Appendix F

Timber Markets and Practices

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CHAPTER 1.0 INTRODUCTION

The UPM/Blandin Paper Thunderhawk Project will operate in a greater Minnesota forest products industry context if implemented. This appendix provides an overview of timber harvesting in terms of: wood supply and demand, forest practices, UPM/Blandin Paper forest management, and forest health.

1.1 TIMBER HARVESTING – SUPPLY AND DEMAND

1.1.1 TIMBER HARVEST IN MINNESOTA

The management of forestlands in Minnesota (including timberlands whose wood may be used at the UPM/Blandin Paper) is an ongoing activity. Harvest of any given stand occurs at the discretion of the landowner, whether public or private, and is subject to the management prescriptions needed to meet the landowner's goals for site-specific cases. This means that over time some stands classified as timberland may be harvested repeatedly while others may never be harvested. In addition, industrial demand for wood species as a raw material varies according to a number of factors, including changes in harvesting technology, new mill technology, transportation costs, production capacity, product demand, and macroeconomic factors such as global markets. Industrial users in this region (Lake States[1] and Canada) compete in a market setting for access to the available raw timber material supply across Minnesota. This competition results in a very dynamic market that makes it impossible to isolate the timing and location of timber harvest connected with any wood-using mill, including the UPM/Blandin Paper facility.

1.1.2 REGIONAL INDUSTRY OVERVIEW

Minnesota pulpwood[2] users face a competitive environment that can be understood through examination of regional forest industry trends. In the northeast and north central part of the United States, inventories of both softwoods and hardwoods have been slowly increasing over the past several decades and are projected to continue to do so into the future. Softwood net annual growth and annual harvest is projected to remain relatively constant. However, the ratio of hardwood growth to harvest is expected to decline as increasingly tight harvest levels escalate while annual growth declines in future decades due to shifts in land use. Increasingly, surplus wood flows from one region to another to offset increased demand or price differentials; see Table F-1.

[1] Lakes States are those states that border the Great Lakes: Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York.

[2] Pulpwood is defined as roundwood, whole tree chips, or wood residues that are used for the production of wood pulp, and other reconstituted board products including oriented strandboard, particleboard, or engineered lumber.

Table F-1
USFS Resource Planning Act Timberland Change Projections to 2050 for Key Metrics

Northeast and North Central US	Base Year	RPA Projections				
	1997	2010	2020	2030	2040	2050
Softwoods						
Harvest	825	817	786	790	806	818
Growth	1,175	1,199	1,158	1,108	1,058	1,017
Inventory	49,376	56,742	61,201	65,206	68,480	71,532
Hardwoods						
Harvest	2,713	3,070	3,341	3,639	3,869	4,113
Growth	4,169	4,126	4,060	3,955	3,830	3,697
Inventory	164,905	195,597	212,565	226,549	238,029	247,573

Source: RPA General Technical Report PNW-GTR-560, 2003, USFS (in million cubic feet)

Pulp producing mills use 80 percent of the non-sawtimber[3] harvest material at present in the northern United States. Although pulpwood consumption by mills has been on a slow decline, this decline is being offset by increased fiber demand in the oriented strandboard (OSB) industry. In Minnesota, pulp mills and facilities that manufacture structural panel and I-joist[4] materials consume equal quantities of non-sawtimber-type wood (e.g., 50:50 ratio).

Minnesota's pulp and paper industry is an important part of the northern Minnesota economy (MFRC/UMD, 2001). The northern market share for pulp and paper producers is shifting to other regions; these are both national and international shifts. Several factors negatively affect Minnesota and other regional mills including:

(a) The increased use of chemical fillers and recycled fiber;

(b) The competition among forest values reducing fiber production emphasis; and,

(c) The loss of market share due to limited capacity manufacturing facilities that can no longer compete with newer, low-cost facilities in other regions (both nationally and internationally).

This last factor is most critical to Minnesota's pulp and paper manufacturing sector. Minnesota's pulp and paper capacity has not been retooled and restructured on a scale similar to what has already happened in Europe or the U.S. South. Although some change has occurred, it is not to the degree that is needed for Minnesota-based industry to remain competitive in a global market place.

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3 Sawtimber is a log or tree that is large enough (usually 10 to 12 inches in diameter) to be sawed into lumber. Minimum log length is typically 8 feet.

4 An I-joist is defined as the wood, steel, or concrete beams set parallel from wall-to-wall or across or abutting girders to support a floor or ceiling.

In an RISI (2004) study, northern pulp and paper mills were analyzed in a number of ways, including a mill closure risk class. Certain grades of paper have narrow ranges between high- and low-cost producers, while others, such as producers of uncoated freesheet grades of paper, have cost differentials of $450 per ton between low- and high-cost producers. Five of the eight U.S. mills classified by RISI as high risk for closure are located in Wisconsin and Minnesota.

The industry must modernize and restructure paper-producing capacities in order to remain viable in the larger regional and global market setting. Certain mills are in better positions to do this, especially where facilities have highly competitive modern machines operating with older, high-cost machines. Regarding UPM/Blandin Paper's current operation, the mill relies on the "newer" PM6 and "older" PM5 for paper production. The mill has a relatively large per ton spread in costs between the modern machine and old machine, which provides a modernization opportunity.

1.1.3 ESTIMATE OF MINNESOTA WOOD USE

The DEIS relies on the most recent wood use data as compiled by the DNR in its Minnesota Forest Resources (2004) report. In the DEIS, the import-export balance is held constant to better determine the environmental impacts under the Build and No-Build Alternatives. Table F-2 illustrates the overall statewide wood supply-demand balance. In considering this information, it is important to understand that today's economies function increasingly at a larger regional and international scale. The values presented in Table F-2 represent a snapshot in time; wood flows in fact are very dynamic.

Table F-2

2002 Minnesota Wood Use [5]

Minnesota Wood Consumption (all uses)	Cord Units[1]
Current MN roundwood demand	4,175,000
DNR base case MN harvest (No-Build Alternative)	3,675,000
Exports estimate (DNR data)	125,000
Imports estimate (DNR data)	625,000
Roundwood wood demand under the Build Alternative	4,372,000
MN harvest with the Build Alternative	3,872,000
Exports estimate (DNR data)	125,000
Imports estimate (DNR data)	625,000

[1] *DNR 2004 Forest Resources Report*

[5] Most recent available data.

In mechanical grades of paper production, there is limited room for species substitution due to process and product quality constraints. The kraft mill and engineered wood industries have more latitude to shift between species.

1.1.3.1 Aspen Utilization in Minnesota

The GEIS assumed that significant shifts to use of species other than aspen would occur as part of its analysis. The *Minnesota Timber Harvesting GEIS: An Assessment of the First 10 Years* (GEIS Report Card) reported that large-scale substitution of other species for aspen in the engineered wood industry did not happen prior to 2001. However, in the past three years significant changes were made as engineered wood plants are now using 31 percent non-aspen species according to interview information. These non-aspen species are primarily birch and balm, but also include pine, red maple, tamarack, ash, basswood, and balsam. The ratio of use of aspen to other species, which are typically a mix of hardwoods and limited amounts of pine, in Minnesota's kraft pulp mills is 65:35.

Further shifts in wood-use by kraft and engineered wood mills that favor non-aspen mixed hardwoods are ongoing, but aspen will remain the preferred species, especially for the engineered wood users. Aspen has excellent pulp and papermaking qualities, as well as having excellent wafer production properties. Aspen trees debark easily, are relatively straight, and contain an average of 15 cubic feet of wood under bark, where as pulp size birch and maple tend to be crooked and contain only an average of five to six cubic feet per tree. These differences, coupled with different drying cycles, slow down and complicate the production process, and can impact quality standards if not done properly. For kraft mills, there appear to be good opportunities for increased use of ash, tamarack, and maple because stumpage prices are relatively low and there are significant surpluses.

Despite the high aspen stumpage prices, the aspen to other hardwood pulp stumpage price ratio is currently still at 2.5:1. This is indicative of the process and product importance of aspen fiber. UPM/Blandin Paper has no direct control over shifts in demand and species use by other industries. These shifts will continue based upon mill processing modifications to take advantage of lower cost fiber species. The DEIS examines the issue of shifts in existing species use and alternate species for the proposed project; this occurs in Section 5.1.4.5.

1.1.3.2 Roundwood and Residual Chips – Minnesota Imports and Exports

The globalization of many industries including the forest products industry has been a difficult concept to understand. Until recently, Minnesota forest industries have been more isolated from the east and west coast regions of the U.S. and other parts of the world.

Due mainly to tight aspen supplies, Minnesota will likely average a high net import of wood annually into the near future. Below are several comparisons to other regions.

<u>Annual Trade Balance (Exports-Imports) Cords</u>

- Russian Federation (2003) + 13,600,000*
- European Union (2003) - 10,800,000*
- USA (2010 RPA projection) - 47,019,000*
- Maine (2001) - 1,255,000*

* *Note that negative numbers represent net importers and positive numbers represent net exporters. Conversion used 2.55 solid cubic meters of wood = 1 solid cord of wood, over bark.*

Forest product companies within the European Union have some of the world's best technology and operate at high levels of profitability despite reliance on imported wood.

1.1.3.3 Roundwood Imports from Canada

The availability of timber from public lands in Minnesota has been relatively fixed for some time. The DNR and counties have gradually increased timber outputs over the past five years; however, these increases have been offset by lower outputs from the national forests. In 2001, average stumpage prices for aspen from Minnesota public timber auctions reached a level where they exceeded Canadian stumpage prices, plus harvesting cost and rail rates combined. In 2001, Ontario aspen stumpage prices averaged about $35 per cord less than Minnesota public timber auction prices. Favorable exchanges rates have also been an incentive for Minnesota roundwood-based industries to consider utilization of Canadian timber resources.

Securing additional non-industrial private forest (NIPF) sources of wood in small lots can be a costly, time-consuming activity, while Canadian sources of aspen have been available. Therefore, industry has chosen to buy surplus wood from other regions (Canada, Southern U.S. and Eastern U.S.), resulting in significant wood procurement cost savings. If fiber supplies tighten in Canada and other regions, then these sources may become economically or legislatively unavailable in the future.

In the market for roundwood and chips, industrial users in this region (adjacent Canada and Lake States) compete for access to the available supplies of wood across the entire region based on cost, quality, and reliability of supply. This competition results in a very dynamic market, which is difficult to predict accurately future import and export balances.

1.1.3.4 Comparison of Key Timber Indicator Metrics

Standing timber inventories, annual net growth of forests, annual harvest removals, and net growth per unit of forestland are useful forest metrics for analyzing the sustainable supply-demand situation in Minnesota. Comparisons to other regions add perspective on this issue; see Table F-3.

Table F-3

Regional Comparative Forest Metrics

U.S. Timberland Regions and Ownership Class	2002 Growing Stock Inventory (billion cu ft)	2003 Net Annual Growth (billion cu ft)	2003 Annual Harvest (billion cu ft)	2003 Annual Net Growth (cu ft/ac/yr)	2003 % of Lands Capable of Growing 50+ cu ft/ac/yr
US Northeast Private	90.5	1.81	0.88		
MN Private	7.41	0.22	0.14	36	57
US North Central Private	62.7	1.37	0.99		
MN Public	7.86	0.16	0.12	20	49
US South Private	189.9	1.99	3.08		

Combination of 2002 RPA, 2003 RISI, and 2003 FIA data sets. Public forests subtracted from regional figures to focus on private lands.

When comparing growth to harvest ratios, Minnesota's forests are close to the national average, for growth to harvest rations. Minnesota's ratio is 63.6 percent of annual grown harvested on private lands and 75 percent for public forests. Private lands in other north central states average 72.3 percent of annual growth harvested; see Figure F-1, Growth to Harvest Ratios. The FIA data shows that a little over 50 percent of Minnesota's forests will grow significantly more wood than under current conditions. Current growth is limited because there is still an excessive amount of old forest stands that are in a state of growth decline. As the older forest areas are harvested, annual growth rates are projected to increase.

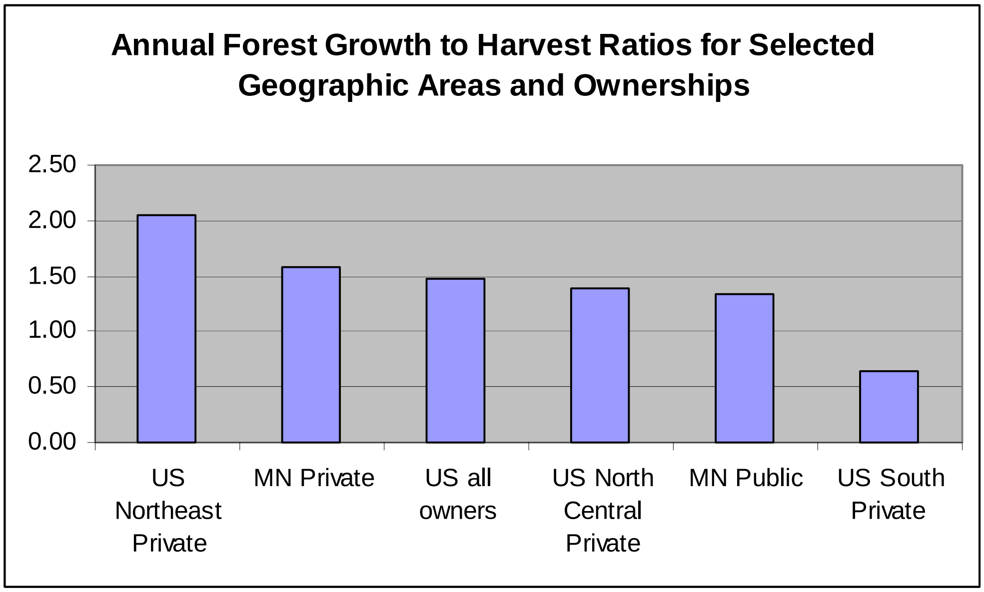
1.1.3.5 Productivity of Private Lands

As just noted, Minnesota's timberland resources on private lands are slightly more productive than other regions on comparable ownerships. Further investigation can be done by comparing FIA data for public and private forestlands. Considerations include:

- Based on site index measurements, 57 percent of private forestlands are capable of producing 50+ cubic feet of wood per acre per year as compared to 49 percent for public forests.
- Private land net growth is 0.46 cords/acre/year – 77 percent higher than on public lands. On FIA plots, most net growth shows up on 30- to 60-year age classes, as younger stands have not yet reached measurement stages and older stands have declining growth rates. When considering net growth within just those age classes, private lands have a growth rate of 0.58 cords/acre/year and public lands show 0.31 cords/acre/year. Note that public forest areas often have inherently lower productivity. For example, the DNR lands include approximately 43 percent of the lowland conifer forest types in Minnesota, which are slower growing thus less productive. FIA measurements are limited and trends change with new data. As younger stands on public lands come into growth measurement stages, expectations are that growth measurements will improve.

The comparatively favorable growth to harvest ratios on private lands, current growth, and potential growth, all indicate that the private forest sector is likely to be a focus of industry sourcing opportunities, including wood to supply the proposed project.

Figure F-1
Growth to Harvest Ratios



Continuation of current public forest management policies also have a direct bearing on the likelihood that the additional wood for the proposed project will largely come from private lands. Minnesota has the highest annual mortality to net growth ratio of any state east of the intermountain region; a prime indicator that Minnesota's forests are continuing to get older causing forest health issues. As noted above, the annual mortality to net growth ratio is skewed because there has been a lot of cutting over the past 10-15 years that has yet to show up in the growth data because it is too young/small to be counted by FIA. Higher timber prices are likely to result in new forest management investment opportunities, by enticing more private forest landowners to harvest timber on their lands. Resultant intensified forest management could support economic development by increasing timber outputs from both public and private forests, while also contributing to other wildlife, ecological, and forest health values.

In 2003, Minnesota's Governor formed the Governor's Advisory Task Force[6] to report on Minnesota's competitive position within the forest industry as compared to 13 other states and countries. In the category of forestland productivity, 12 of 13 surveyed locations rated better than Minnesota. The DNR and most county agencies indicate they currently are reviewing management options within the context of balancing the many demands on public forestlands, including providing opportunities for improving timber and forest productivity. However, in the current situation public agencies have limited plans to

[6] Governor's Advisory Task Force Report on the Competitiveness of Minnesota's Primary Forest Products Industry; July 2003

intensify forest management activities. Therefore, most of the aggregate increase in statewide timber harvest associated with the Project will likely be sourced from non-public ownerships. Even with intensified management, additional wood from state lands is likely to be modest in the overall picture.

1.1.4 FOREST PRACTICES OVERVIEW – MINNESOTA

1.1.4.1 Private Logging Firms

There are between 500 and 700 logging companies in Minnesota that employ from one to twenty (or more) people. There are many part-time contractors, but the majority are full-time operators that harvest wood. Mechanization has resulted in a significant increase in wood output per employee in the past 20 years.

Full-time logging firms and many part-time loggers are members of the Minnesota Logger Education Program (MLEP). Program members participate in annual training to maintain their logger training certification. A current logger education certificate is required to sell wood to all large- and mid-sized wood-using firms within the state. UPM/Blandin Paper requires additional annual training in certain areas for contactors and their employees operating on UPM/Blandin Paper land or permits. The additional training improves their environmental management system and meets forest certification requirements.

1.1.4.2 Harvest Methods

There are many variations of forest management prescriptions and harvesting methodologies. These can be categorized into four general cutting prescriptions and four basic types of harvesting systems.

Cutting prescriptions[7] include:

1. Clear-cutting/clear-cutting with residuals: Most trees are cute within an area. With the application of the site-level guidelines, these types of cuts generally have scattered and/or patches of live- and dead-leave trees for wildlife and reseeding purposes;
2. Partial retention: Most trees are cut within an area. However, a larger percentage of trees remain than with clear-cutting, but overall the percentage of trees left for wildlife and reseeding purposes is small. Retained trees are usually scattered across the harvest area;
3. Thinning harvests: A tree removal practice that reduces tree density and competition between trees in a stand. Thinning concentrates growth on fewer, high-quality trees, provides periodic income, and generally enhances tree vigor. Heavy thinning can benefit wildlife through the increased growth of ground vegetation;
4. Selective harvesting: Removal of certain trees in a stand as defined by specific criteria (species, diameter at breast height, or height and form). It is analogous to highgrading.

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[7] Source: Status of Minnesota Timber Harvesting and Silvicultural Practices in 1996, MFRC report

Due to the short-lived, even-aged nature of most northern forest types, plus the advanced age of many stands, clear-cutting/clear-cutting with residuals is the most common treatment followed by partial retention. Treatments falling into the thinning and shelterwood class have had more limited uses. However, opportunities for increasing their use do exist, depending on changing management attitudes, equipment configurations, training, and economic models.

Harvesting systems include:

- Chainsaw and cable skidder
- Mechanized systems consisting of a feller-buncher, a grapple skidder, a mobile delimber, and a road-side slasher for cutting up trees
- The same mechanized equipment mix as above (number 2) without the road-side slasher for tree length operations
- The cut-to-length (CTL) system

A small percentage of the wood is harvested by the chainsaw and cable skidder method, but this is manually intensive. In small private ownerships, in farm woodlots, and in the southeast hardwood region, this method will continue to be important and useful.

The majority of wood is harvested by the mechanized systems (feller-buncher, grapple skidder, mobile delimber, roadside slashing, or the tree-length variation). Important advantages of this system are:

- It is a high production, low cost method.
- It is best suited to large hardwood trees having crooked stems and large limbs. Since a good share of the northern forest areas have an abundance of these types of trees in older stands, the system can serve large owners and extensive forest areas well.
- It is ideal for clear-fell operations and in areas where one of the objectives is to clear the site for replanting.
- Operators can be semi-skilled. The problem with shortages of timber harvest operators can be partly satisfied by bringing in labor from the construction industry during the winter months, when most harvesting is done.
- Its major disadvantage is that it is not suitable for many partial harvest situations or treatment of small tract sizes.

The CTL system has a small but increasing presence. Currently, approximately 12 percent of wood is harvested using this system. UPM/Blandin Paper has increased CTL sytem use from 40 to 50 percent. It is important to understand more about this emphasis by UPM/Blandin Paper in relation to the proposed project. Much of the additional wood required in the proposed project will come from small private landowners, and a significant portion will likely come from selective or partial harvests. The main reasons that this emphasis on CTL by UPM/Blandin Paper has relevance to the Project is: (1) The CTL system is designed to operate on much smaller tract sizes than the more conventional large scale harvesting systems; therefore, the CTL system is highly compatible with the small tract sizes that dominate private ownerships. (2) Many private owners prefer alternatives to clearcutting and the CTL system combined with well-trained operators can provide owners with thinning and partial cut harvest outcomes tailored to the owners' wishes. (3) Many forest types in central Minnesota contain more of a mix of hardwoods and aspen that may be more adaptable silviculturally and ecologically to partial harvest methods that are best done either manually or with the CTL system.

CTL is a two-person, two-machine system that processes trees at the stump to the desired product types and sizes, and then forwards the products to the roadside. The system was designed for managing tree spacing, improving forest productivity, and improving wood quality throughout the life of forest stands.

The advantages of a CTL system are:

- It is ideal for low impact needs, product merchandizing, and selective harvesting.
- It is more versatile, which is better for leaving advanced reproduction undamaged.
- More efficient in smaller harvest sizes where more moves are required.
- It has lower fuel consumption.
- Landowners often prefer the aesthetic outcome, versus a clear-cut harvest method.

The disadvantages of a CTL system are:

- It has a higher per unit clear-fell wood production cost.
- It is not well suited to over-sized, large limbed hardwoods or excessive numbers of very small stems.
- It requires highly skilled operators. In addition, there are adaptability challenges with computer systems and wood reporting/GPS tracking capabilities.
- It requires year-round operation to offset high capital and operator costs.

1.1.4.3 Related Industry-wide Wood Supply Chain Challenges

From a timber harvesting and forest management perspective, one of the biggest challenges is to better balance wood consumption with opportunities to manage all forest types on the landscape across all ownership classes. For example, balsam fir procurement largely depends on aspen harvest; this is because approximately half of the balsam fir resource volume is contained within the aspen forest type. Forest management and industrial wood procurement of many other tree species has an association with aspen. Much of the soft maple, birch, and balm volumes are located within the aspen cover type, or in smaller, adjacent cover types. Therefore, aspen stands generate the timber supply flow of many other species, especially pulp/OSB quality hardwoods and pulp, and balsam fir and white spruce for pulp & paper markets.

Other challenges are presented by the shortage of total logging capacity, especially in newer technologies and appropriately trained operators. Vocational school programs that interest young persons to enter the business are limited, perhaps because logging is not thought of among the general populace as a skilled, full-time profession even though there is a shortage of skilled labor. As noted in the GEIS Report Card, 65 percent of harvest sites are restricted to frozen ground conditions. Summer/fall season operability could be higher than current levels, but not enough investments are made in all-season access trails and low-impact equipment. This means that loggers must harvest 65 percent of wood in a matter of 14 weeks or less, during the winter months. Full-time logging is, in many ways, part-time work. All of the above represent serious challenges for the logging and forest products industry.

1.1.5 FOREST MANAGEMENT ON UPM/BLANDIN PAPER LANDS

1.1.5.1 Description of Company Lands

The Blandin Paper Company lands (193,340 acres) are comprised of 9 percent plantations (mostly white spruce, *Picea glauca*) and 91 percent natural forests and wetlands. Of the 91 percent natural forest (in a landscape perspective), 52 percent are plant communities that are mainly comprised of aspen (*Populus tremuloides*), birch (*Betula papyrifera*), spruce (*Picea glauca*), and fir (*Abies balsamea*); 22 percent are northern hardwood communities comprised of sugar maple (*Acer saccharum*), basswood (*Tilia americana*), and yellow birch (*Betula alleghaniensis*); 15 percent are pine communities comprised of red pine (*Pinus resinosa*), white pine (*Pinus strobus*), and jack pine (*Pinus banksiana*); and 11 percent are non-forested wetlands and sensitive forested wetlands (northern white cedar, *Thuja occidentalis*). Forests studied vary from pure stands to mixed species, and all together contain 21 different tree species, numerous shrub species, and several hundred forb species.

1.1.5.2 Forest Age Classes

The company's forestland exhibits the following age class distribution:

Current Age Classes

- 0-49 = 64 percent
- 50-79 = 22 percent
- 80-99 = 8 percent
- 100+ = 6 percent

1.1.5.3 Habitat Typing Approach

Reserve area set-asides have been instituted to provide opportunities for development of older growth stages in northern hardwoods, forested wetlands, and non-forested wetlands. This is necessary because previous management efforts resulted in a deficit in stands with characteristics that can be managed to resemble older growth stages. The lack of a seed source and pure stands do not allow this to occur. Reserve area set asides total 24 percent of the land base with the balance managed for pulpwood and value-added products.

Company land managers consider habitat type in their decisions on where to use a life-cycle management approach. Attempts are made to balance productivity with ecological considerations. Management emphasis is to capture the natural productive capacities of best site lands (about 52 percent of productive land) to grow the most wood for mill use and trading stock while providing a reasonable financial rate of return. This requires combining habitat typing and ecological management with semi-intensive silvicultural practices. The ecological goal over a 50-year period is to gain similar biodiversity and successional conditions to non-managed (custodial approach) 65-year-old stands. Higher quality wood is expected to be obtained in shorter timeframes through the use of ecological principles, which is the principal focus the life-cycle approach.

The "Habitat Type" (plant classification) forest classification system was developed by Dr. John Kotar (Kotar and Burger, 2000). This has been combined with traditional forest cover types and soil typing in a nearest neighbor approach to create ecologically based forest capability map units. Lands were then divided into ecological capability classes. From this point, Class 1 and 2 were targeted for a life-cycle approach; see Table F-4 and Table F-5. Repeated exams are made of each stand of trees during its natural lifetime and appropriate action is taken, if needed; measures include regeneration success monitoring, pre-commercial spacing, commercial thinning(s), and regeneration harvest. In certain cases, this harvest may be preceded by silvicultural treatments designed to assist natural reforestation processes. An example might be scarification of the forest floor using anchor chaining to expose mineral soil for seedbed development in oak or mixed-conifer forest types.

Life-cycle forestry means each forest parcel will be entered 3-5 times during its lifetime, from seedling to regeneration harvest. Some sites may only need attention at regeneration harvest, then a check for survival/regeneration in the next couple of years. However, most sites will need to be given a pre-commercial thinning/spacing, possible commercial thinning, and some will see several thinnings. Site index 70[8] has been the lower limit for pre-commercial aspen thinning. Northern hardwoods on rich habitat types are managed in an all-age system, with continuous cover. Rich habitat types typically have a more well defined soil profile that is rich in nutrients, are moist, and have good drainage versus poorer habitat types that are lacking in one or more of the above conditions.

Whenever feasible, loggers perform silvicultural stand treatments before or following harvest, or before leaving the site, for maximum cost efficiency. Mixed stands of aspen, balsam fir, and spruce, when occurring on certain habitat types, will be the focus of this management template. These stands offer the greatest opportunity to gain or restore conifers by using alternative cutting patterns and natural regeneration by seeding, limiting aspen suckering, and follow-up supplemental tree planting. Gains in species diversity are one result, such as the reintroduction of white pine on appropriate sites where it is not currently found. Other considerations are neighboring ownerships, structural diversity of neighboring forest areas, and forest certification requirements.

[8] Site index is defined as a species-specific measure of actual or potential forest productivity, expressed in terms of the average height of the taller trees of that species within a specific forest stand at a base age of 50 years.

Table F-4
Management Strategy Matrix

	CLASS 1 Production Forests	CLASS 2 Quality Forestry	CLASS 3 Maintenance Forestry	CLASS 4 Special Management Areas
Physical Description	Highly suited to aspen and/or spruce/fir establishment • Planted forests • Idle Ag-lands	Above average productivity potential, mostly upland sites	Below average productivity potential, many lowland sites	Unique areas: old forests, biotopes, corridors, etc.
Goals	Maximum volume growth in least time; quality and uniformity of fiber.	Capture natural forest value and volume potential. Practices emulate nature at key times in structural development; wood quality	Harvest and regenerate; selective harvests possible. Low inputs, multiple use	Protect and enhance biodiversity, social stewardship
Habitat Types	ATiCa, ATiPo, AAbAa, AbArAo, AbFnAu, AbThSp	AtiCa, AtiPo, AAbAa, AbArAo, AbFnAu, AbThSp, AbArV, AbArV-Ly, FnTiAt, AbPiV, AbPiG, AbPiP1	AbThLe, AbFnThAn, AbFnThAn-Moss, FnLa, PmCh, PmP1	Any

Table F-5
Habitat Type Codes

Habitat Code	Tree Species
AbPiPl	*Abies balsamea, Picea glauca, Pleurozium spp.*
AbPiG	*Abies balsamea, Picea glauca, Gaultheria procumbens*
AbPiV	*Abies balsamea, Picea glauca, Vaccinium angustifolium*
AbArV	*Abies balsamea, Acer rubrum, Vaccinium angustifolium*
AbArV-Ly	*Abies balsamea, Acer rubrum, Vaccinium angustifolium, Lycopodium spp. variant*
AbArAo	*Abies balsamea, Acer rubrum, Apocynum androsaemifolium*
AAbAa	*Acer saccharum, Abies balsamea, Aralia nudicaulis*
ATiCa	*Acer saccharum, Tilia americana, Polygonatum pubescens*
ATiPo	*Acer saccharum, Tilia americana, Caulophyllum thalictroides*
FnTiAt	*Fraxinus nigra, Tilia americana, Athyrium filix-femina*
AbFnAu	*Abies balsamea, Fraxinus nigra, Asarum canadense*
FnLa	*Fraxinus nigra, Laportea canadensis*
AbFnThAn	*Abies balsamea, Fraxinus nigra, Thuja occidentalis, Alnus rugosa*
AbFnThAn-Moss	*Abies balsamea, Fraxinus nigra, Thuja occidentalis, Alnus rugosa, moss variant*
AbThSp	*Abies balsamea, Thuja occidentalis, Sphagnum spp.*
AbThLe	*Abies balsamea, Thuja occidentalis, Ledum groenlandicum*
PmCh	*Picea mariana, Chameadaphne caliculata*
PmPl	*Picea mariana, Pleurozium spp.*

Source: Kotar and Burger. 2000. Field Guide to Forest Habitat Type Classification for North Central Minnesota

1.1.5.4 Company Management Practices

UPM/Blandin Paper's forest management reflects the findings and recommendations of the GEIS. The most useful of those recommendations have been adopted in its forest management strategies and plans. Because this is an adaptive and flexible form of forest management, it is not possible for UPM/Blandin Paper or the DEIS to be more specific as to the projected rotation ages by tree species or native plant communities, or how management will change the natural stage mix of forest types.

This is a work in progress and a unique management approach for Minnesota forests. There is an effort to balance semi-intensive wood production with the application of ecological and landscape knowledge to improve wood quality and quantity (Oliver, 1999).

Old forest goals in some of the northern hardwood types address some GEIS projected significant impacts to certain wildlife populations and assists maintenance of genetic variability. Likewise, reserves of cedar forests reduce impacts projected on mature lowland conifers. On some sites, thinning can lessen the forest health deterioration now occurring in overstocked, suppressed stands.

There is an important relationship between ruffed grouse, woodcock, and deer with the aspen forests, especially in providing early successional forest habitat. Hunters and non-hunters place a high value on favorable game bird and songbird populations (Dessecker and McAuley, 2001; Fouchi and Gullion, 1984; Huffman, 1997). The United States Fish and Wildlife Service (USFWS) reported that more money is spent annually on bird watching than on hunting pursuits. There is a positive relationship between all successional stages of aspen forests, interspersions of other forest types, and habitat requirements of a wide variety of songbirds (Hunter, 1990; Green, 1995).

The Blandin Paper Company has extensive areas of aspen, a large part for of which the company plans to manage by clear-felling and harvesting again in 40 to 60 years. Based on habitat typing to help determine native plant communities, a proportion of these areas are being shifted into a mixed aspen and softwood forest type. Mixed stands of aspen, pine, and spruce/fir are also important to deer, game birds, songbirds, and many more wildlife species, especially in providing protection from predators and winter thermal cover. Better site stands are being pre-commercially thinned or commercially thinned and are targeted to continue to be managed as aspen forests. Thinning forests from basal areas of 120-130 down to 70-80 is a common thinning practice in hardwood forests. This can be a positive practice relative to wildlife populations. This is not a common practice in the aspen forest type.

UPM/Blandin Paper's forestry staff reported that early implementation of the MFRC guidelines (MFRC/SFRA, 1998) and building the most important aspects of the guidelines into a monitoring checklist, have aided in reducing impacts and in improving productivity of land management. Training only certain staff or owner-operators, is not as effective as training everyone. UPM/Blandin Paper requires all staff, contractors and their employees, including truck drivers, to undergo guideline training.

1.1.6 FOREST HEALTH [9]

Insects, pathogens, weather, fire, and other factors cause damage and loss in forests throughout Minnesota every year. These factors, and how they affect forest health, can result in adverse social, ecological, or economic effects upon forest resources.

Since 1954, the eastern spruce budworm has defoliated spruce/fir forests annually, establishing itself as the most consistent damaging agent in the state. The prevalence of spruce budworm had been declining over most of the past decade, but increased significantly in 2002. It then declined again in 2003 by 60 percent to 34,601 acres.

In 2003, another defoliator, the forest tent caterpillar, was active on a large scale throughout aspen and birch forests for the fifth consecutive year, although declining to 2.25 million acres (down from 7.4 million acres) in 2002. Populations are expected to be much smaller in 2004 with only seven localized spots being defoliated.

Other significant damage agents active during 2003 were jack pine budworm, defoliating 18,546 acres and killing older, open growing jack pine, and the introduced larch casebearer, defoliating larch over 1,660 acres, down 40 percent from 2002.

Since 1997, all of these and other defoliating agents have been active, sometimes on the same acreages at the same time. Trees that are repeatedly defoliated often sustain measurable growth loss and in certain situations, such as the balsam fir, the repeated defoliation results in increased stress and a weakened state that can lead to mortality.

In 2003, mortality from larch beetles declined by 50 percent to just over 6,000 acres. Mortality is usually limited to individual trees or small pockets of trees. However, some stands of 30 acres and larger have experienced over 75 percent mortality.

In mid August of 2002, two-lined chestnut borer damage to oaks began to show up in Itasca County. By late August dieback, topkill, and whole tree mortality were widespread in northern and southern Minnesota. Drought and two or more years of forest tent caterpillar defoliation were the likely stress factors contributing to the success of the borers. An aerial survey flown in September 2003 detected mortality over an additional 12,557 acres in Cass, Itasca, northern Aitkin, northern Crow Wing, and southeastern Beltrami counties.

Spruce beetle has been killing large diameter white spruce along the Lake Superior shore over the past few years. The amount of mortality is increasing, and new infestations continue to be found. The

[9] MN Forest Resources in 2003; USFS, North Central exp sta NC-246

damage is most obvious within a few miles of the lake, but it has also been found in Koochiching County, as well as in a windbreak in Wadena County.

Oak wilt continues to be one of the greatest concerns in central Minnesota, especially in Sherburne and Anoka counties. Following the storms of 1997 and 1998, the number of infection pockets dramatically increased in those areas affected by the storms. As a result, the oak wilt epicenter shifted northwestward into Sherburne County, where storm damage and increased development have put many oaks at risk. An evaluation of ongoing control efforts indicates that some communities are making progress on reducing the number of centers; however, the incidence of oak wilt appears to be increasing overall.

In recent years, the jack pine budworm (*Choristoneura pinus*) is having a significant impact on certain areas within the 300,000 acres of jack pine forest type in northwestern Minnesota. The current outbreaks are centered around the Bemidji, Minnesota area. The damage and mortality occurred in stands aged 75 years and older. The outbreaks generally occur ever 10 to 12 years and last from two to four years in duration. Many state and local agencies are taking action to address these outbreaks.

To date the spread of gypsy moth has been limited in Minnesota. The forest areas most susceptible to gypsy moth defoliation damage are the considerable oak forests found throughout the central and southeast regions of the state. In the northern areas, both aspen and birch stands are thought to be the most susceptible to any future infestation. Extreme winter temperatures (-25 degrees F) tend to kill over-wintering egg masses and has likely slower the spread of this pest within the state. However, other northeastern states and Canadian Provinces with similar winter climates have had major gypsy moth infestations. Most entomologists believe it is just a matter of time before more extensive forest areas will be affected.

Arguably, agents completely beyond human control, namely the weather, cause the most significant damage. Periods of drought and flooding, snow, ice, cold, and wind damage are an integral component of the state's forest dynamics. In 2003, flooding occurred on almost 8,000 acres, down 30 percent from 2002. Wildfire burned 168 acres, wind/tornado damaged 586 acres, and winter injury struck 17 acres.