3.4 TIMBER

3.4.1 Uneven-aged versus Even-aged Management Prescriptions

Issue Statement

There is debate about how much even-aged management can be used while providing for ecological integrity as well as providing for the economic and social needs of people. Forest Plan revision will establish how much even-aged management (especially clearcutting) may be used and in what forest types and landscape ecosystems it may be used over time.

Indicator 1- Even-aged, Even-aged with Clearcutting, and Uneven-aged Management

Harvest treatment projections have been grouped into even-aged or uneven-aged management. Clearcutting is a type of even-aged management that has been most controversial.

The percent of harvest treatments by alternative are displayed in Tables TMB-3 and TMB-4. This indicator highlights the differences between alternatives because the vegetation age class objectives are different by alternative and the amounts of even-age vs. uneven age treatments produce different vegetation age class distributions.

Scope of Analysis

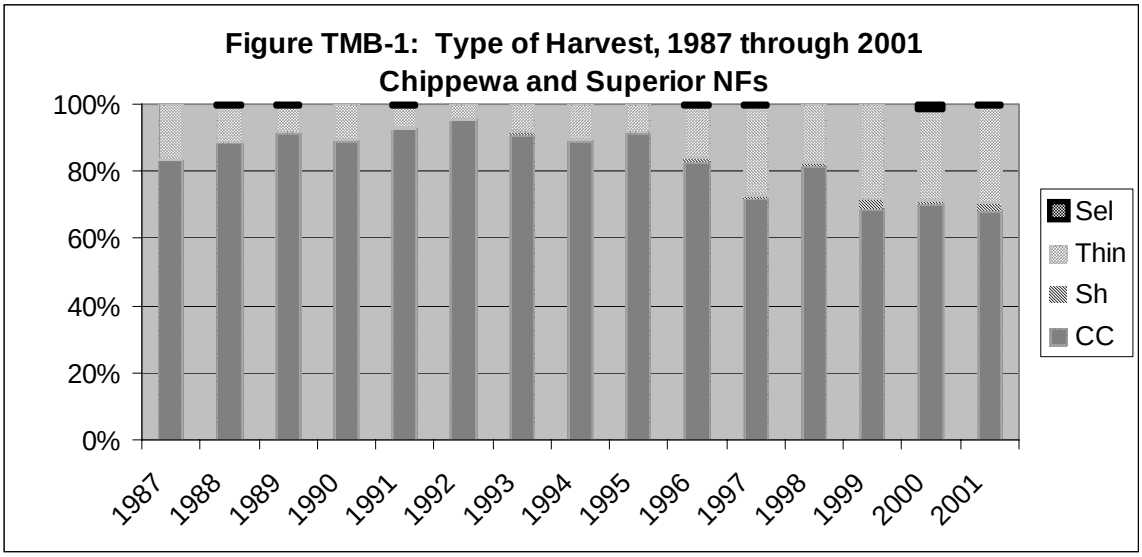
The analysis area includes land tentatively suitable for timber management on the Chippewa and Superior National Forests (See section 3.4.2 for definitions of suitable and tentatively suitable timber land.). The discussion of direct and indirect effects considers only National Forest land, while the discussion of cumulative effects includes land in northern Minnesota.

3.4.1.a Affected Environment

The 1986 Forest Plans indicated clearcutting would be the most common type of harvest. Figure TMB-1 displays the percentage by harvest type that resulted from implementation of the 1986 Forest Plans.

The high clearcutting percentage is due to the 1986 Plans' emphasis on aspen management. Clearcutting is the most accepted harvest treatment utilized in aspen management.

Both even-aged and uneven-aged management may require frequent stand entries when thinning is planned in even-aged systems. Without thinning, more frequent access is required for uneven-aged management. Usually uneven-aged management (individual tree selection in northern hardwoods for example) requires a harvest entry every 15 to 20 years. Even-aged management with thinning (clearcutting in red pine for example) generally provides the first commercial thinning opportunity between 25 to 30 years of age. Productive stands can be thinned at intervals of 15 to 20 years. Aspen management is usually even-aged management, using clearcutting without thinning. Stand entries in aspen management would be 40 to 80 years apart.



3.4.1.b Environmental Consequences

Effects Common to All Alternatives

Resource Protection Methods

Numerous laws, regulations and policies guide how trees are harvested on lands administered by national forests. Key points relating to this issue are listed below.

The National Forest Management Act (NFMA) directs that stands shall generally have reached culmination of mean annual increment prior to a regeneration harvest. This would apply to clearcutting, shelterwood, and seed tree harvests (even-aged management). The age when a stand generally reaches culmination of mean annual increment is identified in Chapter 2 of the Forest Plan.

NFMA also restricts harvesting to productive timber land where there is assurance that such lands can be adequately restocked within five years after harvest.

In 1992, the Forest Service was directed to reduce the amount of clearcutting on National Forest lands (letter from Chief F. Dale Robertson).

General Effects Common to All Alternatives

Table TMB-2 identifies the type of harvest determined to be appropriate by forest type group. See Appendix B for more detailed information on the various harvest treatments.

Generally, tree species that require more sunlight to survive and grow do better with even-aged management. Such species include aspen, paper birch, tamarack, jack pine, and red pine.

Clearcutting is identified as a treatment that may be selected for aspen, aspen/fir, paper birch, jack pine, red pine, oak, spruce/fir, and lowland conifer forest type groups. Where regeneration back to the same type and composition is the objective, clearcutting is the optimum method for regenerating fully stocked stands and maximizing growth. It would provide conditions for the greatest amount of high quality merchantable wood growth in these forest types.

Clearcutting provides the necessary light conditions needed for aspen, paper birch, jack pine, and red pine. It is also reduces the windthrow in spruce/fir and lowland conifer types that often occurs when these tree species are retained after harvesting. However, Clearcutting tends to create stands that are simplified in terms of structure and composition.

Frequently, oak stands are a mix of aspen, paper birch, and oak, which contributes to the decision to allow

clearcutting in oak types on the Chippewa National Forest. Oak species are considered merchantable on the Chippewa NF, although frequently stands of the oak forest type are not as economical due to the absence of a good market for oak pulpwood size products. The best quality oak sawlog trees occur as a component within northern hardwood forest types. Oak forest types are not considered merchantable on the Superior NF because they seldom achieve sawlog size and no commercial market exists for pulpwood size oak.

Species that can survive under shade can be managed with either even-aged or uneven-aged management. Such species include sugar maple, spruce, and balsam fir.

See FEIS Section 3.2.3 for the effects of insect and disease when using even-aged and un-evenaged harvest treatments.

Standards and guidelines for all alternatives would direct harvest activities to minimize adverse effects on soil, water, air, wildlife, recreation, and visual resources. (See other resource sections in Chapter 3 for an analysis of effects specific to each resource).

Direct and Indirect Effects

Uneven-aged and Even-aged Management

It is often difficult to label a harvest treatment as even-aged, uneven-aged, or clearcut. Uneven-aged treatments may retain half of the trees present at the time of harvest. Even-aged treatments, such as shelterwood harvests may retain similar stocking.

The difference between whether the treatment is labeled even-aged or uneven-aged depends on whether the retained trees are removed within ten years to allow the regeneration to grow (this would be termed even-aged). If the subsequent harvest entry, after the initial harvest retaining half the trees, were delayed for 30 years, it would result in 30 years of a two-storied or multi-storied stand condition and would be considered uneven-aged.

Clearcutting as summarized in the tables is harvesting that retains nine reserve trees per acre from the main canopy. This is almost identical to a seed tree harvest; however, the trees are retained for multiple uses (such as wildlife, future snags, and large woody debris) and not to provide seed to regenerate the harvest area. If the main purpose reserving the trees is providing seed to regenerate the harvest area, the correct term would be a seed tree harvest.

The clearcutting used on the National Forest lands in Minnesota is usually more correctly called clearcut with reserves, which according to the Society of American Forester's (SAF) terminology, is a two-aged regeneration method. SAF recognizes four types of regeneration methods: coppice, even-aged, two-aged, and uneven-aged (Helms 1998). The difference is most apparent in the objectives, which for even-aged is a single age class, for two-aged is two age classes (tending to uneven-aged) and for uneven-aged is three or more age classes. However, in this analysis clearcutting is considered an even age treatment. Clearcut stands contribute to 0-9 age class objective.

Depending on the species and the site conditions, trees retained in clearcuts may be susceptible to windthrow or sunscald particularly if the trees retained are older, short-lived species. Selecting leave trees for longevity and windfirmness will increase the likelihood that the trees will be retained over time and will contribute to a two-aged stand condition. According to MFRC (2002),

Table TMB-2: Type of Harvest Modeled by Forest Type Group

	Jack pine	Red pine	White pine	Spruce/ fir	Aspen	Aspen/ fir	Paper birch	North. hardwd	Oak*	Black ash	Lowland conifer
Even-aged	X	X	X	X	X	X	X	X	X		X
(clearcut)	X	X		X	X	X	X		X		X
Uneven-aged		X	X	X	X**	X**		X	X	X	

‡Notes: Clearcut is an even-aged treatment.
* Oak is not harvested on the Superior NF.
** Aspen and Aspen/fir types are modeled with retaining 60 sq.ft. of basal area for 30 years or less while regenerating to white pine, spruce/fir or northern hardwoods.

white pine, oak, elm, ash, sugar maple, yellow birch and basswood are excellent choices for leave trees and aspens, red pine, tamarack, cedar, red maple and others are good choices for leave tree retention.

Stands adjacent to clearcuts frequently experience some damage from wind. Some of this can be avoided or reduced with careful attention to boundary locations. During the windstorms experienced in northern Minnesota in 1992, 1995, and 1999, stands on the downwind side of clearcuts were frequently damaged. Those windstorms included down-bursts associated with thunderstorms and also did heavy damage in stands that were not adjacent to clearcuts.

Tables TMB-3 and TMB-4 summarize the percent of harvesting by even-aged or uneven-aged groupings.

Thinning is an intermediate treatment in even-aged regeneration systems and is tallied separately. Thinning was modeled in red pine and white pine forest types and totaled ten percent or less of the total harvest in any one alternative for any one decade.

Decade one and decade three are displayed since two of the alternatives (C and D) depart from non-declining, even-flow during the first two decades. Decade three shows the amount of harvesting by type

Table TMB-3 Model Results for Decade 1: Type of Harvest - Chippewa and Superior NFs

	Appendix B Treatment Number	Alt A	Alt B	Alt C	Alt D	Mod Alt E	Alt F	Alt G
Chippewa NF		%	%	%	%	%	%	%
Even-aged	1-5	92%	37%	93%	72%	53%	55%	55%
(clearcut)	1,2	70%	30%	65%	0%	38%	50%	39%
Uneven-aged	6-12	3%	59%	4%	28%	38%	39%	39%
Thinning		5%	4%	3%	0%	9%	7%	6%
Superior NF		%	%	%	%	%	%	%
Even-aged	1-5	92%	59%	93%	77%	81%	69%	74%
(clearcut)	1,2	73%	42%	74%	0%	63%	61%	52%
Uneven-aged	6-12	2%	36%	3%	23%	11%	23%	19%
Thinning		6%	5%	5%	0%	8%	9%	7%

Table TMB-4 Model Results for Decade 3: Type of Harvest - Chippewa and Superior NFs

	Appendix B Treatment Number	Alt A	Alt B	Alt C	Alt D	Mod Alt E	Alt F	Alt G
Chippewa NF		%	%	%	%	%	%	%
Even-aged	1-5	87%	31%	57%	78%	57%	45%	44%
(clearcut)	1,2	64%	22%	42%	0%	48%	37%	25%
Uneven-aged	6-12	12%	66%	42%	22%	37%	51%	52%
Thinning		2%	3%	2%	0%	6%	4%	4%
Superior NF		%	%	%	%	%	%	%
Even-aged	1-5	87%	53%	78%	91%	78%	65%	69%
(clearcut)	1,2	64%	40%	49%	0%	62%	59%	50%
Uneven-aged	6-12	7%	41%	16%	9%	12%	26%	22%
Thinning		6%	6%	6%	0%	9%	10%	9%

that is more typical for future decades.

Alternatives that include more uneven-aged management are expected to increase the amount of shade tolerant tree species such as sugar maple, spruce and balsam fir, while those with more even-aged management are expected to increase the amount of shade intolerant tree species such as jack pine, aspen and white birch. Timber harvest and treatment method are the tools that move the Forests toward vegetation objectives reflected in Appendix G and in the analysis of effects for vegetation in Chapter 3.

Alternative A

Alternative A would have the highest percentage of even-aged harvesting at 92 percent the first decade and 87 percent the third decade. It also would have the highest percentage of clearcutting. The high percentage of even-aged management would be continued into later decades.

Alternative A would also have the highest levels of clearcutting at 70% for the Chippewa and 73% for the Superior in the first decade and 64% for both Forests in the third decade.

This alternative would favor those species that require more sunlight, such as aspen, paper birch, jack pine, and red pine.

Alternative B

Alternative B would have the lowest percentage of even-aged harvesting in the short term when compared with the other alternatives. Alternative D would have a higher percentage of even-aged harvesting in the first decade, the actual acres of even-aged harvest would be considerably less in the third decade than Alternative B.

Light demanding species would be greatly reduced in this alternative. More shade tolerant species, such as maple, spruce, and balsam fir are expected to increase substantially, although not to the extent of Alternative D.

Alternative C

Similar to Alternative A most harvest in Decade 1 would be even-aged (93%). Alternative C would favor those species that require more sunlight, such as aspen, paper birch, jack pine, and red pine. In decade three, levels of even–aged management are similar to Modified Alternative E.

Alternative D

This alternative has a high percentage of the total treated acres proposed as even-aged treatments; however, Alternative D would have the lowest number of total acres harvested. The alternative has the highest vegetation objective for older forest conditions. The harvesting that would occur is meant to provide a change in forest type during the first two decades. Small harvest acreages in the remaining decades would provide some representation of zero to nine age classes on the landscape. Light demanding species would be greatly reduced in this alternative. More shade tolerant species, such as maple, spruce, and balsam fir are expected to increase substantially.

Modified Alternative E

This alternative would result in a relatively lower amounts of even-aged treatments in decade 1 and moderate amounts in decade 3 on the Chippewa and higher levels on the Superior. This would be less than Alternatives A and C. Clearcutting increases on the Chippewa between the first and third decade, but remains at moderate levels. Clearcutting on the Superior remains stable between decades one and three.

Nearly 60 percent of the forest type objectives for this alternative are shade intolerant species such as jack pine, aspen, and paper birch, which require even-aged treatments (see vegetation section for forest type objectives). More shade tolerant species are expected in this alternative than in Alternatives A and C.

Alternative F and G

These two alternatives would result in similar amounts of even-aged harvesting. This moderate amount of even-aged harvesting would be less than in Alternatives A, C, and D. on the Chippewa and on the Superior less than A, C, D and Modified E.

Although the percentages would be very similar, Alternative G would harvest more even –aged harvest acres than Alternative F.

These alternatives are expected to result in fewer light requiring species and increased amounts of shade tolerant species than in Alternatives A, C, and Modified E.

Cumulative Effects

Although it is difficult and there is uncertainty, it is possible to make some basic assumptions about reasonably foreseeable actions in Minnesota. The percentage of uneven aged harvest has increased in recent years and will likely to continue to account for a higher percentage of total harvest in the future. Several initiatives within the State of Minnesota have produced analyses that help describe the condition of Minnesota forests in the future, based upon various management scenarios. Two key analyses relevant to the Chippewa and Superior National Forests are the Minnesota Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota, 1994 (GEIS) and the Minnesota Forest Resource Council Landscape Project.

The types of harvest treatments that are dominant in Minnesota were estimated from the GEIS. The GEIS analysis modeled clearcutting, thinning, and multi-aged harvesting. Multi-aged harvesting is more common in southern Minnesota. Thinning was modeled in jack pine, red pine, and white pine forest types (Jaakko Poyry 1991).

Seed tree and shelterwood harvesting were not modeled for the GEIS. These treatment types have historically been a very small part of the treatments occurring on National Forest lands and likely state-wide.

Clearcutting and clearcutting with reserves accounted for over 80 percent of the total volume harvested on all ownerships during a GEIS survey (Jaakko Poyry 1992).

This information indicates clearcutting has been the most common type of harvest within the State. The education effort by the State on the voluntary harvest guidelines published in February 1999 has resulted in more reserve trees being retained in clearcuts.

The State plans to monitor the harvest practices used on an approximately five-year cycle. The first monitoring occurred in 1996. Clearcutting decreased from 89 percent in 1991 to 85 percent in 1996. Thinning increased between 1991 and 1996. Residual trees were retained on 77 percent of the acres clearcut; which is nearly twice the 1991 percentage (Puettmann, 1999).

More current summaries of the types of harvest treatments on non-National Forest System lands in northern Minnesota are not available (Hansen 2002).

In 2001, clearcutting was still the dominant type of harvest occurring on the National Forests in Minnesota, although it has declined since 1992.

The recent work by the Minnesota Forest Resource Council's Landscape Committee encourage forest managers increase the amount of uneven-aged management and shelterwood harvests in northern Minnesota. The Council has also recommended increasing the multi-aged conditions within appropriate ecosystems.

The reduction in clearcutting predicted by the modeling of alternatives for this analysis appears to be consistent with the Landscape Committee's recommendations. The reduced use of clearcutting and increase of uneven-aged management is also expected to occur to some extent on other ownerships in Minnesota.

3.4.2 Timber Supply

Definitions

Suitable timber land - Land where timber harvesting is a scheduled management practice.

Tentatively suitable timber land - Forest land that is producing or is capable of producing crops of industrial wood and:

(a) Has not been withdrawn by Congress, the Secretary, or the Chief of the Forest Service,
(b) Existing technology and knowledge is available to ensure timber production without irreversible damage to soil productivity, or watershed conditions,
(c) Existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that it is possible to restock adequately within five years after final harvest, and
(d) Adequate information is available to project responses to timber management activities.

Non-declining even-flow - A timber sale and harvest schedule formulated on the basis that the quantity of timber planned for any future decade is equal to or greater than the planned sale and harvest for the preceding decade.

Issue Statement

There are divergent opinions on how much timber the Chippewa and Superior National Forests can supply without adversely affecting ecosystem integrity and the social and economic needs of people. Forest Plan revision will determine the level of timber that the Chippewa and Superior NFs may supply over time. Revision will also establish the acreage and location of land that is suitable for timber production.

Indicator 1 – Timber Sell Volume

The first indicator for timber supply is the volume scheduled to sell in each decade. Timber volume reflects the maximum amount of volume from the Chippewa and Superior NFs that each alternative could contribute to public social and economic needs.

Indicator 2 – Amount of Land Identified as Suitable for Timber Management

The second indicator for timber supply is the amount of land identified as suitable for timber management. Forest inventory data was reviewed to ensure that only appropriate productive land was identified as suitable for timber management. Further, the potential market for species and products was assessed and land which might previously have been determined non-suitable due to low demand was included.

The amount of land identified as suitable for timber management varies between the alternatives because some Management Areas do not allow timber management. Areas recommended for Wilderness, Research Natural Areas or Unique Biological, Geological, or Historical Areas do not allow regularly scheduled timber management.

Alternatives B, D, Modified E, and G also include a proactive approach to riparian management. The near bank zone of lakes and streams (generally 100 feet) was not considered suitable for timber management in these alternatives.

Scope of Analysis

The analysis area for this issue includes National Forest System land in the Chippewa and Superior NFs that is identified as suitable for timber management.

The National Forests have 12.3 percent of the productive timber land in the State (Hansen 1990).

For cumulative effects, the analysis area includes the suitable timber land on the two National Forests, plus the productive timber lands on other ownerships within Minnesota. Timber sale volumes and product mix are analyzed through the planning horizon (100 years). Investment by the forest products industry depends on, among other things, being able to predict the amount of timber available from all sources over the long term. World market factors, transportation systems, and labor and construction costs are also key factors (State of MN, 2003).

3.4.2.a Affected Environment

Indicator 1 – Timber Sell Volume

The amount of timber that could be sold needs to be understood within the context of the historical role that the National Forests have played in providing commercial wood for society's needs. Figure TMB-5 displays the past harvest levels from 1945 to the present for both Forests.

The current Forest Plan for the Superior NF identified more land available for timber production than was needed to meet anticipated demand. Essentially, the mill capacity at that time could not use all the wood that could have been provided.

In order to improve the economy of northern Minnesota, the State attracted more mills to northern Minnesota. Pulp mill capacity has increased since 1986 and additional particleboard mills have been constructed.

This increased capacity stimulated the preparation of the Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota (GEIS) (Jaakko Poyry 1994). The GEIS looked at the following harvest levels for the State: 4.0, 4.9 and 7.0 million cords per year (2,000, 2,450, and 3,500 MMBF per year respectively). Seven million cords per year was identified as not sustainable over the 50 years analyzed. The highest sustainable volume was identified as 5.5 million cords per year (Jaakko Poyry 1994).

Table TMB-6 shows the wood harvested annually in Minnesota on all ownerships. The GEIS uses millions of cords as a unit of measure. Millions of board feet (MMBF) are also shown. The standard conversion from cords to board feet is 2 cords per thousand board feet or 500 board feet per cord. Four million cords is equal to 2,000 MMBF.

The average volume from Minnesota National Forests sold between 1992 and 2002 is shown in Table TMB-7.

Figure TMB-5: Harvest from 1945 to present

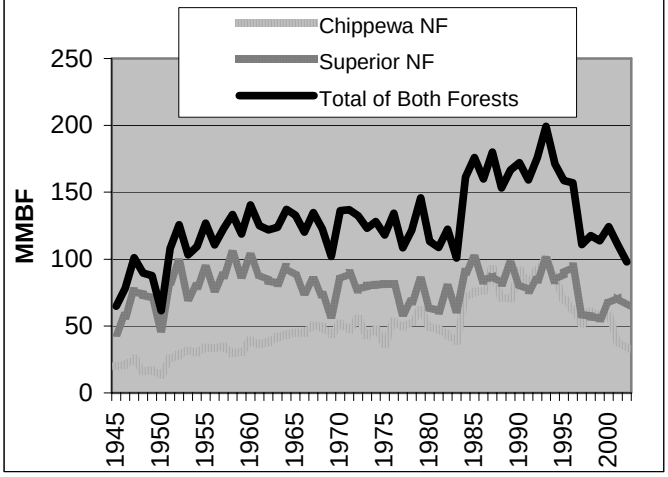


Table TMB-6: Total Wood Harvested in Minnesota

Year	Millions of Cords	MMBF
1994	4.1	2,050
1995	4.1	2,050
1996	3.8	1,900
1997	3.7	1,850
1998	3.7	1,850
1999	3.8	1,900
2000	3.7	1,850

Source: MN DNR, Forest Utilization & Marketing

Table TMB-7: Average Annual Timber Sell Volumes from 1992 to 2002	
	(MMBF)
Chippewa NF	65
Superior NF	74

During the last few years, the harvest on National Forest land has declined due to numerous factors. Some factors contributing to lower harvest levels on NFS lands include: lost volume due to flooding or drought; natural decline in volume as stands age; diseases and insect epidemics; NEPA document decisions that incorporate new information to provide for healthy ecosystems, aesthetics, biodiversity, old growth, ever increasing demand from the public to provide a wider range of products, increasing number of sensitive species concerns; and increasing costs associated with timber sale project preparation.

The current age class distribution for each Forest and the portion that is short-lived forest types (such as jack pine, aspen, and paper birch) is displayed in Figures TMB-8 and TMB-9 to identify why a departure from non-declining, even flow constraints was considered for one alternative. Aspen comprises 46 percent of the Chippewa NF tentatively suitable acres and 39 percent of the Superior NF tentatively suitable acres. Jack pine and paper birch are 10 percent of the Chippewa NF and 18 percent of the Superior NF tentatively suitable acres. Thus, 56 percent of the Chippewa NF and 57 percent of the Superior NF tentatively suitable timber lands are short-lived forest types.

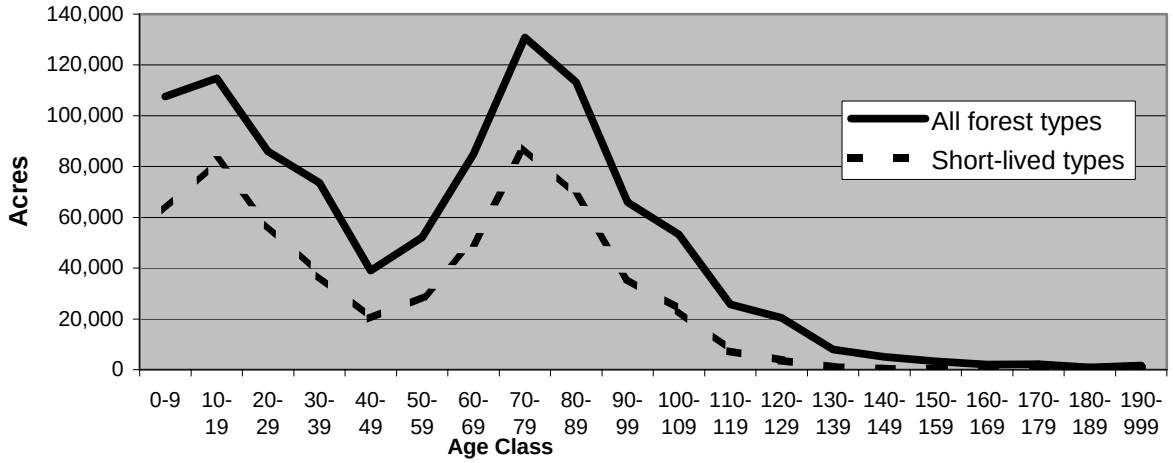
Short-lived species over 70 years of age on tentatively suitable timber land cover 40 percent of the Superior National Forest and 23 percent of the Chippewa NF. Volume losses generally increase as these forest types increase in age beyond 70 (Hahn 1982). These short-lived forest types are expected to succeed to spruce/fir or northern hardwoods within the next approximately 10 to 40 years when those species are present. When longer-lived species are not present, these forest types are likely to become poorly stocked with trees.

Average Annual Growth, Mortality, and Removals

Table TMB-10 compares the growth, mortality, and removals on the National Forests land and state-wide within Minnesota from 1977 to 1989 (more recent data are not available). Units are average annual volume of growing stock on timber lands in thousand cubic feet.

Figure TMB-8: Age Class Distribution - Chippewa NF tentatively suitable timber land

Figure TMB-9: Age Class Distribution - Superior NF tentatively suitable timber land



This comparison shows the National Forests land removals are 45 percent of the total growth, compared to 37 percent state-wide. State-wide mortality is higher than removals. Removals include harvesting, logging residue, and other removals including land use changes (land use changes were estimated at 2.5 percent). In terms of removals with harvesting as a percentage of total tree growth, more wood is growing on National Forest System land than is being removed. There is also more wood growing state-wide than is being removed.

Table TMB-10: Growth, Mortality and Removals (MCF)

	Chippewa & Superior NFs	Minnesota
Total growth	80,108	590,642
Mortality	30,159	220,800
Net growth	49,949	369,842
Removals	36,371	210,062
Removals as % of Total Growth	45%	37%

Source: 1990 FIA data
Definitions: All values are average annual in thousands of cubic feet.

Indicator 2 – Amount of Land Identified as Suitable for Timber Management

Suitable timber land is the land base on which the planned timber harvest occurs. This is tentatively suitable timber land that includes producing commercial timber for societies needs as part of multiple use management direction. This designation varies by alternative.

3.4.2.b Environmental Consequences

Effects Common to All Alternatives

The National Forest Management Act gives guidance on the amount of harvesting that should occur on national forests. Section 13 of the Act limits the amount of harvest to a quantity that is equal to or less than that which could be removed annually in perpetuity on a sustained-yield basis. The Act also allows for a departure from this non-declining, even-flow concept in order to meet overall multiple-use objectives.

Under all alternatives, the Forest Plans would direct harvest activities to minimize adverse effects on soil, water, air, wildlife, recreation, and visual resources.

Direct and Indirect Effects

Indicator 1 - Timber Sell Volume

Table TMB-11 displays the proposed annual maximum sell volumes by alternative that could be sold from lands classified as suitable for timber production. The volume numbers are based on Dualplan model outputs by decade displayed average annual volume in millions of board feet for all commercial wood products. Model outputs are projections based on a series of modeling runs. Actual sell volumes will likely fluctuate somewhat between decades from those displayed, but would not exceed the maximum sell volumes displayed and would be very similar in outputs and effects across the planning horizon (100 years).

Alternatives A and C

Compared to the other alternatives, Alternatives A and C propose the highest maximum timber volume that could be sold (Table TMB-11). These two alternatives would average between 211 and 212 million board feet total from both Forests each year for the ten decades modeled; while the average annual timber sell volume in the recent past for both Forests is 139 MMBF (Table TMB-7).

Alternative A is not the current situation but rather our best estimate of modeling how the current management direction would likely be carried forward into the future (see Chapter 2 for more details).

On both Forests, the timber sell volume in Alternative C would be higher in the first two decades than in subsequent decades (Table TMB-11). This would result in a departure from non-declining, even-flow in order to capture the volume in the first two decades that would be lost due to aspen, jack pine, paper birch, and spruce-fir stands succumbing to insects and disease as they age.

Alternative B

Compared to the other alternatives, harvest levels would be low under Alternative B.

Alternative D

Alternative D emphasizes a higher harvest level the first two decades than in subsequent decades to change the forest types to those that are less frequent today than they were during the mid-late 1800s (such as white pine, red pine, jack pine, spruce-fir, and northern hardwoods). This would result in a departure from non-declining, even-flow.

Compared to the other alternatives, harvest levels would be the lowest under Alternative D. For both Forests combined, this alternative would harvest a relatively small amount of timber in the first and second decades, and less in the later decades (Table TMB-11). These volumes would not be considered part of an Allowable Sale Quantity because producing timber products is not part of the management objectives in Alternative D.

Modified Alternative E

Modified Alternative E proposes harvest levels lower than A and C, but higher than B, D, F and G.

Table TMB-11: Annual Maximum Sell Volumes for the Chippewa and Superior NFs by Alternative (MMBF)

Decade	NF	Alternatives						
		A	B	C	D	Mod. E*	F	G
1	Chippewa	77	40	92	21	58	39	49
	Superior	138	63	187	37	102	93	93
	Total	**215**	**103**	**279**	**58**	**160**	**132**	**142**
2	Chippewa	75	40	80	14	60	43	49
	Superior	137	64	153	24	102	95	92
	Total	**212**	**104**	**233**	**38**	**163**	**138**	**141**
3	Chippewa	76	39	70	8	58	48	49
	Superior	136	63	127	11	101	92	91
	Total	**212**	**102**	**197**	**19**	**159**	**140**	**140**
4	Chippewa	77	46	70	10	59	53	50
	Superior	131	62	129	11	98	92	90
	Total	**208**	**108**	**199**	**21**	**157**	**145**	**140**
5	Chippewa	77	46	71	14	60	53	51
	Superior	135	62	130	10	103	94	93
	Total	**212**	**108**	**201**	**24**	**163**	**145**	**144**
6	Chippewa	77	47	71	11	60	54	51
	Superior	135	63	136	11	102	97	96
	Total	**212**	**110**	**207**	**22**	**162**	**151**	**147**
7	Chippewa	79	48	73	8	60	55	52
	Superior	131	64	129	11	100	96	95
	Total	**210**	**112**	**202**	**19**	**162**	**151**	**147**
8	Chippewa	78	48	69	6	60	55	52
	Superior	132	66	129	10	98	100	96
	Total	**210**	**114**	**198**	**16**	**158**	**155**	**148**
9	Chippewa	77	47	71	5	60	54	51
	Superior	132	63	135	11	101	97	94
	Total	**209**	**110**	**206**	**15**	**161**	**151**	**145**
10	Chippewa	76	46	71	5	60	54	52
	Superior	131	65	131	9	101	98	94
	Total	**209**	**111**	**202**	**14**	**161**	**152**	**146**

***** Model outputs are projections based on a series of modeling runs. Actual sell volumes will likely fluctuate somewhat between decades from those displayed, but would not exceed the maximum sell volume in any given decade.

Alternatives F and G

Compared to the other alternatives, harvest levels would also be intermediate under Alternatives F and G but lower than in Modified Alternative E

Indicator 2 - Amount of Land Identified as Suitable for Timber Management

Table TMB-12 shows the acres of suitable timber lands identified for each Alternative.

Alternatives A, B, C, Modified E, F, and G

These alternatives vary by less than ten percent in terms of acres of land suitable for timber management. The productive timber land that is in candidate Research Natural Areas (Alternatives B, D, Modified E, F and G), proposed Wilderness (Alternatives B, D and G) and the acres of near-bank riparian areas (Alternatives B, D, Modified E and G) account for the differences between these alternatives.

Table TMB-12. Acres of Land Suitable for Timber Management by Alternative							
National Forest	Alt. A No Action	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)
Chippewa	471,365	456,399	471,365	0	459,313	444,360	456,933
Superior	981,908	884,727	991,954	0	944,908	959,428	944,024
Total	1,453,273	1,341,126	1,463,319	0	1,404,221	1,403,788	1,400,957
Source: Forest Service inventory data supplied to Dualplan model, adjusted for management area acres and near bank riparian management areas.							

Alternative D

Under Alternative D, no land would be classified as suitable for timber management. While there would be timber harvest under this alternative, producing commercial wood for industry is not part of the theme of this alternative.

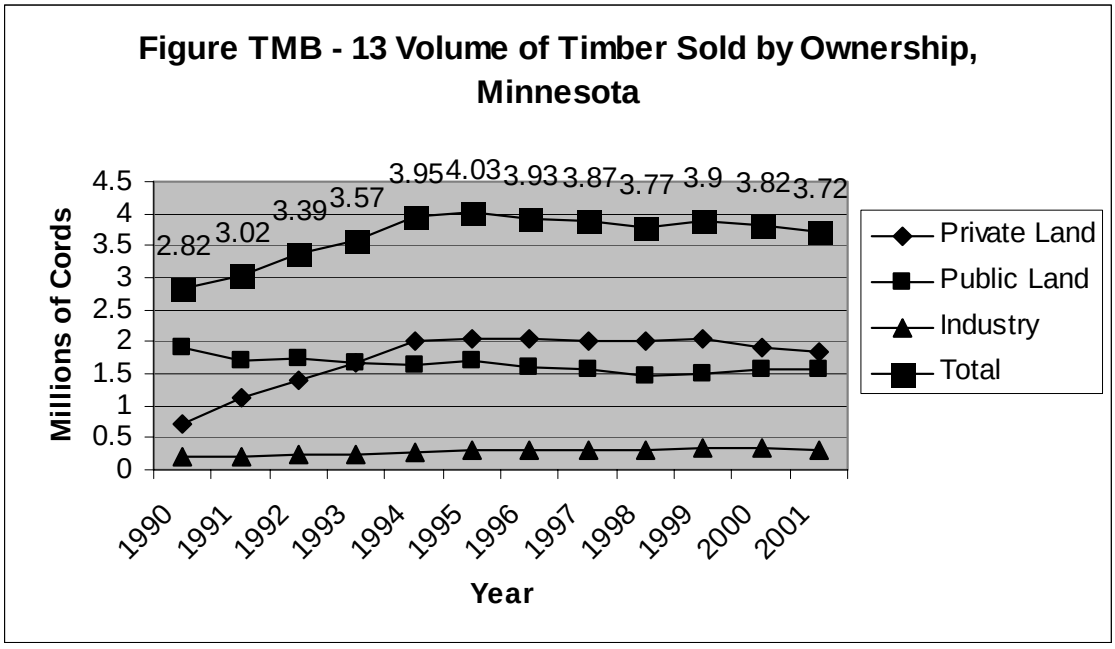
Cumulative Effects

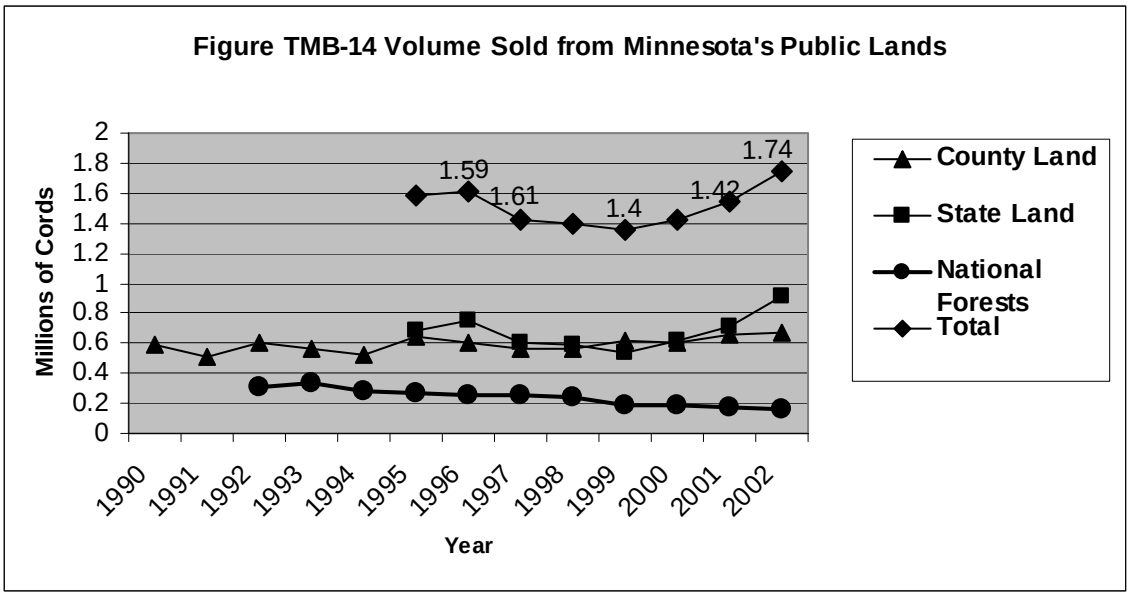
Indicator 1 - Timber Sell Volume

This indicator describes the harvest level considered for potential harvest by alternative. Harvest levels in Minnesota are not expected to change substantially in the foreseeable future unless wood processing mills are reduced.

In 2003, the Governor of Minnesota convened a Task Force to examine the competitiveness of Minnesota's forest product industries with special emphasis on conditions that can have a near term impact on "issues vital to maintaining a healthy primary forest products industry" (State of MN, 2003). Some key findings from the Task Force Report include:

- Minnesota has become a net importer of pulpwood, roundwood and chips since about 1999.
- Aspen pulpwood stumpage prices have risen significantly and are currently the highest among likely importers (Michigan, Wisconsin, Quebec and Ontario).
- Factors such as wood and fiber availability, transportation, wood and fiber quality, taxation, labor and construction costs and





forest land productivity tend to be worse in Minnesota than to other locations used as comparisons in the report.

- Global market factors (such as increased production capacity in Finland, Sweden, southeast Asia and Latin America) also influence competitiveness in Minnesota
- Minnesota exports approximately 200,000 cords (100 million board feet) of pulpwood per year, largely to Wisconsin.

Figures TMB-13 and TMB-14 are taken from the report above and are based on the data available to the Task Force at that time. Figure TMB-13 displays the volume of timber sold by ownership in the State of Minnesota from 1990 through 2001. Total volume sold from all lands combined has increased since 1990, but decreased somewhat from the peak in the mid-nineties. Reduced harvest levels on National Forest System land in the past several years as well as an increase in stumpage prices have resulted in an increase in harvest levels on private land in Minnesota and increased imports from Canada, Wisconsin, and Michigan (DNR 2002, State of MN, 2003).

Figure TMB – 14 displays the volume sold from Minnesota's public lands from 1990 to 2002. Volume sold from National Forests has decreased since 1992, but total volume from all public lands has increased since the mid-nineties. Volume sold from State lands has risen and in 2002 was at the highest level this decade.

Table TMB-15: Comparing Timber Sell Volumes with Forest Plan Revision Alternatives with Minnesota GEIS Volumes of 4.0 and 4.9 million cords

Alt.	1st decade		Average 10 decades	
	% of 4.0 million cords	% of 4.9 million cords	% of 4.0 million cords	% of 4.9 million cords
A	9%	8%	9%	8%
B	5%	4%	5%	4%
C	12%	10%	9%	8%
D	3%	2%	1%	1%
Mod. E	7%	6%	8%	7%
F	6%	5%	7%	5%
G	6%	5%	7%	5%

It is difficult to estimate the future mill needs for wood in Minnesota. The GEIS study was initiated when the mill use was near 4.0 million cords; however since the GEIS was completed in 1991, mill use has dropped. Table TMB-15 shows the amount of wood each alternative provides as a percent of two of the GEIS harvest levels (4.0 and 4.9 million cords). This approach allows a general comparison of how each alternative relates to the total mill needs within the State of Minnesota.

Alternative D would contribute the lowest amount.

Under Alternative D, mortality is expected to greatly exceed harvest on the National Forests. More harvesting would occur on other ownerships, and there would be more imports from Wisconsin, Michigan, and Canada.

Alternative B would have a low to intermediate harvest level. Mortality is expected to exceed harvest on the National Forests. More harvesting would occur on other ownerships, and more imports from Wisconsin, Michigan, and Canada.

Alternatives Modified E, F, and G would have intermediate harvest levels. Mortality is expected to exceed harvest, but not as much as in Alternatives B and D. Some of the recent shift to increased harvesting on other ownerships and more imports would continue.

Alternatives A and C would have the highest harvest levels. Growth would still exceed harvest. A return to 1996 levels of harvesting on other ownerships and imports from outside Minnesota would likely occur.

Indicator 2 - Amount of Land Identified as Suitable for Timber Management

The amount of land classified as suitable for timber management varies little between the existing condition and alternatives B, C, Modified E, F, and G. It is not expected that these differences would have a measurable cumulative effect on the amount of suitable land within the analysis area (suitable timber land on the two National Forests, plus the productive timber lands on other ownerships within Minnesota). Productive timber lands on the Minnesota National Forests are approximately 12% of the productive timber lands in the state. Proposed changes to suitability classes in Alternatives B, C, Modified E, F, and G are plus or minus less than 1% of the existing condition statewide. Alternative D removes all lands on the National Forests from lands suitable for timber production, resulting in a 12% reduction of suitable lands across the state.

3.4.3 Mix of Forest Products

Issue Statement

There are different views on what mix of forest products will adequately provide for local mills over the long term. Forest Plan revision will determine the mix of sawtimber and pulpwood that the Chippewa and Superior National Forests may supply.

Indicator – Mix of Forest Products

The mix of forest products that could be produced by each Alternative is displayed for

- Aspen pulpwood
- Hardwood pulpwood (other than aspen)
- Softwood pulpwood (spruce and fir for example)
- Hardwood sawtimber (hardwoods other than aspen) and
- Softwood sawtimber (spruce and fir for example).

The ratio of sawtimber to pulpwood is also used to show the differences between alternatives. This information highlights the differences between alternatives because it identifies the amount of each important species and product.

Scope of Analysis

Mills commonly receive forest products from harvest areas within a 100-mile radius from the mill site (this distance used to be 75 miles). Softwood sawtimber is frequently hauled longer distances. Although some wood is hauled from northern Michigan, eastern Wisconsin and Canada to mills in Minnesota, over 95 percent of the wood used in Minnesota is grown in Minnesota (DNR 2002).

3.4.3.a Affected Environment

This analysis considers the raw material supplied to wood processing mills in northern Minnesota. Some mills procure wood from both Forests and some from only one Forest. No mills rely solely on National Forest supplied wood.

Aspen, balsam fir, and spruce are the most common species used by the paper mills. Some mills can use pine and tamarack. At least one paper mill is starting to use hardwood pulpwood.

Aspen is the most common species used in making panel boards (oriented strand board and hardboard). Birch, pine, and maple are also used.

Sawmills use several species, although the greater profits are usually in higher value species such as red pine and white pine. Generally, larger diameter logs yield higher quality lumber with less milling. The following species currently make up the bulk of the species used in sawmills in Minnesota: jack pine, aspen, red pine, red oak, and birch (DNR 2002).

3.4.3.a Environmental Consequences

Direct and Indirect Effects

Harvesting on National Forest System land results in a mix of species and products. Figures TMB-16 through TMB-19 and Table TMB-20 display the mix expected from each alternative in decade one and ten. All volumes are in average annual amounts. The last column on the far right of these figures and table shows the average volume sold from each National Forest between 1992 and 2000.

Paper mills and panel board mills use sawlog material as well as pulpwood. The larger logs require less machining and as a result are more economical. Therefore, some of the effects shown for sawtimber may be less than what is displayed in the figures and table.

The harvesting that would take place in the first decade is a result of the existing forest condition and does not reflect the future direction of a specific alternative. Decade ten data displays the future direction of an alternative.

Impacts on employment and the economy are discussed in the Social and Economic sections.

Current Product Mix

A relative ranking system was used to compare alternatives with the following categories:

- "High" is 25 plus MMBF
- "Moderate" is between 10 and 24 MMBF
- "Low" is less than 10.

Data from 1992 through 2000 indicates that the Forests have been harvesting high levels of aspen, moderate levels of softwood pulpwood, and low values of other species/product groups.

Alternative A

Alternative A would harvest high levels of aspen pulpwood in both decades examined. In decade ten, the Superior NF could offer high levels of softwood pulpwood. Other species/products would be at moderate levels, with the exception of hardwood sawtimber, which would remain low.

Substantial increases in sawtimber and hardwood pulpwood would occur, compared to the historical 1992 through 2000 data. Softwood pulpwood outputs would be slightly higher than the historical period, except for decade 10 on the Superior, which would be greatly increased. Aspen harvest levels would increase on the Superior NF compared to historical levels, while very similar to past harvest levels would occur on the Chippewa NF.

This alternative would provide considerably more raw material to sawmills. Paper mills and panel board mills using aspen from the Superior NF and hardwood pulpwood from both Forests would see increased raw material.

Alternative B

Alternative B would harvest moderate levels of aspen, except in the tenth decade on the Chippewa NF, where levels would drop to low. Moderate levels of softwood sawtimber would be provided in both decades. Moderate levels of softwood pulpwood would result for the Superior NF in both decades and in decade 10 on the Chippewa NF. Chippewa NF softwood pulpwood in decade one would be low. Hardwood pulpwood and sawtimber harvests would be at low levels.

This alternative would show increased sawtimber harvest levels compared to the last ten-year values. Softwood pulpwood values would be reduced, while hardwood pulpwood values would remain the same. Aspen would be considerably less than historic levels.

This alternative would provide increased raw material for sawmills. Paper mills and panel board mills using softwood pulpwood and aspen would see considerably reduced raw material.

Alternative C

High levels of aspen would occur for both decades in Alternative C. The Superior NF is projected to have high levels of softwood pulpwood in both decades, while the Chippewa NF is projected to have moderate levels. Hardwood pulpwood levels would be high on the Superior NF in the first decade and moderate elsewhere. Hardwood sawtimber would be low. Softwood sawtimber would be at moderate levels.

On the Superior NF substantial increases would occur for all species/products in the first decade. With the exception of aspen, this would also be true for decade ten. Aspen would be at historic levels in decade ten.

The Chippewa NF data indicate a similar trend. All species/product groups, except aspen would increase compared to historic levels. Aspen would be at historic levels in the first decade and reduced in decade ten.

This alternative would provide considerably more raw material to sawmills. Paper mills and panel board mills using aspen from the Superior NF would have greatly increased raw material available the first decade, with historic levels elsewhere. Pulpwood products would be substantially higher, benefiting paper mills and panel board mills.

Alternative D

This alternative would produce moderate amounts of aspen in the first decade and low levels elsewhere. Since this alternative would reduce harvest levels after the first two decades, the amount of each species/product group would decline. Hardwood sawtimber would drop to zero and all other products would drop to very low numbers.

All species/product groups would see large reductions compared to historic levels.

The percent sawtimber would vary from 16 to 37 percent; however, the amounts are too low to be meaningful.

Raw material would be reduced for all types of mills when compared to historic levels.

Modified Alternative E

In both Decades 1 and 10, the Superior N F could offer high levels of aspen pulp; moderate levels of softwood sawtimber, softwood pulp and hardwood pulp; and low levels of hardwood sawtimber. In Decade 1 the Chippewa N F could produce moderate levels of softwood sawtimber, softwood pulp, hardwood pulp and aspen pulp and low levels of hardwood sawtimber. In Decade 10 the Chippewa National forest could produce moderate levels of softwood sawtimber, softwood pulp and aspen pupl and low levels of hardwood sawtimber and hardwood pulp.

Alternative F

High levels of aspen would be available on the Superior NF and low levels in decade ten for the Chippewa NF. In decade 1, low levels of all species/product groups with the exception of aspen would be available on the Chippewa NF. Aspen would be moderately available. Decade ten on the Chippewa NF would also have low values for hardwood products. The Superior NF would have low values for hardwood sawtimber. All other species/products on both Forests would be moderate.

Compared to historic levels the amount of sawtimber would be considerably increased, although decade one hardwood sawtimber on the Chippewa NF would be similar to past values. Pulpwood products would be near historic levels for the Superior NF, but reduced for the Chippewa NF. Aspen would be considerably reduced on both Forests.

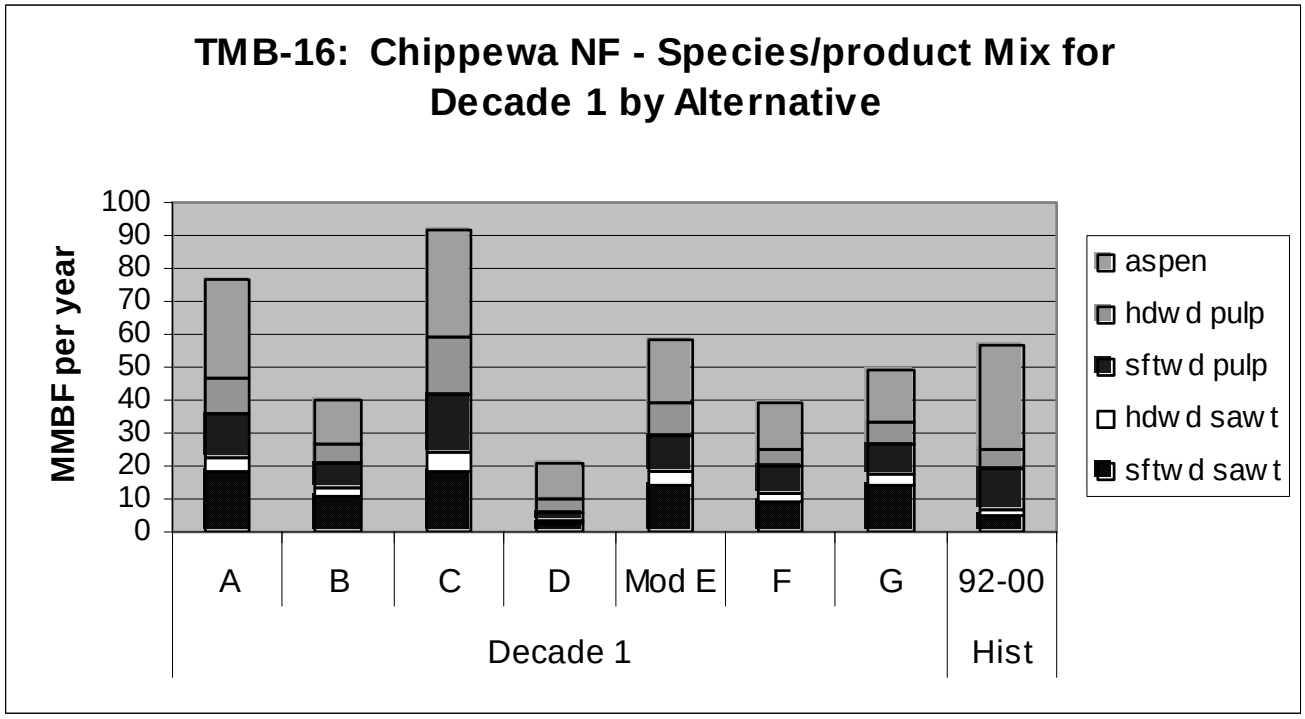
This alternative would provide increased raw material for sawmills. Mills relying on pulpwood and aspen from the Chippewa NF would have reduced raw material available. The mills obtaining pulpwood from the Superior NF would have raw material at historic levels. Mills using aspen from the Superior NF would have reduced material available.

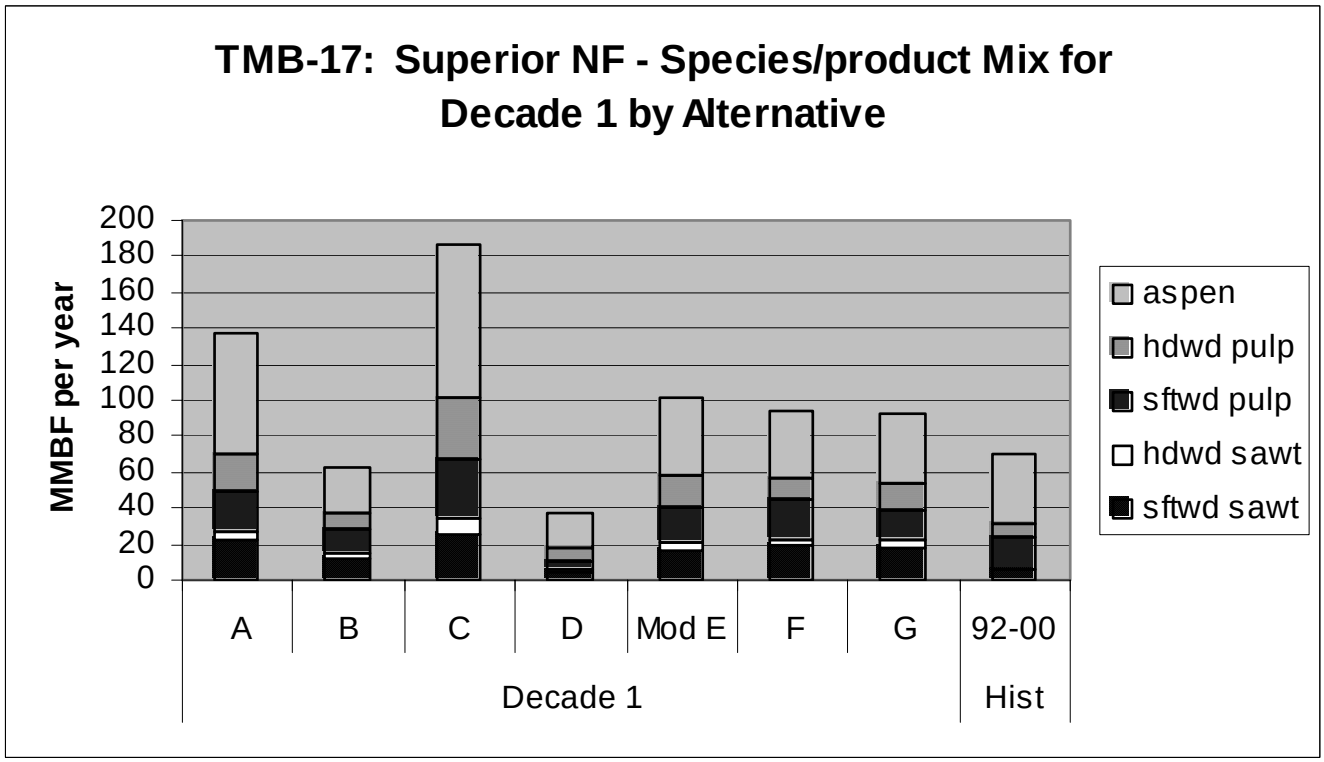
Alternative G

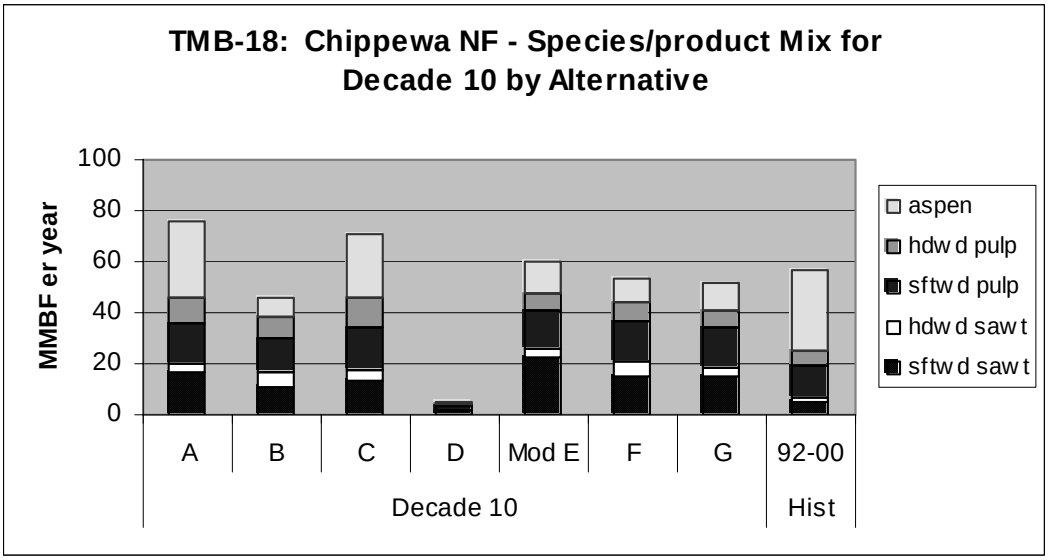
High levels of aspen would occur for the Superior NF. Low levels of hardwood sawtimber would occur for both Forests. Low levels of pulpwood would occur for the Chippewa NF. All other values would be moderate.

Compared to historic levels the amount of sawtimber would increase considerably. Pulpwood levels would be similar to the past. Aspen levels would be considerably less.

This alternative would provide increased raw material for sawmills. Mills using softwood and hardwood pulpwood would have raw material available near historic amounts. Those mills using aspen would see considerable reductions in raw material available.


TMB-16: Chippewa NF - Species/product Mix for Decade 1 by Alternative
MMBF per year
100
90
80
70
60
50
40
30
20
10
0
A
B
C
D
Mod E
F
G
92-00
Decade 1
Hist
aspen
hdw d pulp
sftw d pulp
hdw d saw t
sftw d saw t


TMB-17: Superior NF - Species/product Mix for Decade 1 by Alternative
MMBF per year
200
180
160
140
120
100
80
60
40
20
0
A
B
C
D
Mod E
F
G
92-00
Decade 1
Hist
aspen
hdwd pulp
sftwd pulp
hdwd sawt
sftwd sawt



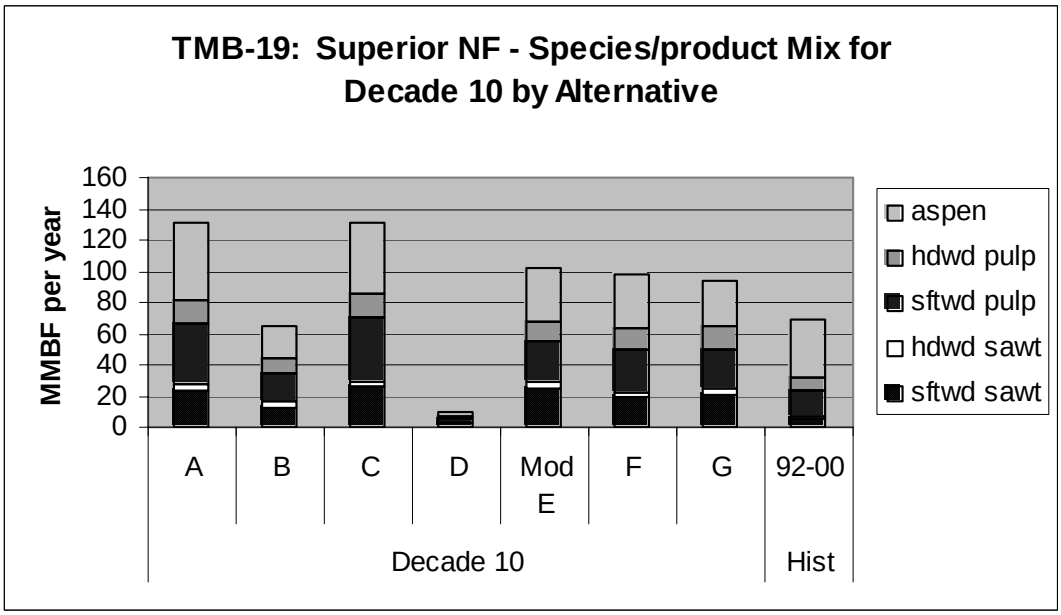


Table TMB-20: Ratio of Sawtimber to Pulwood by Alternative Decades 1 & 10

National Forest	Alt. A No Action	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G	1992-2002
Decade 1								
Chippewa	29:71	34:66	26:74	16:84	32:68	29:71	35:65	12:88
Superior	19:81	24:76	18:82	16:84	21:79	24:76	23:77	9:91
Decade 10								
Chippewa	27:73	36:64	25:75	37:63	43:57	40:60	36:64	12:88
Superior	21:79	25:75	22:78	35:65	28:72	23:77	26:74	9:91

Source: Dualplan output and cut report.

Cumulative Effects

It is difficult and there is uncertainty about making future predictions of species/product supply and use associated with the alternatives.

The cumulative effects of total wood supplied to industry are discussed under Section 3.4.2 Timber Supply. The point made in that section relating to wood supplied from private land and imported from outside Minnesota also applies to individual species/product groups. (Also consult the social and economic section for effects on income and employment.)

In the past, mills have typically adapted to supplies of different species/products. The GEIS indicates mills plan to replace aspen with hardwoods as the age class imbalance of aspen causes reductions in availability of aspen.

The Minnesota Forest Resource Council Landscape Committees' recommendations indicate conifers and multi-aged stands will increase in the future at the expense of aspen cover types. This will likely hasten the effect of replacing aspen with other species/product groups as discussed in the preceding paragraph and make the replacement long term.

Alternatives A and C would provide historic or higher levels of each species product, which is expected to reduce the amount of wood from other ownerships and the amount of imports from Wisconsin, Michigan, and Canada.

Alternatives B, F, and G would increase the amount of sawtimber and reduce the amount of aspen which is expected to have a corresponding reverse effect on wood procurement from imports and other ownerships.

Alternative D would generally reduce all species/product groups from historic values, effectively removing these two National Forests from supplying wood to industry. Thus, imports and other ownerships would become the source of raw material for industry.

Modified Alternative E would generally increase all species/product groups except on the Chippewa NF where aspen would be greatly reduced. Mills procuring wood from the Superior NF would likely reduce imports and procurement from other ownerships and increase aspen from these sources near the Chippewa NF.

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