, Lake, St. Louis
WI Douglas

The model area was determined with consideration of such things as generally recognized functional economies, supply-based regions, resident concepts of "local", and contiguous counties. A full discussion of model area delineation is available in the project record.

Forest Contribution and Economic Impact Analysis

Impact analysis describes what happens when a change in final sales (e.g. exports and consumer purchases) occurs for goods and services in the model area. Changes in final sales are the result of multiplying units of production (e.g., hundred cubic feet of timber harvest or recreation visitor days (RVDs) of recreation use) times sales per unit. Economic impacts were estimated using the best available production and sales data. The source of each are listed below.

Impacts to local economies are measured in two ways: employment and labor income. Employment is expressed in jobs; a job can be seasonal or year-round, full-time or part-time. The number of jobs is computed by averaging monthly employment data from state sources over one year. The income measure used was labor income expressed in 1999 dollars. Labor income includes both employee compensation (pay plus benefits) and proprietors' income (e.g. profits by self-employed).

The planning area model was used to determine the employment and income consequences throughout the economy of one-million-dollar changes for each kind of impact. The results are called response coefficients. Because input-output models are linear, multipliers or response coefficients need only be calculated once per model and then applied to the direct change in output. Spreadsheets were used to calculate total effects by multiplying the response coefficients by estimated levels of dollar activity. A customized Excel workbook called Forest Economic Analysis Software Tool (FEAST) was developed and used for this purpose. Details of FEAST may be examined in the project record. Specifications for developing response coefficients and levels of dollar activity are stated below.

Timber

Sales Data

Information on timber stumpage values was provided from historical sales records available on each National

Forest. Direct information on the shipped value of finished timber products for all processing sectors was not available from any source. Because this information was unavailable, the IMPLAN model was used to derive these production values.

Use of the Model

There is a diverse mix of timber processing firms in northern Minnesota. Of the possible eighteen different types of timber processing sectors, fifteen can be found in this area. Employment in the lumber and wood products industry was estimated by the IMPLAN model. Paper mills are by far the largest employer (4,300), followed by reconstituted wood products (1,600), and logging camps (800). Seven different kinds of timber products are harvested off National Forests in Minnesota, and processed by nine sectors. Details of distribution estimates are available in FEAST, which is located in the project record.

One million dollars of exports were modeled through each timber processing sector to determine a "response coefficient." Timber volume from the National Forests was multiplied by historical stumpage prices and multiplied by the response coefficient for "Logging Camps" to obtain the total economic impact. The distribution of National Forest timber processors and model relationships between "Logging Camps" and other sectors were then used to derive the export value for each timber sector. This value was then multiplied by the appropriate resonse coefficient to determine total economic impact for each sector. All results were then summed for presentation in the EIS. This process was repeated for each alternative.

Recreation & Wildlife/Fish

Expenditure Data

Visitors to the National Forests in Minnesota often engage in a variety of activities during a trip. Often these activities cross over boundary lines between public and private lands. Consequently, a general tourism/recreationist expenditure pattern can reliably represent visitors to the National Forests. Several surveys of tourists in northern Minnesota were used to build an expenditure profile for most recreationists on the National Forests. Where more specific studies were not available, the general expenditure profile from these surveys was used.

Three specific studies were available for important recreation activities in the National Forests. One study was for visitors to the Ely area. This was used to represent expenditures for all visitors to the Boundary Waters Canoe Area. Separate studies were available for mountain biking and snowmobiling. These were used for visitors engaging in these specific activities.

Recreation use is measured in "recreation visitor days" or RVDs. The tourism studies used either days or nights as the unit of measure. RVDs were multiplied by two to convert use to the tourism study unit of measure and provide total spending for each alternative. Further details regarding the expenditures may be found in the project record.

The U.S. Fish & Wildlife Service periodically conducts a national survey to obtain, among other information, data on recreation expenditures for hunting, fishing, and other wildlife-related recreation. This information is available by state. These expenditures profiles were also organized for use in IMPLAN by the agency's Inventory and Monitoring Institute. Expenditures were collected on a "per trip" basis, but converted to a person-day basis for use in IMPLAN. Expenditure profiles for non-resident expenditures in Minnesota were used for estimating impacts from wildlife-related recreation. Details regarding the expenditures may be found in the project record.

Use of the Model

One million dollars of expenditures for three categories of recreation discussed above were run through the model. The results were then incorporated into the FEAST workbook where they were multiplied by total expenditures for each category. Only non-local recreation expenditures (tourism export) use is considered for impact analysis.

Federal Expenditures & Employment

Expenditure Data

The Forest applied budget constraints to every alternative. This budget constraint was used to estimated total Forest expenditures, some of which had local economic effects. Total Forest obligations by budget object code for FY 1999 were obtained from the National Finance Center through the agency's Inventory and Monitoring Institute, and used to estimate how the budget would be spent. Forest Service employment was estimated by the Forest staff based on examination of historical Forest Service obligations. Details regarding the expenditures may be found in the project record.

Use of the Model

To obtain an estimate of total impacts from Forest Service spending, salary and non-salary portions of the impact were handled separately. Non-salary expenditures were determined by using the budget object code information noted above. This profile was run through the model for non-salary expenditures per one million dollars, and the results multiplied by total Forest non-salary expenditures. Sales to the Federal Government are treated in the same manner as exports.

Salary impacts result from Forest employees spending a portion of their salaries locally. IMPLAN includes a profile of personal consumption expenditures for several income categories; the average compensation for an employee on the Chippewa and Superior National Forest fell in the category of $40,000-$49,999. Across the U.S., Americans typically spend about 67% of their total salary plus benefits. Therefore, total Forest Service salaries were multiplied by 0.67 before being multiplied by the one-million-dollar response coefficient.

Revenue Sharing -- 25% Fund Payments

Expenditure Data

Federal law requires that a portion of current or historical revenues be returned to the States and Counties within which the revenues were received. These payments may be used for a variety of purposes, including schools and roads. It was assumed that 25% of all National Forest revenues would be returned to the local impact area, and that a split of 50% for schools and 50% for roads would represent how local governments spend these revenues. A profile of expenditures for each of these purposes was derived from the model itself. Details regarding the expenditures may be found in the project record

Use of the Model

The national expenditure profile for state/local government education (schools) and local model estimates for road construction (roads) are provided within IMPLAN. One million dollars of each profile was used to obtain an estimate a response coefficient for these Forest Service payments to impact area counties. The results were then incorporated into a spreadsheet where they were multiplied by total expenditures. Sales to local government are treated in the same manner as exports.

Output Levels

Output levels are specified in the FEAST Excel workbook, located in the project record.

Financial and Economic Efficiency Analysis

Financial efficiency is defined as how well the dollars invested in each alternative produce revenues to the agency. Economic efficiency is defined as how well the dollars invested in each alternative produce benefits to society. Present Net Value (PNV) is used as an indicator of financial and economic efficiency.

The financial values used were based on experienced revenues (actual returns to the Federal Treasury). Economic values were based on either actual revenues or on a willingness to pay evaluation. These economic values were developed by the SPRA Staff of the Washington Office (Resource Pricing and Valuation Procedures for the Recommended 1990 RPA Program) and updated to 2002 Dollars. Table BEIS-15 displays the economic values and revenues that were used for each resource.

Table BEIS-15. Economic Benefits and Financial Revenue Values

Activity	Unit	Economic Benefit	Financial Value
Camping Picnicing Swimming	RVD	$ 18.57	
Mechanized travel and viewing scenery	RVD	$ 13.95	
Hiking, Horseback Riding, and water travel	RVD	$ 21.55	
Winter Sports	RVD	$ 56.45	
Resorts	RVD	$ 23.23	
Wilderness	RVD	$ 27.74	
Other recreation	RVD	$ 81.37	
Hunting	RVD	$ 59.67	
Fishing	RVD	$ 100.93	
Nonconsumptive Wildlife	RVD	$ 57.75	
Timber – Alt A	CCF		$124.15*
Timber – Alt B	CCF		$ 64.24
Timber – Alt C	CCF		$148.06
Timber – Alt D	CCF		$ 34.20
Timber – Alt E	CCF		$ 88.56
Timber – Alt F	CCF		$ 62.76
Timber – Alt G	CCF		$ 79.12

*Financial values are the average stumpage values derived in FEAST by dividing total estimated revenue by total CCF volume. These values reflect differences in product mix.

Recreation use is based on the National Visitor Use Monitoring survey for the Chippewa and Superior National Forests. Recreation projections are based on Bowker, J.M.; English, Donald B.K.; Cordell, H. Ken.;1999, *Projections of outdoor recreation participation to 2050***:** In: Cordell, H. Ken; Betz, Carter ; Bowker, J.M.; et. al, *Outdoor recreation in American life: a national assessment of demand and supply trends.* Champaign, IL: Sagamore Publishing: 323-351.

Cumulative Effects

Projections of employment and income to 2012 are made by projecting year 2000 US Department of Commerce Bureau of Economic Analysis (BEA) Regional Accounts Data tables CA05, Personal Income and Earnings by Industry and CA25 Total Full Time and Part Time Employment by Industry for counties in the impact area of Minnesota and Wisconsin. Year 2000 values are projected using the University of Virginia Regional Economic

Projections from the Geospatial and Statistical Data Center web site. (Note, the BEA no longer provides projections and the cited web site no longer serves the projections.) These projections implicitly incorporate some level of forest management, and that level was assumed to be Alternative A or the “no action” alternative. Whether each alternative would increase, decrease, or not affect the projections is the purpose of the cumulative effects analysis. Projections for 2012 in this analysis provide a context for understanding alternative impacts. A full description of cumulative effects is provided in Chapter 3.

Social and Economic Analysis

Social and economic assessments are some of the tools the National Forests used to better understand individuals, local Tribes and communities, regional areas and national interests in the management of the forest resources. Each assessment provides valuable information singularly and also when used in conjunction with other assessments. Taken together, all provided helpful insights for the Final EIS Chapter 3 “Effects and Cumulative Effects” discussions.

Assessments are able to provide answers to economic and social questions important to the Chippewa and Superior National Forests. Assessments provide information about supply and demand trends that affect the National Forests, including but not limited to, vegetative resource use, recreational and leisure use, and development and demand for facilities and programs. Descriptions of the current situation or existing condition is also a part of many assessments, detailing such activities as sites that are important for cultural and traditional uses, and an individual’s sense of place. Finally, some assessments will discuss the likely futures of specifics such as outdoor recreation and Wilderness.

Below are summaries of the various levels (local, regional, and national) of assessments and their importance utilized within the forest plan revision process, including a few specific references to individual social/economic assessments. Please see the bibliography for a detailed list of assessments and research consulted.

Local Social and Economic Assessments:

Local social and economic assessments were developed and completed as a direct response to the forest plan revision information needs in addition to ongoing resource management questions of Forest employees. Two assessments were specifically developed to meet forest plan revision needs. These assessments were based on nine questions that were developed by an interdisciplinary team to best address issues and concerns identified by the team as important to local individuals and communities. The questions included:

1. Who are the users of the assessment area?
2. What are the human uses of the assessment area?
3. What are the social and economic characteristics and trends of the assessment area? What are the economic ties of the area to the CNF?
4. What are the special places in the Forests? What meaning does the Forest have to residents and visitors? What’s special about the Forests?
5. What places on the forest are culturally and traditionally important?
6. What access do people have to the Forest? What concerns do people have about access?
7. What are the unique characteristics and priorities as related to National Forests?
8. What is the present land use adjacent to the Forest? What are the trends? What is the attitude towards the changes in use now taking place? How would one characterize the existing regulatory and policy framework?
9. What are the sources of disagreement between the Counties and the Forest? What are the areas of cooperation between the two?

Two Regional Development Commissions, the Headwaters and Arrowhead, were commissioned to develop a social and economic assessment that provided answers in the context of counties associated with the Chippewa and Superior National Forests. These counties included Beltrami, Itasca, Cass, (Chippewa NF), Lake, St. Louis, and Cook (Superior NF). A variety of information gathering techniques were used, as appropriate to the question, and included a survey mailed to randomly selected local and regional people; focus groups; primary and secondary survey data; and key informant interviews. These assessments and associated information are contained as a part of the planning record.

Other local social assessments were used as sources of information when developing the effects analysis. These assessments were also primarily developed in response to a lack of information about specific social issues at the Forest level, such as the research done by Dr. Pam Jakes, Identifying Functional Communities and the Management and Use of Forest Roads on the Chippewa National Forest – Perceptions of Local Residents. Another example is the Leech Lake Reservation Traditional Resource Survey, conducted by the U.S.D.A. - Forest Service, 1998-1999.

Regional Landscape (Minnesota) Assessments:

Regional assessments are able to look across the social, economic and natural resource landscape of Minnesota. To this end, regional assessments provide valuable information that is important in understanding the context of local trends, planning efforts, and decisions and also the effects of the of these activities on the broader scale of Minnesota.

Two examples of regional landscape assessments include the *Generic Environmental Impact Statement study on Timber Harvesting and Forest Management in Minnesota (GEIS)* and the *Minnesota Northeast Regional Landscape* and the *Minnesota Northcentral Current Conditions and Trends Assessments.*

Minnesota's Environmental Quality Board responded to a citizens' petition to prepare a Generic Environmental Impact Statement o the cumulative impacts associated with timber harvesting and forest management in Minnesota. The GEIS provides insights on Minnesota's natural vegetative (tree) resource supply, demands for these resources, economic realities associated with the existing and expected conditions, and related social issues such as leisure activities.

Subdivision 2 of Minnesota's 1995 Sustainable Forest Resources Act provided authorization for establishing regional landscape committees to foster landscape-based forest resource planning. These committees were directed to follow a general planning process that included preparing an assessment of current conditions and trends in the landscape to provide a common understanding of ecological and socioeconomic conditions in order to further landscape planning and coordination among multiple landowners and interests. The assessment information provides a scientific base for the collaborative decision making process as well as point out gaps where more information is needed.

This process has resulted in the *Minnesota Northeast Regional Landscape* and the *Minnesota Northcentral Current Conditions and Trends Assessments*. These assessments give an accurate a social-economic picture of the north central and eastern portion of Minnesota as possible given the limitations of available information and resources. Sections of the assessment include historical conditions, general resources trends and conditions, social and economic trends and conditions, preliminary findings, and preliminary issues. Information was compiled from a variety of sources for counties associated with the Arrowhead Region of Minnesota and the Northcentral Region of Minnesota.

These regional assessments and other are available in the project planning record.

National Assessments:

National Forests, as the name implies, are valued as a resource within the total infrastructure of the United States. Included in this context is the notion of synergism when considering the value of all the National Forests. National assessments are able to address the Forests and their resources from this perspective, with information that comprehensively describes recent trends, current condition and likely futures for timber, water, wildlife, and fish, range, minerals, and outdoor recreation and wilderness. To be responsive and efficient in providing services at the individual Forest level, national assessments are important in identifying possible significant shifts that may signal a need for policy, budget, management, and/or infrastructure adjustments at the national and local level.

An assessment used in planning included information from Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trend (H. Ken Cordell). This assessment has attempted to address the concepts in the above paragraph.

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