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Power Plant Siting Decisions and Transport Implications

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Sharply increasing timber prices in Minnesota reflect an imbalance in the age class distribution of the cover types that are most important to the forest industry. This research examined the potential contributions that short-rotation forest crops grown on marginal agricultural lands can make in producing biomass for wood-based power plants and in supplying wood to the forest industry. A large-scale regional scheduling model was used to allocate forest and agricultural lands in order to minimize wood production costs for forest industry as well as power plant uses. Alternative potential sites for a wood-based power plant were examined in terms of wood production costs and of transportation implications. Preliminary recommendations as to the most appropriate agricultural lands and sites for power plants are made. The higher productivity of agricultural lands leads to reduced harvesting of forest lands. The associated indirect environmental benefits and the direct environmental benefits from putting agricultural lands under tree cover are the subject of additional research.

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Executive Summary

Sharply increasing timber prices in Minnesota reflect an imbalance in the age class distribution of the cover types that are most important to the forest industry. This report examines the potential contributions that short-rotation forest crops grown on marginal agricultural lands can make in producing biomass for wood-based power plants and in supplying wood to the forest industry. A large-scale regional scheduling model was used to allocate forest and agricultural lands in order to minimize wood production costs for forest industry as well as power plant uses. Alternative potential sites for a wood-based power plant were examined in terms of wood production costs and transportation implications, and preliminary recommendations are made as to the most appropriate agricultural lands and sites for power plants. The higher productivity of agricultural lands leads to reduced harvesting of forest lands. The associated indirect environmental benefits and the direct environmental benefits from putting agricultural lands under tree cover are the subject of additional research.

Introduction

Increasing demand for wood has put upward pressure on timber prices over the past few years. Plans for one or more wood-burning power plants are adding to this demand and pressure on timber prices. Management intensification in selected locations close to major forest industry centers can reduce price pressures by growing wood more efficiently and help mitigate the increasing constraints imposed on forest managers, especially those of public forests. Although the sustainable harvest level of forest lands in Minnesota could be increased through intensive management, at issue are the relative cost of such intensification and the priority that timber production should receive. Some of the public argues that relatively few undisturbed forested acres remain in Minnesota and that many of those acres should be preserved. Arguments are also being made that more forested acres should be managed using longer rotations and less intensive management. With increased wood demands from the forest industry, there are more pressures than ever on forest resources.

In Minnesota, almost two million acres of marginal agricultural lands have been idled under Federal Conservation Reserve Program (CRP) contracts (Taff 1993). Many of these contracts began to expire in 1996 with nearly 80 percent expiring by the end of 1998. Some of these lands may be a potential source of wood. Marginal agricultural lands can support fast-growing hybrid tree species such as poplar, which have average annual growth rates that are ten times those of native hardwoods grown naturally on the same site (Strong and Hansen 1993). The conversion of a portion of these lands to intensively managed short-rotation tree crop production may be a viable alternative. However, the identification of locations where such conversion to forest crops is attractive for a farmer depends on the interaction of complex market forces, land characteristics, and government policies. Forest industries in Minnesota, due to increasing supply pressures and associated price increases for raw materials, are in a strong position to compete with potential wood-based power plants for the wood coming from intensively managed plantations on agricultural lands.

Inclusion of CRP lands in the forest resource base can mean significant savings in public expenditures currently incurred in order to make contract payments. The modeling of timber supply with traditional forest lands and agricultural lands as well as the addition of new demand centers in the form of wood-based power plants is adding to the complexity of resource management decisions. Policy decisions concerning subsidies for marginal farm lands, transportation issues, carbon credits, renewable energy, and management of public forest lands require an understanding of the economic and environmental impacts of different location-specific wood demand scenarios.

Background

Forest land occupies 16.7 million acres of Minnesota, roughly 31 percent of the state. In 1990, Minnesota's wood industry employed nearly 59,000 people with gross sales of $6.2 billion. Statewide harvest levels have increased from 2.3 million cords in 1980 to 4.9 million cords in 1995. Growth of the forest products industry has been accompanied by increasing demands for preserving old-growth forests, for maintaining biological diversity, and for considering forest management impacts on the tourism industry. It is not surprising that there has been substantial concern about the ability of the forest resource to sustain an expanding forest industry. Over $800,000 of state funds were invested in the first-ever Minnesota Generic Environmental Impact Study (GEIS) to address the impacts of increased timber harvesting in Minnesota (Jaakko Pöyry 1992). This study identified severe physical shortfalls for aspen, the most important species for the industry, within one to two decades even under current forest industry demands. The study also illustrated that additional constraints on timber management for environmental reasons will further exacerbate the supply shortages.

The shortages in industrial requirements of aspen products can be overcome in a number of ways. Forest industries can either import the balance of their aspen requirements from other states or use substitutes for aspen from sources within the state. Importing aspen can be an increasingly expensive operation because of transportation costs. It will also result in additional pressures on the forest resources of the exporting states. The use of aspen substitutes such as hybrid poplar from locations within Minnesota will require forest industries to invest in the modification or purchase of new compatible processing equipment.

A great potential source of wood is the vast acreage of marginal agricultural lands that can support fast growing hybrid tree species such as poplar without posing any significant environmental concerns. The production of fast growing hybrid poplar on marginal agricultural lands can increase timber supplies and reduce wood production costs. Hybrid aspen can have average annual growth rates that are ten times those of native hardwood grown naturally on the same site. In addition to direct economic benefits to farmers and the wood-using industries, these tree plantations on agricultural lands are expected to generate two types of environmental benefits: environmental benefits associated with tree versus an agricultural cover crop on the selected agricultural sites, and the environmental benefits of harvesting fewer forest acres because of the increased wood production potential of intensive short-rotation systems. Agricultural lands utilized to grow wood in intensive, short-rotation crop systems can at the same time protect soil resources, provide wildlife habitat, and help reduce the pressure on forest resources, especially where critical and fragile ecosystems are involved such as in the riparian zones, locations with more erodible soils, and in certain locations where public demand for non-timber services is strong.

In this report we describe some results of a research project that examined how timber supplies in Minnesota could be sustained and what role agricultural lands might play in supporting the forest industry and an emerging wood-based power plant industry. The associated project,

"Identifying Potential Sites for Energy Production from Woody Biomass," was funded by the Consortium for Plant Biotechnology Research (CPBR) and the Minnesota Center for Transportation Studies (CTS).

Model Description

A management scheduling model (Hoganson and Rose 1984, 1989) was used to allocate forest and agricultural lands by choosing among numerous management options. These options were developed using the prescription writer RxWRITE (McDill and Rose 1991), a set of software programs compatible with the scheduling model. The prescription writer simulates harvesting and different types of thinnings. RxWRITE utilizes all stand-level inventory data including individual tree records. Tree growth over time was simulated using the Stand and Tree Evaluation and Modeling System (STEMS) which was developed by the USDA Forest Service (Belcher et al. 1982). The model was used to simulate sets of specified management options for a given stand or group of stands. The output from these simulations was converted into input files for use by the scheduling model version used in this study, DTRAN, which recognizes alternative market location (Hoganson and Kapple 1991). Timber product demand in six forest markets was modeled for ten ten-year planning periods. Six aggregated forest product markets were considered in this study, located in Brainerd, Bemidji, Cook, Duluth, Grand Rapids, and International Falls. These locations represent the concentration of major forest industries in Minnesota. The timber product requirements were similar to those modeled in the Minnesota GEIS medium scenario (Jaakko Pöyry 1992). These demands reflect the future raw material requirements of the existing forest industries as well as those projected to 1997. Forest management options representing traditional and environmentally restricted management practices were used, along with hybrid poplar production on agricultural lands.

Information about the commercial forest land of about 13 million acres for this research was taken from the latest North Central Forest Inventory and Analysis (NCFIA) project conducted by the USDA Forest Experiment Stations. The farm land data set for this study of about 1.8 million acres of land enrolled in Minnesota was obtained from the Minnesota Department of Agriculture (MDA). Acreage that was reported as highly erodible was excluded from any further analysis. These exclusions reduced the agricultural land base considered for tree production to 438,364 acres, about 26 percent of the original database. Annual cash rental rates were used to determine the land owner's opportunity cost of growing hybrid poplar.

Yield estimates for hybrid poplar were derived from a network of research plantations which were established in a five-state region of the north central U.S during the 1980s (Hansen et al. 1994). Yield rates were modeled as a function of land capability classes and subclasses, rainfall, and soil types.

Estimates of variable production costs for hybrid poplar production were obtained from the Natural Resources Research Institute (Berguson 1994) based on actual cost data associated with a network of plantations in Minnesota and Wisconsin.

The harvest cost model was specifically designed for the forest harvest conditions encountered in Minnesota (Jaakko Pöyry 1992). It accounted for factors such as clear-cut or thinning, average tree size, volume per acre, off road distance, and total volume harvested.. Harvesting cost estimates for hybrid poplar were based on data by the Oak Ridge National Laboratories (ORNL) for the Great Lakes region (Walsh 1994). Transportation costs were generated using actual road distances between analysis areas and the market locations.

The most direct output of the scheduling model are the estimated shadow prices for products at various levels of production over time. Differences in production costs between different management scenarios measure the trade-offs of changing forest product demands and management constraints.

Previous Key Findings

A previous study "Identifying Potential Sites for Energy Production from Woody Biomass," funded by the Consortium for Plant Biotechnology Research (CPBR) and the Minnesota Center for Transportation Studies (CTS) generated a number of key findings: Inclusion of intensively managed CRP lands can result in significant shifts in the traditional forest land use and can help meet the ever increasing demand for timber (Rose and Husain 1997, 1998; Husain and Rose 1997a, b) .

Shadow prices for major species were significantly higher in the restricted runs than in the unrestricted runs because of the reduced forest acreage and because of higher costs of restricted management alternatives. This difference in shadow prices is one measure of the cost of imposing environmental restrictions on forest management. The inclusion of agricultural lands for wood production helped meet timber product demands, particularly in those planning periods where not enough timber was available from forest lands.

Land use decisions and policies affecting these decisions in the agriculture and forestry sectors have significant impacts on rural highways as well as the cost of transporting wood. Transportation costs make up a significant portion of delivered timber costs. Cost differences impact competitiveness and locational advantages for individual producers. Siting decisions for new power plants have important impacts. Two power plant sites examined in the study, Alexandria and Granite Falls, appear to be poor choices. Short-rotation hybrid poplar grown in the model on Conservation Reserve Program (CRP) agricultural lands almost exclusively is being transported to forest industrial production centers far away from the wood production sites. This is a direct result of the ability of the forest industry to compete for this wood fiber which is a good substitute for a scarce aspen resource. On the other hand, wood fuel needs by the identified power plants are met from forest lands, mostly the relatively abundant northern

hardwood covertype, and wood is transported a fair distance from the wood production to the consumption centers in Alexandria and Granite Falls. This results in more pressure on rural roads than necessary under better siting decisions for power plants and for wood production. Fuelwood energy costs were shown to be in a range that makes wood an attractive renewable energy alternative. The study also identified supply bottlenecks in terms of where and when they can be expected to occur and identified locations where management intensification might have the greatest benefits in terms of reduced road impacts, transportation costs, and income opportunities for rural farmers. Wood production opportunities for agricultural lands in specific townships were identified by the study. However, the identification of locations where such conversion to forest crops is attractive for a farmer depends on the interaction of complex market forces, land characteristics, and government policies.

While that study answered a number of questions, it also raised several additional issues. These questions were addressed in a second year of funding from CPBR and CTS. One was the need for examination of questions surrounding the use of industrial wood residues in power generation. The use of industrial wood residue can have great significance in power plant siting decisions. Many forest industries are co-generating power, but are faced with excess supplies of wood residues. The emergence of increasing environmental restrictions on timber harvesting and the pending deregulation of the power industry are adding a new dimension and complexity to questions of power plant siting and timber management investments. A re-examination of the power plant siting decision has potentially great ramifications for impacts on rural road from trucking traffic, transportation and wood production costs, environmental impacts of timber harvesting and investment opportunities for farmers in Minnesota. We are currently examining three other power plant sites in northern Minnesota, Bemidji, International Falls and Brainerd.

Preliminary results suggest substantial reduction in timber production and transportation costs for some of these new power plant sites. Better land use policies and decisions which can reduce the impacts on rural roads, and transportation costs and which can improve the environment and the income potential for farmers will be formulated from this research.

In view of these findings, siting of power plants should be made to minimize transportation costs and thus delivered wood costs. Once these siting decisions are made, it will be possible to identify which farmers would benefit from growing wood fiber for wood-based industries. Siting decisions should not only be based on the wood production costs and the potential for rural economic development. In addition to direct economic benefits to farmers and the wood using industries, these tree plantations on agricultural lands are expected to generate two types of environmental benefits. One, are environmental benefits associated with tree versus an agricultural cover crop on the selected agricultural sites, the second are the environmental benefits of harvesting fewer forest acres because of the increased wood production potential of intensive short-rotation systems. Agricultural lands utilized to grow wood in intensive, short-rotation crop systems can at the same time protect soil resources, provide wildlife habitat, and help reduce the pressure on forest resources especially where critical and fragile ecosystems are

involved such as in the riparian zones, more erodible soils and in certain locations where public demand for non-timber services are strong.

Thus an additional key consideration in making land use decisions is to make site selection in such a way that the environmental benefits of growing trees on agricultural lands are maximized. These environmental benefits derive directly from having a tree cover on agricultural land and indirectly from the potential reduction in total harvest acreage of forest lands required to meet industrial demands. The reduction of required harvest acres is a direct result of the vastly higher wood production potential of intensively managed tree crops. To maximize direct environmental benefits we need to understand which aspects of a specific agricultural land accounts for any environmental benefits. They could be related to specific physical properties of a site and equally important to the landscape, e.g., river basin, in which this site occurs. In order to maximize indirect environmental benefits associated with reduced need for harvest acreage, we need to understand the environmental benefits associated with not harvesting specific forest lands. These benefits, as in the case of agricultural lands, are related to specific physical properties of a site as well as the landscape in which the site occurs.

Expanded Research

Some of these questions raised by the first year of study were addressed in a second year of funding from CPBR and CTS. The major focus was a re-examination of the power plant siting decisions. In this expanded research we examined additional sites for a power plant in location of existing forest industries, among these sites selected were Bemidji, Brainerd, and International Falls. While in the previous analyses energy demand could be met from any available wood resource, we restricted in these new runs the wood burned in the power plant to the northern hardwood covertype or hybrid poplar grown on CRP lands. The reason was that in the previous analyses virtually all the wood energy demand was met from these two sources anyway. Since we simulated only one power plant in these new analyses, we also reran the model with these assumptions for the Alexandria location in order to create a base for comparison with that location which had been identified as the better one among two locations previously examined.

We utilized the same model as before and examined transportation and wood production costs, specifically the impacts on rural roads from trucking traffic. Since we previously did not examine in detail the impacts of various scenarios on transportation, we first, however, examined the results of the first year study in light of transportation statistics. These transportation statistics were then compared with the new power plant siting decisions.

Transportation Implications of Run One Scenarios
In the first part of this paper, we will summarize key transportation results from the earlier study (Rose and Husain 1997). In this study we derived management schedules for eight scenarios:

The run one scenarios involved the following management scenarios:

Producing timber on forest land only

Managing forest without restrictions

1) Meeting wood demand for forest industry only
2) Meeting wood demand for forest industry and two power plants

Managing forest with restrictions

3) Meeting wood demand for forest industry only
4) Meeting wood demand for forest industry and two power plants

Producing timber on forest land and CRP land

Managing forest without restrictions

5) Meeting wood demand for forest industry only
6) Meeting wood demand for forest industry and two power plants

Managing forest with restrictions

7) Meeting wood demand for forest industry only
8) Meeting wood demand for forest industry and two power plants

We will highlight results for the most important wood products, aspen, hardwoods wood produced on forest lands, and hybrid poplar wood produced on CRP lands. Transport distances in the figures in the appendix are displayed in average weighted miles.

Aspen

Figure 1 illustrates that aspen shortages due to age class imbalances will lead to increasing average transportation distances over the next few decades before beginning a decline. Average transport distances are generally higher in all scenarios that include potential wood production from CRP lands, whether power plants are present or not or whether forest management is restricted or not. The reason is that hybrid poplar can be substituted for aspen at lower costs despite the longer distances associated with transporting wood from CRP lands to timber markets. While the scheduling model selects CRP parcels for wood production on the basis of the overall lowest cost including land opportunity costs, wood production costs, and transportation costs, it is clear that substantial volumes of wood can be produced on CRP land cheaper than on forest land despite the higher transportation costs. Forest management restrictions do not appear to have a significant impact on transportation costs.

Another interesting observation is that wood transportation costs initially increase and then show a decline for the scenarios including CRP lands, and an increase followed by a decline and another increase for the forest land alone scenarios. The initial increase is explained by the age class imbalance in the aspen inventory, which forces the model to look for harvestable stands farther away from the production centers. Without wood supplies from CRP lands, the age class imbalance remains a cyclical problem where transportation costs decline and increase over time because the same groups of stands harvested in a period will become harvestable in future periods.

Figures 2-9 show average transport distances by major timber markets for the eight individual management scenarios. These figures display the same patterns described for Figure 1. Additionally, it is apparent that substantial differences exist between the individual timber markets. The Cook, Brainerd, and Grand Rapids markets have generally lower average transport distances for aspen than the Duluth, Bemidji, and International Falls markets. In general, markets with higher demands for aspen also have higher average transport distances, but market locations also contribute to cost differences (see Table 1). Energy demand for the two power plants in Alexandria and Granite Falls was 350,000 cords per year and could be met from any species.

Table 1. Annual Product Demand in Cords by Major Forest Market

Market	Aspen	Northern Hardwoods
Bemidji	580,000.00	89,000.00
Brainerd	319,000.00	198,000.00
Cook	203,000.00	59,000.00
Duluth	590,000.00	355,000.00
Grand Rapids	519,000.00	69,000.00
Int. Falls	458,000.00	49,000.00
Total	2,669,000.00	819,000.00

The market differences in average transport distances are present across all scenarios. Comparing the scenarios, it is apparent that transportation distances are normally higher when CRP lands are scheduled for wood production because CRP plots often are farther away from the forest industry centers. For some markets average transport distance declines when CRP lands are included. This is the result of CRP lands being in close proximity to such markets or closer forest lands now available because demand for competing markets for these forest lands is now being met more efficiently from CRP lands.

Northern Hardwood Shipments

Figure 10 illustrates the differences in hardwood transportation burned in both power plants; transportation distances are highest for all scenarios including power plants. Transportation distances increase rapidly after the first decade when the power plants come on line, followed by a general decline in the middle of the planning horizon. For the scenarios without power plants, transportation costs remain relatively more stable. The increase in average transport distances from period one to two for the power plant scenarios is explained by the startup of power plants in the second decade.

Figures 11-18 show average transport distances by major timber market for the eight individual management scenarios. These figures display the same patterns described for Figure 10. Additionally, substantial differences exist between some of the timber markets. The Cook and Grand Rapids markets generally have lower average transport distances for hardwoods than the

Brainerd, Duluth, Bemidji, and International Falls markets. In general, markets with higher demands for hardwoods also have the higher transport distances, but market locations also contribute to cost differences (see Table 1). The market differences in average transport distances are present across all scenarios. Comparing the scenarios, it is apparent that transportation distances are normally lower when CRP lands are scheduled for wood production.

Hybrid Poplar Shipments from CRP Lands

When CRP lands were included into the potential timber production base, the scheduling model had to make a decision whether to grow timber on a specific CRP parcel, when to begin this timber production, and finally where to ship the timber produced on the parcel. Hybrid poplar could be shipped as fuelwood to any forest industry location with an aspen demand or be shipped to a power plant for burning. An important observation is that relatively little hybrid poplar was shipped to the power plants and that most of the wood burned came from forest lands. For Granite Falls, being farther away than Alexandria from the forest lands, the scheduling model allocated relatively more hybrid poplar for burning (Figure 19). Under restricted forest management, the model allocated increasing amounts of hybrid poplar to the Alexandria power plant because it could supply some wood cheaper than from forest lands. Forest management restrictions generally increased average transportation distances (Figure 20).

Figures 21-24 show the hybrid poplar pulpwood volumes shipped to the six forest markets for the scenarios with and without forest management restrictions and with and without power plant demands. The relative differences in volumes shipped between markets is a result of the demand for aspen in these markets and relative closeness of CRP lands to these markets. Hybrid poplar pulpwood volumes shipped in most cases are relatively stable for the first four decades, but then begin to decline. This can be explained by the disappearance of the aspen age class imbalance after decade four.

Figures 25-28 show the hybrid poplar pulpwood average transport distance to the six forest markets for the scenarios with and without forest management restrictions and with and without power plant demands. The relative differences in average transport distance between markets is a result of the demand for aspen in these markets and relative closeness of CRP lands to these markets. Hybrid poplar pulpwood average transport distances in most cases are relatively stable for the first four decades, but then begin to decline because smaller volumes of hybrid poplar are shipped when the aspen age class imbalance disappears after decade four.

Figures 29-30 display information on the breakdown of species volumes burned in the Alexandria and Granite Falls power plants for four management scenarios. Hardwoods make up the major contribution across all management scenarios. Hybrid poplar makes a steady, but relatively smaller contribution when CRP lands are included into the production base. Aspen volumes burned are very small. Miscellaneous other species make up the rest.

Figures 31-34 display information on the breakdown of species volumes burned in the Alexandria power plant. Hardwoods make up the major contribution across all management

scenarios, but show a decline over the planning horizon. Hybrid poplar makes a steady, but relatively smaller contribution when CRP lands are included into the production base. Miscellaneous other species otherwise make up the rest.

Figures 35-28 display information on the breakdown of species volumes burned in the Granite Falls power plant. As for the Alexandria power plant, hardwoods make up the major contribution across all management scenarios, but show a decline over the planning horizon. Hybrid poplar makes a steady, but relatively smaller contribution when CRP lands are included into the production base. Miscellaneous other species otherwise make up the rest.

Figures 39-46 display average transport distances by major species for the two power plants for the restricted and unrestricted forest management scenarios and with and without CRP lands.

Transportation Implications of Run Two Scenarios

The run two scenarios involved the following eight management scenarios with all scenarios involving production of timber on forest land and CRP land:

Producing timber on forest land and CRP land
- Managing forest without restrictions
  - Meeting wood demand for forest industry and one power plant for four different locations (Alexandria, Bemidji, Brainerd, International Falls)
- Managing forest with restrictions
  - Meeting wood demand for forest industry and one power plant for four different locations (Alexandria, Bemidji, Brainerd, International Falls)

Table 2. Annual Product Demand in Cords by Major Forest Market

Market	Aspen	Northern Hardwoods
Bemidji	580,000.00	89,000.00
Brainerd	319,000.00	198,000.00
Cook	203,000.00	59,000.00
Duluth	590,000.00	355,000.00
Grand Rapids	519,000.00	69,000.00
Int. Falls	458,000.00	49,000.00
Total	2,669,000.00	819,000.00

In all the scenarios performed in the new analyses, one 100MW power plant was adding a demand of 291,000 cords per year starting in the second decade. This power plant was located in one of four sites: Alexandria, Bemidji, Brainerd, and International Falls. This demand is lower than the 350,000 cords/year required in the first run scenarios in which energy demand could be met from any available wood resource because of the higher energy content of the denser

northern hardwoods. While in the previous analyses energy demand could be met from any available wood resource, we restricted in these new runs the wood burned in the power plant to the northern hardwood covertype or hybrid poplar grown on CRP lands. The reason was that in the previous analyses virtually all the wood energy demand was met from these two sources anyway. In all scenarios, CRP lands were included as potential wood producing lands.

Aspen Shipments

For aspen, we see a sharp increase in average transportation distance for several decades followed by a major decline for both the unrestricted and restricted management scenarios (Figures 47-48). This is explained by the serious age class imbalance in the aspen covertype. Management restrictions imposed on forest lands for environmental mitigation purposes add about ten miles of transportation distance per cord transported to forest industries. This translates into millions of additional cord x miles. Figures 49-56 show similar trends for the four individual power plant locations—Alexandria, Bemidji, Brainerd, and International Falls—by individual forest markets. There are some significant differences in the average transportation distances between individual markets.

Northern Hardwood Shipments

Hardwood transportation costs show an increasing trend over the planning horizon (Figures 57-58). Management restrictions imposed on forest lands for environmental mitigation purposes again add to transportation distance per cord transported to forest industries. These results are, however, not totally reliable as the scheduling model had some difficulty in reaching feasible solution for hardwoods when forest management restrictions were imposed. Figures 59-66 show similar trends for the four individual power plant locations—Alexandria, Bemidji, Brainerd, and International Falls—by individual forest markets. There are some significant differences in the average transportation distances between individual markets.

Hybrid Poplar Shipments from CRP Lands

Figure 67 shows average transport distances for hybrid poplar shipments for the eight management scenarios that were analyzed. Figure 68 shows the hybrid poplar volumes shipped for the eight management scenarios.

Figures 69-72 show hybrid poplar fuelwood volumes shipped to each of six forest industry markets for each power plant location and the unrestricted management scenario. Figures 73-76 show hybrid poplar fuelwood volumes shipped to each of six forest industry markets for each power plant location and the restricted management scenario. Of interest is that hybrid poplar shipments are relatively high for several decades and then begin to decline. This is in accordance with the initial aspen age class imbalance, which later in the planning horizon begins to improve. When forest management restrictions exist, hybrid poplar pulpwood volumes per decade are about 1.5 million cords higher than without management restrictions.

Across all eight scenarios, Bemidji receives the largest shipments of hybrid poplar pulpwood from CRP lands, followed by International Falls, Cook, and Brainerd. Grand Rapids and Duluth receive only small volumes of hybrid poplar pulpwood because of their distance from CRP acres.

Figures 77-80 show hybrid poplar average transport distances to each of six forest industry markets for each power plant location and the unrestricted management scenario. Figures 81-84 show hybrid poplar average transport distances to each of six forest industry markets for each power plant location and the restricted management scenario. Associated with the higher initial shipment volumes are also higher average transport distances and a steady decline after about the fifth decade. Average transport distances are slightly higher when forest management restrictions exist. Across all eight scenarios, International Falls has the highest average transport distance for hybrid poplar pulpwood, followed by Bemidji, Duluth, Grand Rapids, Cook, and Brainerd. Transport distances from CRP lands are generally higher than from forest lands.

Figures 85-86 show hybrid poplar total volumes shipped for all six forest industry markets combined for the four power plant locations for the restricted and unrestricted management scenarios. Figures 87-88 show hybrid poplar average transport distance for all six forest industry markets combined for the four power plant locations for the restricted and unrestricted management scenarios and forest management scenario. Associated with the higher initial shipment volumes are also higher average transport distances and a steady decline after about the fifth decade. Average transport distances are slightly higher when forest management restrictions are imposed.

Summary

Ongoing research on agricultural land-use has examined the economic issues associated with producing wood for forest industries and power plants from forest versus agricultural lands, and, has identified the opportunities and trade-offs for producing wood on marginal agricultural lands. Conversion of marginal agricultural lands to the growing of intensively managed tree crops has the potential to reduce timber costs and to contribute to rural economic development.

Siting decisions for new power plants can lead to significantly different transportation costs and trucking miles. Due to the high volume of wood moved for forest industries and potential new power plants, wood-based power plants should be sited near existing forest industry centers. The best site identified in this study is Bemidji. A further reduction in wood transportation costs and impact on rural highways due to the trucking traffic can be achieved by utilization of sawmill residues from local forest industries when power plants are sited in such locations.

Future Research

Siting decisions should not be based only on the wood production costs and the potential for rural economic development. An additional key factor is to make site selection in such a way that

the environmental benefits of growing trees on agricultural lands are maximized. One of the key contributions of intensive wood production on marginal agricultural lands is the potentially large reduction in the harvest acreage needed to supply the industries' demand for wood. Certain agricultural lands can be efficiently utilized to grow additional wood in intensive, short-rotation crop systems while at the same time protecting soil resources, providing wildlife habitat, and helping reduce the pressure on forest resources. This is especially important where fragile ecosystems are involved such as in the riparian zones. This provides opportunities for improving the environmental conditions of large forest areas without impacting the ability to supply wood fiber. Additional environmental benefits are expected from the conversion of agricultural lands from annual to wood crops.

To maximize direct environmental benefits we need to understand which aspects of a specific agricultural land accounts for any environmental benefits. They could be related to specific physical properties of a site and equally important to the landscape, e.g., river basin, in which this site occurs. In order to maximize indirect environmental benefits associated with reduced need for harvest acreage, we need to understand the environmental benefits associated with not harvesting specific forestlands. These benefits, as in the case of agricultural lands, are related to specific physical properties of a site as well as the landscape in which the site occurs.

The development of guidelines for the assignment of marginal agricultural lands to their best use in terms of economic and environmental considerations will help farmers as well as government policy makers make better resource decisions that will generate economic benefits to farmers and economic and environmental benefits to the state. This research is also useful to decision makers in state agencies for developing land use policies and incentive programs. Environmental trade-off analyses are considerably more complex than the siting decisions related to minimizing wood production and transportation costs. However, the development of government policies in the form of regulations and/or incentives for growing trees on agricultural and forest lands requires an understanding of both the economic and environmental benefits associated with regional decisions on how agricultural and forest lands are to be managed in the future.

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Appendix C

Scenario 1: Timber Product Demands with Unrestricted Forest and Agricultural Lands - Alexandria Power Plant

Table C.1.1: Total Variable Costs ($) by Planning Period for Scenario 1

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	20,985,510	1,035,559,000	**1,056,544,510**
2	83,105,100	989,122,200	**1,072,227,300**
3	88,532,260	981,794,600	**1,070,326,860**
4	93,986,820	963,844,300	**1,057,831,120**
5	113,921,800	990,823,200	**1,104,745,000**
6	117,455,500	1,001,088,000	**1,118,543,500**
7	119,520,900	988,576,800	**1,108,097,700**
8	123,106,900	1,000,697,000	**1,123,803,900**
9	121,636,000	991,389,000	**1,113,025,000**
10	120,662,500	1,004,460,000	**1,125,122,500**
TOTAL	**1,002,913,290**	**9,947,354,100**	**10,950,267,390**

Table C.1.2: Aspen Shadow Prices by Planning Period and Market for Scenario 1

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	37.36	38.64	36.56	41.67	39.62	42.12
2	36.62	39.38	39.95	44.63	42.80	43.48
3	36.95	40.94	42.12	46.86	44.61	44.31
4	37.06	42.45	43.28	48.73	45.84	44.54
5	37.29	42.92	43.43	47.74	45.73	44.64
6	35.63	39.75	39.96	44.44	42.50	43.10
7	35.56	39.09	38.68	43.04	41.93	42.87
8	35.51	38.21	37.56	41.56	41.12	42.11
9	35.55	37.66	36.90	40.74	40.66	41.90
10	35.31	36.56	36.22	39.88	40.06	41.58

Table C.1.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 1

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	15.15	21.21	19.09	25.90	15.86	20.98
2	17.64	21.87	18.99	25.95	16.81	22.28
3	18.27	22.26	19.49	25.95	17.03	22.08
4	18.64	23.33	20.33	26.49	18.21	22.02
5	19.62	24.13	20.39	27.02	18.73	21.90
6	20.82	24.98	20.63	27.82	19.67	21.18
7	21.12	25.93	21.31	28.54	20.68	21.42
8	22.09	26.89	23.00	30.26	21.50	23.62
9	23.14	28.67	24.51	31.79	23.13	25.09
10	24.84	30.75	25.88	33.85	23.98	26.27

Table C.1.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 1

MARKET							
	Pine Pulpwood			Spruce-Fir			Pine Sawlogs
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	Combined
1	31.14	44.35	39.45	55.62	53.11	47.28	23.01
2	31.01	44.63	40.23	57.00	54.39	48.40	21.53
3	32.33	45.87	41.72	57.56	55.91	49.27	18.77
4	33.92	46.83	43.72	59.61	58.40	51.38	16.02
5	35.83	46.50	42.05	62.21	61.98	54.48	13.83
6	32.13	41.45	37.04	64.63	66.74	58.18	10.82
7	21.79	30.88	24.95	66.78	70.48	62.72	11.30
8	15.57	23.95	17.19	67.75	72.42	64.99	15.67
9	11.49	17.89	10.80	67.15	73.54	66.70	19.42
10	9.67	15.77	8.94	67.60	73.23	67.72	24.12

Table C.1.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 1

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	166100	153200	149800	121600	107600	84500	55100	143100	127400	109600	**1218000**
Balsam Fir	57400	116400	93600	110300	115900	103700	112700	83700	67600	63600	**924900**
N. White Cedar	0	1000	0	900	800	2500	4300	0	1500	800	**11800**
Tamarack	48400	34300	30700	34100	39000	54300	72000	20700	30200	21000	**384700**
Spruce	248100	196400	167200	188500	230200	186600	87500	262200	194800	148200	**1909700**
N. Hardwoods	124400	226000	253400	260400	281700	311200	281900	290800	276300	341000	**2647100**
Aspen	1300900	938700	908900	891500	920200	836400	838600	675800	740900	745300	**8797200**
Balsam Poplar	106300	69700	71200	66900	64200	61600	67500	51500	61400	56500	**676800**
TOTAL	**2051600**	**1735700**	**1674800**	**1674200**	**1759600**	**1640800**	**1519600**	**1527800**	**1500100**	**1486000**	**16570200**

Table C.1.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 1

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	279000	225700	246500	249500	222000	211500	170300	213200	174500	170500	**2162700**
Misc. Public	75900	34500	55200	42600	49600	39600	39600	50600	40400	44500	**472500**
State	361500	317800	299500	304700	344900	293200	279600	313100	250100	269900	**3034300**
County	510800	378600	320500	317400	326600	382800	322400	338500	318800	304000	**3520400**
Private	723900	694700	653100	651000	708700	620800	613500	528800	609400	604400	**6408300**
F. Industry	100500	84400	100000	109000	107800	92900	94200	83600	106900	92700	**972000**
TOTAL	**2051600**	**1735700**	**1674800**	**1674200**	**1759600**	**1640800**	**1519600**	**1527800**	**1500100**	**1486000**	**16570200**

Table C.1.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 1

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1680400	1453200	1391200	1379900	1421800	1334900	1240100	1239600	1249100	1232400	**13622600**
Buffers	87700	66300	51300	70900	100400	78900	53100	82300	67000	70800	**728700**
Extended	143800	95600	111700	110700	107900	115200	105200	113800	79400	79100	**1062400**
Old Growth	5000	2600	1400	1400	2500	2400	2600	1200	2900	2500	**24500**
Reserve	134700	118000	119200	111300	127000	109400	118600	90900	101700	101200	**1132000**
TOTAL	**2051600**	**1735700**	**1674800**	**1674200**	**1759600**	**1640800**	**1519600**	**1527800**	**1500100**	**1486000**	**16570200**

Table C.1.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 1

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	98700	103500	81400	77600	80100	83600	89700	86000	82700	66000	**849300**
Becker	27900	16800	46600	33100	22000	22600	30000	27000	27000	30600	**283600**
Beltrami	128100	70000	79500	80400	81400	87200	60400	67000	69100	68600	**791700**
Benton	1800	0	6600	10600	3800	5000	1700	1800	8900	2800	**43000**
Carlton	69800	69900	48700	56900	76100	57900	49700	58300	62500	64500	**614300**
Cass	183900	109600	97400	104100	108900	126000	102400	102900	89100	101200	**1125500**
Chisago	0	4700	1200	0	2100	3000	3300	1200	1300	2900	**19700**
Clay	0	0	0	1900	4500	2000	1200	0	0	0	**9600**
Clearwater	40100	40200	28600	27100	32200	25600	27900	38300	27800	27900	**315700**
Cook	9500	23600	88300	77700	29500	21800	22800	18600	10100	12300	**314200**
Crow Wing	81500	58800	65900	43800	71300	58600	49400	46100	50600	62600	**588600**
Douglas	0	24700	2600	1500	700	0	2000	7900	1900	14100	**55400**
Grant	0	0	1500	1000	0	0	1200	0	0	0	**3700**
Hubbard	79600	53100	66400	61300	39200	74200	40600	41800	50600	46800	**553600**
Isanti	400	4600	9200	5100	1800	3800	3200		3200	7500	**38800**
Itasca	215800	193200	161100	170700	199900	150600	167300	159300	181500	181200	**1780600**
Kanabec	12200	6700	17100	13000	9900	13000	14000	23700	24100	18900	**152600**
Kittson	0	0	0	0	3600	0	1200	0	0	0	**4800**
Koochiching	179400	147200	146300	153700	147200	169400	158500	154800	144000	123600	**1524100**
Lake	120200	95500	108100	124200	133200	112700	65300	106300	101500	70600	**1037600**
Lake Woods	33500	22200	37800	42300	9900	36400	31000	28800	27300	16300	**285500**
Mahnomen	5500	9400	5100	5100	7600	3900	5100	6300	8400	9200	**65600**
Marshall	1100	0	3300	6600	18200	4100	6200	2000	1100	0	**42600**
Mille Lacs	5100	6300	23000	14500	13300	9100	11400	35100	11900	15700	**145400**
Morrison	38300	33200	26100	15000	14000	33400	16800	20500	18900	16800	**233000**
Norman	2300	0	0	0	1200	0	900	0	0	1200	**5600**
Otter Tail	7000	28200	23800	25000	27000	19700	31100	16700	15400	12000	**205900**
Pennington	0	1100	3300	2200	5700	0	0	0	1100	0	**13400**
Pine	100200	72700	68900	65200	91500	81100	90800	63800	68900	81900	**785000**
Polk	6600	1100	2200	4500	1100	2200	2200	0	2200	4400	**26500**
Red Lake	1100	1100	2200	2200	4400	2200	1100	0	0	3100	**17400**
Roseau	5600	7800	22000	24300	24900	9500	8300	4400	5000	4800	**116600**
St. Louis	585200	500500	367800	391600	463100	394700	387900	395300	379100	397000	**4262200**
Todd	7000	19400	11900	12600	15300	18300	14100	5800	11100	10400	**125900**
Wadena	4200	10600	20900	19400	15000	9200	20900	8100	13800	11100	**133200**
TOTAL	**2051600**	**1735700**	**1674800**	**1674200**	**1759600**	**1640800**	**1519600**	**1527800**	**1500100**	**1486000**	**16570200**

Table C.1.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 1

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	73742	72334	72021	71977	66886	67272	66062	66364	60157	**616815**
Brainerd	0	33499	32664	33499	33554	28486	24576	21075	17439	13500	**238292**
Cook	0	0	0	0	0	0	0	0	0	0	**0**
Duluth	0	3092	3092	3092	3081	1818	1163	686	585	482	**17091**
G. Rapids	0	7752	10144	9622	9622	5428	5446	4465	3061	2064	**57604**
I. Falls	0	43367	43218	43218	43218	37963	34487	33218	29238	24958	**332885**
TOTAL	**0**	**161452**	**161452**	**161452**	**161452**	**140581**	**132944**	**125651**	**117132**	**102069**	**1264185**

Table C.1.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 1

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	62	62	62	62	62	62	62	62	62	**558**
0M	0	7131	7131	7131	7131	6116	5716	5432	5271	4502	**55561**
0S	0	0	0	0	0	0	0	0	0	0	**0**
0W	0	2609	2609	2609	2609	1965	1965	1905	1905	1905	**20081**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	0	0	0	0	0	0	0	0	0	**0**
2E	0	7232	7232	7232	7232	6607	5601	4483	3447	2564	**51630**
2M	0	0	0	0	0	0	0	0	0	0	**0**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	57250	57250	57250	57250	49975	47492	46340	42677	37338	**452822**
3E	0	5434	5434	5434	5434	4370	3774	3080	2491	1752	**37203**
3M	0	42	42	42	42	42	42	42	42	42	**378**
3S	0	9103	9103	9103	9103	5477	4430	3496	2780	2328	**54923**
3W	0	44781	44781	44781	44781	41505	40944	40038	39769	34691	**376071**
4E	0	1313	1313	1313	1313	1080	999	844	662	540	**9377**
4M	0	355	355	355	355	335	335	335	335	335	**3095**
4S	0	12158	12158	12158	12158	10060	9027	7750	5869	5050	**86388**
4W	0	12283	12283	12283	12283	11835	11835	11429	11429	10567	**106227**
6E	0	413	413	413	413	290	220	65	65	65	**2357**
6S	0	1033	1033	1033	1033	621	261	109	87	87	**5297**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	0	0	0	0	0	**48**
TOTAL	**0**	**161452**	**161452**	**161452**	**161452**	**140581**	**132944**	**125651**	**117132**	**102069**	**1264185**

Scenario 2: Timber Product Demands with Unrestricted Forest and Agricultural Lands - Bemidji Power Plant

Table C.2.1: Total Variable Costs ($) by Planning Period for Scenario 2

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	20,866,950	1,034,143,000	**1,055,009,950**
2	78,423,960	1,002,851,000	**1,081,274,960**
3	87,001,940	998,487,200	**1,085,489,140**
4	91,875,570	981,416,300	**1,073,291,870**
5	112,466,500	1,010,199,000	**1,122,665,500**
6	113,935,900	1,021,063,000	**1,134,998,900**
7	117,789,500	997,921,300	**1,115,710,800**
8	119,259,100	1,008,485,000	**1,127,744,100**
9	120,681,700	1,017,158,000	**1,137,839,700**
10	120,214,800	1,011,105,000	**1,131,319,800**
TOTAL	**982,515,920**	**10,082,828,800**	**11,065,344,720**

Table C.2.2: Aspen Shadow Prices by Planning Period and Market for Scenario 2

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	37.21	38.58	36.38	41.64	39.55	41.93
2	35.83	39.94	39.71	44.59	42.31	43.20
3	36.32	41.16	41.86	46.83	44.24	43.95
4	36.62	42.77	43.10	48.69	45.46	44.41
5	36.89	42.78	43.15	47.63	45.38	44.58
6	35.38	39.74	39.68	44.39	42.28	42.89
7	35.26	39.36	38.58	43.06	41.72	42.57
8	35.36	38.73	37.58	41.73	40.93	42.04
9	35.25	38.11	36.86	40.83	40.49	41.72
10	35.17	37.14	36.22	39.90	39.80	41.26

Table C.2.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 2

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	18.50	21.53	20.37	26.14	16.92	22.86
2	25.43	21.70	20.27	26.26	18.54	24.91
3	26.33	21.79	20.79	26.32	19.29	25.21
4	27.33	22.70	21.51	26.66	20.28	24.87
5	28.29	23.34	21.95	27.20	20.98	24.93
6	29.83	24.01	23.26	27.89	22.35	25.30
7	31.09	24.72	24.23	28.53	23.20	26.40
8	32.86	25.52	25.87	30.13	24.49	28.41
9	34.95	26.68	27.83	31.45	26.22	30.22
10	36.87	28.37	29.51	33.19	28.03	32.06

Table C.2.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 2

MARKET							
	Pine Pulpwood			Spruce-Fir			Pine Sawlogs
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	Combined
1	30.89	44.30	39.40	55.17	52.71	46.90	22.29
2	30.73	44.54	40.17	56.34	53.87	47.74	20.73
3	31.90	45.81	41.62	56.69	55.22	48.40	17.97
4	33.62	46.88	43.48	58.63	57.66	50.44	15.05
5	35.09	46.28	41.82	61.40	61.08	53.51	13.66
6	31.13	40.28	36.25	63.62	65.75	57.09	11.10
7	18.30	28.87	22.65	65.91	69.45	61.59	11.90
8	10.24	20.72	13.90	67.59	71.82	63.67	16.52
9	6.01	15.16	6.98	68.44	73.37	66.12	20.15
10	4.61	13.59	5.64	68.94	72.94	67.46	24.53

Table C.2.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 2

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	166700	148800	152000	120000	109100	79700	54500	140900	119600	112000	**1203300**
Balsam Fir	58100	115600	93400	108700	114800	107800	111800	79700	68400	67500	**925800**
N. White Cedar	0	1000	0	900	800	3400	3700	0	1500	800	**12100**
Tamarack	46800	33800	30900	33200	37700	54300	73400	17500	21900	21200	**370700**
Spruce	247700	191600	151800	189500	229100	186900	99900	261900	196100	135200	**1889700**
N. Hardwoods	132000	215500	276700	288000	316100	348100	299900	342000	313600	328200	**2860100**
Aspen	1293700	968300	918500	903800	940800	867100	842600	665600	759300	784100	**8943800**
Balsam Poplar	107400	71700	70100	72600	64300	61600	79400	45800	64900	61700	**699500**
TOTAL	**2052400**	**1746300**	**1693400**	**1716700**	**1812700**	**1708900**	**1565200**	**1553400**	**1545300**	**1510700**	**16905000**

Table C.2.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 2

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	274200	233300	262300	251900	232600	225700	184800	220400	179700	176100	**2241000**
Misc. Public	78300	41500	52100	51000	55900	59500	50900	49000	51300	42200	**531700**
State	366000	316300	297600	314800	340600	315000	296200	317100	266200	261900	**3091700**
County	496900	415000	343700	338100	344900	373800	337100	342300	349000	305200	**3646000**
Private	735500	660700	632700	651600	728900	645700	596100	532700	600700	623600	**6408200**
F. Industry	101500	79500	105000	109300	109800	89200	100100	91900	98400	101700	**986400**
TOTAL	**2052400**	**1746300**	**1693400**	**1716700**	**1812700**	**1708900**	**1565200**	**1553400**	**1545300**	**1510700**	**16905000**

Table C.2.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 2

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1676700	1464000	1420600	1417500	1470900	1384400	1272900	1280800	1271000	1248500	**13907300**
Buffers	90700	60500	50900	71200	103000	80400	54700	72900	62200	78500	**725000**
Extended	145200	100500	113200	112000	105500	126800	110400	114500	85000	86100	**1099200**
Old Growth	3900	3700	2900	1400	1400	2400	3700	2700	2900	1400	**26400**
Reserve	135900	117600	105800	114600	131900	114900	123500	82500	124200	96200	**1147100**
TOTAL	**2052400**	**1746300**	**1693400**	**1716700**	**1812700**	**1708900**	**1565200**	**1553400**	**1545300**	**1510700**	**16905000**

Table C.2.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 2

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	98600	101900	81900	77700	78400	90200	81200	85000	81500	60200	**836600**
Becker	29400	19800	42300	30200	22900	30000	26500	27200	26600	33100	**288000**
Beltrami	128700	95500	94200	103300	88100	103700	90000	71600	81300	72300	**928700**
Benton	900	0	1900	3700	1400	900	6200	1700	6100	5000	**27800**
Carlton	69800	65400	54100	56000	78400	53500	50800	56500	57900	67900	**610300**
Cass	167300	141100	106800	117200	114200	140400	113900	104800	105900	99000	**1210600**
Chisago	0	4700	1200	0	2100	3000	3300	1200	1300	2900	**19700**
Clay	0	0	41500	0	0	0	0	0	0	1500	**43000**
Clearwater	37900	54900	0	28400	41100	39700	40800	47500	34100	31600	**356000**
Cook	9500	23600	84500	77000	27100	18900	26000	21000	9300	12300	**309200**
Crow Wing	86100	58100	59100	47800	63400	59400	43800	50300	54600	47900	**570500**
Douglas	0	0	900	900	4700	0	0	600	0	300	**7400**
Grant	0	0	0	1000	0	0	0	0	0	0	**1000**
Hubbard	75000	67600	73000	73200	58300	68600	41200	44800	52700	61200	**615600**
Isanti	400	3600	9300	3500	1800	3800	300	900	3800	2600	**30000**
Itasca	217800	191500	180300	173000	208500	163800	189400	183000	186300	191200	**1884800**
Kanabec	12200	6700	14500	15600	8600	13000	12700	21100	23300	18700	**146400**
Kittson	0	0	148400	1200	4800	0	1200	168800	0	0	**324400**
Koochiching	181900	150200	0	160000	157000	164300	169000	0	160700	130800	**1273900**
Lake	119000	97000	110300	121600	131700	116400	59900	106800	96900	67200	**1026800**
Lake Woods	33500	20700	37200	47800	11100	38300	31800	23200	30700	23600	**297900**
Mahnomen	6500	10400	6000	9500	14500	13800	14700	16100	14400	11000	**116900**
Marshall	1100	0	2200	4400	17100	5200	7500	2000	1100	1100	**41700**
Mille Lacs	5100	7300	21100	11200	14500	7300	9400	28300	11900	16700	**132800**
Morrison	40700	26600	19600	14800	18900	33200	16600	16500	15100	21100	**223100**
Norman	2300	0	0	0	1200	0	2100	0	0	1200	**6800**
Otter Tail	11400	7400	9200	10600	11300	15000	10600	7800	10300	10300	**103900**
Pennington	0	0	2200	4400	5300	1900	3500	2200	1100	0	**20600**
Pine	103600	73100	70500	64200	92800	85800	91200	59800	66900	76700	**784600**
Polk	6600	3300	3300	7800	4400	8800	1100	3100	6700	4400	**49500**
Red Lake	2200	1100	2200	1100	6600	3300	2200	4200	2200	2200	**27300**
Roseau	5600	7800	17600	26400	27300	9500	8300	7200	2800	3700	**116200**
St. Louis	587500	492900	374100	392700	468100	403800	384600	376200	378800	400100	**4258800**
Todd	8400	6100	7500	10200	12400	5000	9400	5800	9000	21500	**95300**
Wadena	3400	8000	16500	20300	14700	8400	16000	8200	12000	11400	**118900**
TOTAL	**2052400**	**1746300**	**1693400**	**1716700**	**1812700**	**1708900**	**1565200**	**1553400**	**1545300**	**1510700**	**16905000**

Table C.2.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 2

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	70101	70017	69660	69660	59536	59800	60060	57079	56303	**572216**
Brainerd	0	36003	34159	34221	34596	28648	27994	24530	20237	15391	**255779**
Cook	0	0	0	0	0	0	0	0	0	0	**0**
Duluth	0	3081	3092	3092	3081	1818	1163	836	682	482	**17327**
G. Rapids	0	6857	8774	9604	9240	5236	3730	2115	2946	2046	**50548**
I. Falls	0	39431	39431	38896	38896	34873	33574	32161	29286	23762	**310310**
TOTAL	**0**	**155473**	**155473**	**155473**	**155473**	**130111**	**126261**	**119702**	**110230**	**97984**	**1206180**

Table C.2.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 2

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	62	62	62	62	62	62	62	62	62	**558**
0M	0	6750	6750	6750	6750	5953	5639	5445	5428	4886	**54351**
0S	0	0	0	0	0	0	0	0	0	0	**0**
0W	0	2317	2317	2317	2317	1965	1965	1905	1905	1905	**18913**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	0	0	0	0	0	0	0	0	0	**0**
2E	0	7232	7232	7232	7232	6607	5841	5402	4394	3027	**54199**
2M	0	0	0	0	0	0	0	0	0	0	**0**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	52467	52467	52467	52467	44950	44381	43324	38717	33930	**415170**
3E	0	5434	5434	5434	5434	4370	3953	3326	2741	1822	**37948**
3M	0	42	42	42	42	42	42	42	42	42	**378**
3S	0	9255	9255	9255	9255	5477	4874	3697	3358	2409	**56835**
3W	0	44068	44068	44068	44068	36932	36713	36646	35289	32894	**354746**
4E	0	1313	1313	1313	1313	1080	1035	908	693	540	**9508**
4M	0	355	355	355	355	335	335	321	321	321	**3053**
4S	0	12408	12408	12408	12408	10060	9425	7365	6087	5282	**87851**
4W	0	12071	12071	12071	12071	11126	10915	10778	10778	10471	**102352**
6E	0	413	413	413	413	290	270	131	65	65	**2473**
6S	0	1033	1033	1033	1033	621	570	109	109	87	**5628**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	0	0	0	0	0	**48**
TOTAL	**0**	**155473**	**155473**	**155473**	**155473**	**130111**	**126261**	**119702**	**110230**	**97984**	**1206180**

Scenario 3: Timber Product Demands with Unrestricted Forest and Agricultural Lands - Brainerd Power Plant

Table C.3.1: Total Variable Costs ($) by Planning Period for Scenario 3

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	20,677,450	1,033,649,000	**1,054,326,450**
2	81,228,620	1,002,312,000	**1,083,540,620**
3	88,262,600	993,978,800	**1,082,241,400**
4	92,423,770	975,202,900	**1,067,626,670**
5	113,231,800	999,124,400	**1,112,356,200**
6	113,646,500	1,022,069,000	**1,135,715,500**
7	118,122,000	983,066,800	**1,101,188,800**
8	120,775,300	1,010,394,000	**1,131,169,300**
9	122,972,000	996,793,500	**1,119,765,500**
10	120,388,200	1,012,030,000	**1,132,418,200**
TOTAL	**991,728,240**	**10,028,620,400**	**11,020,348,640**

Table C.3.2: Aspen Shadow Prices by Planning Period and Market for Scenario 3

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	37.20	38.69	36.43	41.56	39.52	42.03
2	36.90	39.44	39.84	44.43	42.57	43.43
3	37.04	40.80	41.95	46.65	44.52	44.24
4	37.09	42.71	43.14	48.43	45.75	44.50
5	37.29	42.54	43.22	47.44	45.51	44.62
6	35.56	39.51	39.80	44.24	42.34	43.02
7	35.62	39.02	38.74	42.87	41.87	42.93
8	35.69	38.40	37.64	41.52	41.07	42.09
9	35.79	38.36	36.99	40.63	40.67	41.89
10	35.45	37.56	36.27	39.67	40.00	41.50

Table C.3.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 3

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	15.43	23.42	19.64	26.41	16.78	21.46
2	17.19	25.65	19.57	26.69	17.88	22.86
3	17.98	26.21	20.11	26.89	18.28	22.53
4	18.38	27.05	21.05	27.64	19.48	22.44
5	19.30	28.13	21.40	28.38	20.30	22.12
6	20.99	29.50	21.91	29.11	21.66	21.81
7	21.53	30.58	22.20	30.25	22.19	21.85
8	22.55	31.89	24.33	32.36	23.22	24.75
9	23.75	33.23	26.36	34.29	25.31	26.20
10	25.67	35.20	28.05	36.85	26.88	27.87

Table C.3.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 3

MARKET							
	Pine Pulpwood			Spruce-Fir			Pine Sawlogs
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	Combined
1	31.21	44.33	39.54	55.42	52.92	47.09	22.66
2	31.15	44.61	40.33	56.74	54.13	48.10	21.18
3	32.45	45.93	41.86	57.29	55.55	48.96	18.46
4	33.97	46.84	43.87	59.28	58.00	50.99	15.55
5	35.60	46.24	41.81	61.54	61.50	53.98	13.50
6	31.76	40.83	36.71	63.83	66.26	57.52	10.72
7	20.18	29.08	23.14	65.13	69.94	61.62	11.38
8	12.84	21.18	14.51	67.43	71.87	64.33	15.84
9	8.68	15.39	8.29	66.79	72.82	66.22	19.56
10	7.46	13.38	6.72	66.51	72.72	67.08	24.20

Table C.3.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 3

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	167300	150800	153300	121700	104600	84600	54500	139900	127200	108900	**1212800**
Balsam Fir	57900	114400	93700	111300	111600	106800	110900	79000	66500	66600	**918700**
N. White Cedar	0	1000	0	900	800	2500	3700	0	1500	0	**10400**
Tamarack	46800	31500	30900	36700	36500	55300	73400	19800	19500	16700	**367100**
Spruce	248200	195100	158800	195800	224700	192900	85500	263600	196900	140100	**1901600**
N. Hardwoods	125300	242900	270500	270700	312000	338400	283800	330600	274200	355000	**2803400**
Aspen	1293600	944200	909700	894700	921500	851700	819900	682000	741100	770300	**8828700**
Balsam Poplar	105000	73800	68800	65900	66400	60600	70100	49400	61500	59100	**680600**
TOTAL	**2044100**	**1753700**	**1685700**	**1697700**	**1778100**	**1692800**	**1501800**	**1564300**	**1488400**	**1516700**	**16723300**

Table C.3.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 3

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	284700	221300	248000	258100	222500	218600	171300	218900	176600	175500	**2195500**
Misc. Public	74600	35400	54700	47200	49800	50000	38700	46800	42600	42500	**482300**
State	356100	333100	304800	302000	350500	294700	296000	314400	239200	277300	**3068100**
County	501500	404300	316900	327600	332000	395000	321100	337100	330100	302500	**3568100**
Private	728000	677200	661100	649900	715500	643000	583300	565100	588100	623000	**6434200**
F. Industry	99200	82400	100200	112900	107800	91500	91400	82000	111800	95900	**975100**
TOTAL	**2044100**	**1753700**	**1685700**	**1697700**	**1778100**	**1692800**	**1501800**	**1564300**	**1488400**	**1516700**	**16723300**

Table C.3.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 3

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1673000	1464200	1413900	1396900	1446500	1380600	1215800	1279200	1249300	1257200	**13776600**
Buffers	88800	63200	49900	76200	100000	74100	57000	71900	64000	79600	**724700**
Extended	143100	102100	113500	110000	104700	122800	110400	116800	72200	81200	**1076800**
Old Growth	5000	2600	1400	1400	2500	2400	2600	1200	2900	2500	**24500**
Reserve	134200	121600	107000	113200	124400	112900	116000	95200	100000	96200	**1120700**
TOTAL	**2044100**	**1753700**	**1685700**	**1697700**	**1778100**	**1692800**	**1501800**	**1564300**	**1488400**	**1516700**	**16723300**

Table C.3.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 3

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	95100	106000	96600	88200	92500	96000	95700	104600	86500	66100	**927300**
Becker	30400	13300	26000	30100	19000	18700	22800	23700	19700	27700	**231400**
Beltrami	126700	71700	80900	79500	75600	91800	62700	67200	69000	66500	**791600**
Benton	1800	0	3800	8500	3100	6200	4200	700	10700	2800	**41800**
Carlton	69800	70100	51400	56300	77500	57900	52400	57100	55600	70100	**618200**
Cass	174800	139100	110200	107300	125400	132500	112400	103300	97300	115400	**1217700**
Chisago	0	4700	1200	0	2100	3800	3300	2500	1300	4100	**23000**
Clay	0	0	0	0	0	0	0	0	0	1500	**1500**
Clearwater	40400	38900	28600	26200	34100	25600	25500	40300	29000	28500	**317100**
Cook	9500	22100	87000	79100	27000	20900	23800	23200	12000	12700	**317300**
Crow Wing	72300	92200	75400	43900	67500	61500	48700	49500	40900	69900	**621800**
Douglas	0	0	900	5300	4800	1000	500	1500	300	1100	**15400**
Grant	0	0	0	1000	0	0	0	0	0	0	**1000**
Hubbard	78900	50100	59400	65300	37500	75700	33700	44400	56700	42000	**543700**
Isanti	400	3600	10800	4500	1800	4100	2900	2200	3000	5500	**38800**
Itasca	220400	189600	166200	175700	200800	156800	160700	164000	187400	179800	**1801400**
Kanabec	11100	10400	18600	17100	14000	16100	24700	28000	21600	17200	**178800**
Kittson	0	0	0	0	3600	0	1200	0	0	0	**4800**
Koochiching	179500	147100	144300	152200	145900	169300	160100	156500	145500	128400	**1528800**
Lake	119900	96100	111700	126700	133100	120800	60100	107600	97400	75200	**1048600**
Lake Woods	32600	24000	36900	43300	9900	36400	29800	27800	28600	16300	**285600**
Mahnomen	5500	5700	4900	6100	7600	3900	5100	4800	2100	5800	**51500**
Marshall	1100	0	3300	6600	18200	4100	6200	2000	1100	0	**42600**
Mille Lacs	5100	10100	33300	20100	15400	18400	18200	35900	9700	10700	**176900**
Morrison	37900	40000	27300	13000	23900	24700	19100	17600	17700	33300	**254500**
Norman	1200	1100	0	0	0	0	0	0	0	0	**2300**
Otter Tail	14800	9200	10300	14600	11700	23800	13100	16700	12600	12800	**139600**
Pennington	0	2200	2200	2200	4200	0	1500	0	1100	0	**13400**
Pine	103600	77400	70200	65000	93600	85000	89900	66200	72400	79100	**802400**
Polk	5500	2200	2200	4500	1100	2200	2200	1100	4400	4400	**29800**
Red Lake	1100	1100	2200	3300	3300	1100	2200	0	0	3100	**17400**
Roseau	5600	8900	20900	23100	26100	9500	8300	4400	5000	3700	**115500**
St. Louis	586900	499300	365000	401200	464600	403400	381300	394200	375300	403400	**4274600**
Todd	7300	11600	10800	8300	18100	11600	14300	7200	11600	15200	**116000**
Wadena	4900	5900	23200	19500	15100	10000	15200	10100	12900	14400	**131200**
TOTAL	**2044100**	**1753700**	**1685700**	**1697700**	**1778100**	**1692800**	**1501800**	**1564300**	**1488400**	**1516700**	**16723300**

Table C.3.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 3

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	73792	72770	72027	72071	66886	67532	67581	67834	66172	**626665**
Brainerd	0	32857	32011	32890	32857	26795	24516	21990	23249	16531	**243696**
Cook	0	0	0	0	0	0	0	0	0	0	**0**
Duluth	0	2724	2735	2735	2724	1818	944	686	585	430	**15381**
G. Rapids	0	7752	9609	9622	9622	5446	5405	3517	1592	2046	**54611**
I. Falls	0	42516	42516	42367	42367	35006	34487	33218	29238	24958	**326673**
TOTAL	**0**	**159641**	**159641**	**159641**	**159641**	**135951**	**132884**	**126992**	**122498**	**110137**	**1267026**

Table C.3.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 3

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	TOTAL
0	0	62	62	62	62	62	62	62	62	62	**558**
0M	0	6880	6880	6880	6880	6062	5716	5445	5441	4985	**55169**
0S	0	0	0	0	0	0	0	0	0	0	**0**
0W	0	2649	2649	2649	2649	1965	1905	1905	1905	1905	**20181**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	0	0	0	0	0	0	0	0	0	**0**
2E	0	7205	7205	7205	7205	6295	5601	4825	4825	3200	**53566**
2M	0	0	0	0	0	0	0	0	0	0	**0**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	56817	56817	56817	56817	47512	47492	46943	43280	39261	**451756**
3E	0	5400	5400	5400	5400	4300	3774	3202	3046	2126	**38048**
3M	0	42	42	42	42	42	42	42	42	42	**378**
3S	0	8587	8587	8587	8587	4874	4430	3388	3388	2575	**53003**
3W	0	44624	44624	44624	44624	41011	40944	40837	40568	38073	**379929**
4E	0	1302	1302	1302	1302	1080	999	844	741	662	**9534**
4M	0	355	355	355	355	335	335	321	321	321	**3053**
4S	0	11800	11800	11800	11800	9469	9027	7260	6961	5314	**85231**
4W	0	12283	12283	12283	12283	11835	11835	11487	11487	11218	**106994**
6E	0	413	413	413	413	290	220	81	81	65	**2389**
6S	0	969	969	969	969	578	261	109	109	87	**5020**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	0	0	0	0	0	**48**
TOTAL	**0**	**159641**	**159641**	**159641**	**159641**	**135951**	**132884**	**126992**	**122498**	**110137**	**1267026**

Scenario 4: Timber Product Demands with Unrestricted Forest and Agricultural Lands - I Falls Power Plant

Table C.4.1: Total Variable Costs ($) by Planning Period for Scenario 4

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	20,422,890	1,034,221,000	**1,054,643,890**
2	79,650,650	1,002,863,000	**1,082,513,650**
3	87,181,180	1,004,227,000	**1,091,408,180**
4	92,137,260	980,177,300	**1,072,314,560**
5	115,433,400	1,018,934,000	**1,134,367,400**
6	116,510,000	1,011,033,000	**1,127,543,000**
7	119,989,200	992,249,700	**1,112,238,900**
8	119,807,000	1,019,220,000	**1,139,027,000**
9	121,571,300	1,001,794,000	**1,123,365,300**
10	124,541,500	1,029,193,000	**1,153,734,500**
TOTAL	**997,244,380**	**10,093,912,000**	**11,091,156,380**

Table C.4.2: Aspen Shadow Prices by Planning Period and Market for Scenario 4

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	37.18	38.71	36.55	41.67	39.66	42.16
2	36.56	40.18	39.31	44.52	42.44	42.95
3	36.59	41.52	41.61	46.77	44.35	44.06
4	36.76	43.10	43.02	48.64	45.59	44.42
5	37.00	42.82	42.74	47.57	45.34	44.43
6	35.41	39.86	39.61	44.46	42.22	42.71
7	35.35	39.55	38.60	43.24	41.76	42.50
8	35.59	39.13	37.56	41.92	41.03	42.09
9	35.42	38.32	36.60	40.67	40.33	41.79
10	35.29	37.31	36.07	39.67	39.69	41.76

Table C.4.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 4

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	16.91	21.01	23.70	26.48	17.36	9.73
2	19.34	21.22	25.58	26.73	19.19	9.08
3	20.43	21.21	26.83	26.90	20.04	8.14
4	21.44	21.94	27.88	27.38	20.93	8.04
5	22.72	22.60	29.60	28.03	22.06	10.24
6	24.46	23.41	30.72	28.67	23.60	12.00
7	25.48	24.22	32.19	29.46	24.52	12.03
8	27.51	24.98	34.07	30.95	26.26	14.53
9	28.98	26.27	35.76	32.25	27.76	17.73
10	29.84	27.83	36.87	33.98	29.88	19.72

Table C.4.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 4

MARKET							
	Pine Pulpwood			Spruce-Fir			Pine Sawlogs
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	Combined
1	30.90	44.18	39.08	54.74	52.20	46.35	22.57
2	30.74	44.17	39.70	55.95	53.17	47.00	20.85973
3	32.00	45.53	41.11	56.24	54.28	47.43	18.35148
4	33.40	46.52	43.23	57.82	56.70	49.47	15.4578
5	34.83	45.23	39.53	60.80	60.31	52.77	13.78495
6	30.00	37.77	33.24	62.80	64.91	56.41	11.78802
7	15.97	25.24	18.48	66.11	69.03	61.24	12.57881
8	7.16	16.40	8.45	67.94	71.47	63.91	17.27144
9	5.32	13.58	3.70	69.54	73.03	65.85	20.27566
10	4.10	12.65	2.71	70.80	72.94	67.32	24.69

Table C.4.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 4

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	164700	150200	154400	283900	103500	80200	50700	146600	119700	115000	**1368900**
Balsam Fir	58600	110700	97000	900	126500	106300	104900	83700	68600	76400	**833600**
N. White Cedar	0	1000	0	33000	1800	3400	4700	0	1500	0	**45400**
Tamarack	46800	35200	31900	23700	39300	53500	77800	14300	21700	17700	**361900**
Spruce	246200	189600	142000	168800	235800	195600	121300	252000	182700	140500	**1874500**
N. Hardwoods	130400	244100	285900	1119600	322400	348400	313100	362600	324900	311700	**3763100**
Aspen	1297700	952900	918700	91200	951600	861300	827800	675200	755800	815600	**8147800**
Balsam Poplar	108600	72200	74600	0	73300	63400	68300	58300	62400	79000	**660100**
TOTAL	**2053000**	**1755900**	**1704500**	**1721100**	**1854200**	**1712100**	**1568600**	**1592700**	**1537300**	**1555900**	**17055300**

Table C.4.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 4

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	277200	239100	271500	276200	226100	241600	193700	219800	191700	184200	**2321100**
Misc. Public	72600	44200	54500	45100	54000	46600	53600	55200	62200	42300	**530300**
State	353400	339400	309800	306900	367600	315100	334700	316100	250800	288100	**3181900**
County	512800	393100	337800	338200	370900	372500	324500	335600	340300	331500	**3657200**
Private	741100	646200	621500	642800	726200	634600	554000	580800	589900	611700	**6348800**
F. Industry	95900	93900	109400	111900	109400	101700	108100	85200	102400	98100	**1016000**
TOTAL	**2053000**	**1755900**	**1704500**	**1721100**	**1854200**	**1712100**	**1568600**	**1592700**	**1537300**	**1555900**	**17055300**

Table C.4.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 4

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1685000	1462800	1415600	1430300	1494300	1390600	1264500	1304400	1270100	1300000	**14017600**
Buffers	84800	68800	58200	72600	102100	78800	56500	75100	67000	81900	**745800**
Extended	144200	103400	117500	109000	117000	129100	126500	120100	73800	84300	**1124900**
Old Growth	5000	2600	1400	1400	2500	2400	2600	1200	2900	2500	**24500**
Reserve	134000	118300	111800	107800	138300	111200	118500	91900	123500	87200	**1142500**
TOTAL	**2053000**	**1755900**	**1704500**	**1721100**	**1854200**	**1712100**	**1568600**	**1592700**	**1537300**	**1555900**	**17055300**

Table C.4.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 4

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	97600	102500	86700	72600	79400	82700	83400	95800	77200	68300	**846200**
Becker	30500	10700	27700	28700	15400	20300	13500	23200	22200	15500	**207700**
Beltrami	118200	89200	95300	98800	104400	88200	78600	85100	85000	70500	**913300**
Benton	900	0	1900	3700	1400	900	2200	1700	3600	5000	**21300**
Carlton	70700	67400	54100	55400	80700	53500	53600	49300	56400	77900	**619000**
Cass	188500	110100	93100	102600	116900	138600	97000	102600	95300	94100	**1138800**
Chisago	0	4700	1200	0	2100	3800	3300	2500	1300	2900	**21800**
Clay	0	0	0	0	0	0	0	0	0	0	**0**
Clearwater	42200	40900	28500	25800	41600	34500	23100	52200	35600	29300	**353700**
Cook	10900	22200	80800	77300	27100	18900	24900	18100	8300	13400	**301900**
Crow Wing	80500	58000	60700	42300	67500	55400	40700	51400	54400	58400	**569300**
Douglas	0	0	900	900	4700	0	0	600	0	300	**7400**
Grant	0	0	0	1000	0	0	0	0	0	0	**1000**
Hubbard	82400	47900	56300	66500	42800	76800	33500	63700	54700	46300	**570900**
Isanti	400	4600	9300	3500	1800	3800	1300	2300	3800	3300	**34100**
Itasca	212200	230400	182900	199400	221600	169900	198200	189000	195000	205800	**2004400**
Kanabec	12200	8000	14500	14300	8600	13000	10500	26400	24400	14900	**146800**
Kittson	0	0	0	1200	4800	0	1200	0	0	0	**7200**
Koochiching	173000	180400	169400	167800	185500	197400	172600	165600	159200	149800	**1720700**
Lake	119400	94800	116500	129300	129600	114300	66500	103900	94400	80800	**1049500**
Lake Woods	33300	22300	44200	46800	12000	45100	40200	38200	31500	40100	**353700**
Mahnomen	6500	5700	6700	7400	7100	3900	11800	11000	17600	14000	**91700**
Marshall	1100	0	2200	4400	19300	4100	8200	2200	2200	0	**43700**
Mille Lacs	5100	7300	20600	11800	10600	7300	9800	26200	14900	9800	**123400**
Morrison	40700	26600	21600	11500	19500	30100	16700	18700	11800	25200	**222400**
Norman	2300	0	0	0	0	0	900	0	0	0	**3200**
Otter Tail	11400	6400	10000	5400	7200	13800	9300	5500	6600	2300	**77900**
Pennington	0	2200	2200	2200	5300	0	3500	0	1100	0	**16500**
Pine	102000	75000	71100	67300	93600	86400	87400	65100	67800	73900	**789600**
Polk	6600	1100	2200	4500	1100	6600	1100	4200	3300	5500	**36200**
Red Lake	1100	1100	2200	2200	3300	2200	2200	900	0	4400	**19600**
Roseau	6700	9100	20900	29900	22800	10100	19600	5800	6200	7000	**138100**
St. Louis	584100	517800	395400	407200	492200	417900	430700	369900	379800	412100	**4407100**
Todd	7000	3500	9000	8600	9900	5600	10400	3800	14200	14800	**86800**
Wadena	5500	6000	16400	20800	14400	7000	12700	7800	9500	10300	**110400**
TOTAL	**2053000**	**1755900**	**1704500**	**1721100**	**1854200**	**1712100**	**1568600**	**1592700**	**1537300**	**1555900**	**17055300**

Table C.4.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 4

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	73397	71952	71595	71595	59922	59922	60182	60000	58841	**587406**
Brainerd	0	36287	34424	34850	34861	30310	29149	27028	23441	17219	**267569**
Cook	0	0	0	0	0	0	0	0	0	0	**0**
Duluth	0	2794	2824	2824	2813	1818	1189	836	682	430	**16210**
G. Rapids	0	5919	8774	9240	9240	3785	3730	2115	498	595	**43896**
I. Falls	0	39008	39431	38896	38896	34431	33437	33437	30733	30733	**319002**
TOTAL	**0**	**157405**	**157405**	**157405**	**157405**	**130266**	**127427**	**123598**	**115354**	**107818**	**1234083**

Table C.4.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 4

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	62	62	62	62	62	62	62	62	62	**558**
0M	0	7211	7211	7211	7211	5927	5665	5605	5428	4629	**56098**
0S	0	0	0	0	0	0	0	0	0	0	**0**
0W	0	2609	2609	2609	2609	1965	1965	1965	1905	1905	**20141**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	0	0	0	0	0	0	0	0	0	**0**
2E	0	7223	7223	7223	7223	6617	6046	5649	4825	3083	**55112**
2M	0	0	0	0	0	0	0	0	0	0	**0**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	53620	53620	53620	53620	44950	44381	44381	40718	39645	**428555**
3E	0	5400	5400	5400	5400	4370	4141	3766	3046	1869	**38792**
3M	0	102	102	102	102	42	42	42	42	42	**618**
3S	0	9306	9306	9306	9306	5544	5014	4450	3388	2529	**58149**
3W	0	44251	44251	44251	44251	37025	36835	36768	36489	36367	**360488**
4E	0	1302	1302	1302	1302	1091	1080	918	741	662	**9700**
4M	0	355	355	355	355	335	335	335	321	321	**3067**
4S	0	12194	12194	12194	12194	10060	9939	8254	7180	5533	**89742**
4W	0	12071	12071	12071	12071	11126	10778	10778	10778	10778	**102522**
6E	0	413	413	413	413	290	290	222	81	65	**2600**
6S	0	1033	1033	1033	1033	621	613	162	109	87	**5724**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	0	0	0	0	0	**48**
TOTAL	**0**	**157405**	**157405**	**157405**	**157405**	**130266**	**127427**	**123598**	**115354**	**107818**	**1234083**

Scenario 5: Timber Product Demands with Restricted Forest and Agricultural Lands - Alexandria Power Plant

Table C.5.1: Total Variable Costs ($) by Planning Period for Scenario 5

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	29,967,260	1,035,908,000	**1,065,875,260**
2	103,113,100	984,702,200	**1,087,815,300**
3	107,908,800	975,078,300	**1,082,987,100**
4	113,796,400	959,894,500	**1,073,690,900**
5	131,465,900	998,648,100	**1,130,114,000**
6	132,315,100	991,149,200	**1,123,464,300**
7	135,001,600	998,648,300	**1,133,649,900**
8	131,772,200	985,361,700	**1,117,133,900**
9	130,239,500	994,294,000	**1,124,533,500**
10	131,347,800	1,011,614,000	**1,142,961,800**
TOTAL	**1,146,927,660**	**9,935,298,300**	**11,082,225,960**

Table C.5.2: Aspen Shadow Prices by Planning Period and Market for Scenario 5

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	40.03	42.25	39.49	45.59	42.75	45.08
2	38.27	41.80	43.48	49.59	46.22	45.94
3	38.73	43.73	46.69	52.44	48.31	46.38
4	39.39	45.75	47.68	54.43	49.17	46.52
5	38.63	43.00	44.78	49.71	46.75	45.77
6	36.67	40.32	41.20	46.45	43.71	43.85
7	36.47	39.76	40.55	44.79	43.26	43.72
8	36.69	39.64	39.32	43.74	42.73	43.1
9	36.60	38.90	38.68	42.56	42.04	42.55
10	36.04	38.05	38.05	41.65	41.41	42.06

Table C.5.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 5

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	14.00	20.92	18.63	25.68	15.21	20.68
2	18.01	22.60	18.31	25.96	16.75	22.14
3	18.84	23.23	18.47	26.46	17.35	21.39
4	19.10	24.29	20.62	27.35	19.25	22.11
5	20.85	25.78	21.23	28.59	20.25	21.77
6	21.73	27.21	23.17	29.86	21.64	22.52
7	22.79	28.63	23.90	31.52	22.56	22.61
8	23.6	30.23	25.64	33.69	24.05	25.47
9	25.65	33.04	27.57	36.16	25.89	27.85
10	27.98	36.68	30.13	39.52	29.89	29.91

Table C.5.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 5

MARKET							
	Pine Pulpwood			Spruce-Fir			Pine Sawlogs
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	Combined
1	32.05	45.53	40.50	59.29	57.34	50.99	28.36
2	32.55	46.07	41.69	61.86	60.32	53.28	27.24
3	34.23	48.14	43.67	63.52	62.73	55.18	24.12
4	36.48	49.94	46.83	66.94	66.34	58.66	20.96
5	39.48	49.14	44.72	70.54	71.52	62.44	18.31
6	36.89	45.55	41.15	68.57	74.40	65.26	16.04
7	28.54	36.13	30.40	70.41	73.93	66.48	18.18
8	17.36	26.33	20.47	70.04	74.66	67.64	24.23
9	10.37	19.59	11.65	69.64	74.80	67.77	31.27
10	7.14	13.60	6.48	69.62	74.55	69.30	38.69

Table C.5.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 5

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	160500	159300	161100	117700	112800	90100	75200	120600	98900	123200	**1219400**
Balsam Fir	80800	133900	108800	119600	121700	102000	127500	89200	87200	67200	**1037900**
N. White Cedar	3400	3500	1100	5600	2700	2400	1100	6900	3400	2300	**32400**
Tamarack	49300	33500	51900	36400	38100	46200	65100	30700	32600	24600	**408400**
Spruce	211200	190900	159100	218700	230200	158700	89300	184000	177800	177200	**1797100**
N. Hardwoods	141000	259300	267100	282900	322800	328000	325100	304000	313400	389600	**2933200**
Aspen	1297500	918700	884400	852500	926300	845500	812700	758300	753500	695200	**8744600**
Balsam Poplar	115400	64000	63000	74300	83400	52800	66100	56000	53200	68700	**696900**
TOTAL	**2059100**	**1763100**	**1696500**	**1707700**	**1838000**	**1625700**	**1562100**	**1549700**	**1520000**	**1548000**	**16869900**

Table C.5.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 5

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	292100	233700	250400	261100	208200	218900	207000	231700	188800	196000	**2287900**
Misc. Public	67300	37800	39600	33100	35500	41800	35500	29900	35700	30100	**386300**
State	338400	298200	310700	330800	380600	272100	257000	312200	254500	281800	**3036300**
County	528300	404200	344200	305800	382100	353100	345800	337000	342200	330000	**3672700**
Private	722100	700500	651300	650400	696800	650200	637500	547400	565800	605000	**6427000**
F. Industry	110900	88700	100300	126500	134800	89600	79300	91500	133000	105100	**1059700**
TOTAL	**2059100**	**1763100**	**1696500**	**1707700**	**1838000**	**1625700**	**1562100**	**1549700**	**1520000**	**1548000**	**16869900**

Table C.5.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 5

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1922800	1594300	1525300	1555900	1665600	1469800	1392900	1346400	1397900	1426600	**15297500**
Buffers	63200	85100	83300	83200	98000	75400	68000	72100	43100	30400	**701800**
Extended	70400	82600	85400	68600	74400	79100	97400	128600	77900	91000	**855400**
Old Growth	2700	1100	2500	0	0	1400	3800	2600	1100	0	**15200**
Reserve	0	0	0	0	0	0	0	0	0	0	**0**
TOTAL	**2059100**	**1763100**	**1696500**	**1707700**	**1838000**	**1625700**	**1562100**	**1549700**	**1520000**	**1548000**	**16869900**

Table C.5.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 5

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	75500	101200	90700	92100	77900	84600	100900	92600	79200	72500	**867200**
Becker	35800	25400	51300	36500	19400	26500	44500	31500	34000	27700	**332600**
Beltrami	127400	76100	94800	81400	82800	58200	68300	76900	65100	65000	**796000**
Benton	1800	1000	4500	6000	5000	4500	1900	1400	8400	2800	**37300**
Carlton	54600	53500	62300	44500	69200	53100	57900	47400	63200	52300	**558000**
Cass	191400	98500	107900	97800	113300	116700	94500	106500	97200	122600	**1146400**
Chisago	1700	3000	2500	0	3800	5500	2300	7200	4200	2900	**33100**
Clay	0	0	0	0	3400	3500	1200	0	0	0	**8100**
Clearwater	50500	32000	24800	27300	34900	32100	34100	28200	27500	20300	**311700**
Cook	31200	42700	77300	70900	49000	36700	17300	42200	24400	27000	**418700**
Crow Wing	75900	64800	61500	47100	77700	44500	46900	43000	42600	80400	**584400**
Douglas	0	15800	2700	1200	1000	1000	2800	1900	1000	14200	**41600**
Grant	0	0	1500	0	0	1200	0	0	0	1500	**4200**
Hubbard	82800	49800	77900	58100	42100	83000	34700	50800	49000	41600	**569800**
Isanti	400	4300	2900	15700	2800	1500	4600	3200	3400	3100	**41900**
Itasca	231900	199600	160400	166600	183500	176000	181800	171300	190700	177900	**1839700**
Kanabec	15000	11500	14500	13900	9500	21800	17800	23900	22600	11500	**162000**
Kittson	0	0	2400	2400	1200	1200	1200	1900	0	0	**10300**
Koochiching	183300	154200	135900	174700	181800	154800	131800	137200	160300	131900	**1545900**
Lake	124500	99800	108100	124900	131900	98600	80600	106300	103800	96300	**1074800**
Lake Woods	43200	23600	35300	44100	26800	43800	43500	25900	12100	22500	**320800**
Mahnomen	6500	7400	5300	10600	4800	5400	2900	8500	13600	7600	**72600**
Marshall	5500	1100	5500	10700	23000	1100	2200	1100	1100	0	**51300**
Mille Lacs	8700	7700	25200	17000	12900	15300	13200	32800	18300	12100	**163200**
Morrison	32700	37300	24500	9600	16900	28400	20700	21400	9100	20900	**221500**
Norman	2300	0	0	0	0	0	900	1200	1200	0	**5600**
Otter Tail	2700	22300	22200	32600	31800	13000	31200	12000	18400	19700	**205900**
Pennington	0	4400	1100	7900	900	0	0	0	1100	0	**15400**
Pine	103500	74200	51600	67400	90600	81100	80500	58100	73400	78200	**758600**
Polk	6500	4400	2200	3300	1100	4200	1100	4200	6600	3300	**36900**
Red Lake	3300	0	3300	5500	1100	1100	0	2200	1100	4400	**22000**
Roseau	7800	12000	23300	32900	21100	11900	8500	5200	2800	3000	**128500**
St. Louis	534800	505200	389500	369700	483000	391200	409000	388700	357900	389500	**4218500**
Todd	6200	20900	10700	14000	12600	10000	15100	6600	8300	20200	**124600**
Wadena	11700	9400	12900	21300	21200	14200	8200	8400	18400	15100	**140800**
TOTAL	**2059100**	**1763100**	**1696500**	**1707700**	**1838000**	**1625700**	**1562100**	**1549700**	**1520000**	**1548000**	**16869900**

Table C.5.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 5

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	81392	80906	82322	81032	72444	72115	72375	72423	69824	**684833**
Brainerd	0	44168	44199	45829	43309	31880	29329	29029	23892	18764	**310399**
Cook	0	0	0	0	0	0	0	0	97	97	**194**
Duluth	0	5610	7089	7089	5287	3118	1818	1620	847	589	**33067**
G. Rapids	0	12962	12473	11300	13085	8690	7840	7060	5405	5096	**83911**
I. Falls	0	51315	50780	48907	50005	42516	39045	37577	33526	32113	**385784**
TOTAL	**0**	**0**	**0**	**0**	**0**	**217**	**2108**	**2378**	**3701**	**5536**	**13940**

Table C.5.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 5

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	165	165	165	165	62	62	62	62	62	**970**
0M	0	9299	9299	9299	9299	7235	6670	6499	6080	6012	**69692**
0S	0	117	117	117	107	0	0	0	0	0	**458**
0W	0	5353	5353	5353	5353	2609	2609	2609	2549	2257	**34045**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	69	69	69	69	0	0	0	0	0	**276**
2E	0	8105	8105	8105	8062	7151	6822	6694	5860	4752	**63656**
2M	0	29	29	29	29	0	0	0	0	0	**116**
2S	0	167	167	167	102	102	102	102	102	102	**1113**
2W	0	64102	64102	64102	63903	56470	53501	52584	49572	47070	**515406**
3E	0	8317	8317	8317	7454	5082	4529	4489	3831	3369	**53705**
3M	0	162	162	162	162	42	42	42	42	42	**858**
3S	0	14895	14895	14895	14412	8354	7829	7445	5197	4365	**92287**
3W	0	51217	51217	51217	50669	44989	44674	44416	43825	42916	**425140**
4E	0	1513	1513	1513	1476	1321	1226	1226	1176	909	**11873**
4M	0	355	355	355	355	355	335	335	335	335	**3115**
4S	0	15200	15200	15200	14742	11319	10423	10329	8611	7427	**108451**
4W	0	14283	14283	14283	14283	12325	12113	11889	11678	11541	**116678**
6E	0	447	447	447	447	299	299	299	208	158	**3051**
6S	0	1501	1501	1501	1478	999	880	880	624	563	**9927**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	12	0	0	0	0	**60**
TOTAL	**0**	**195447**	**195447**	**195447**	**192718**	**158865**	**152255**	**150039**	**139891**	**132019**	**1512128**

Scenario 6: Timber Product Demands with Restricted Forest and Agricultural Lands - Bemidji Power Plant

Table C.6.1: Total Variable Costs ($) by Planning Period for Scenario 6

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	29,595,370	1,040,116,000	**1069711370**
2	102,477,700	992,742,300	**1,095,220,000**
3	105,955,600	993,462,100	**1,099,417,700**
4	112,457,800	970,825,200	**1,083,283,000**
5	129,473,800	1,007,900,000	**1,137,373,800**
6	130,011,600	1,019,079,000	**1,149,090,600**
7	131,287,100	995,254,500	**1,126,541,600**
8	127,261,900	997,771,400	**1,125,033,300**
9	129,102,400	994,565,600	**1,123,668,000**
10	133,589,300	1,028,846,000	**1,162,435,300**
TOTAL	**1,131,212,570**	**10,040,562,100**	**11,171,774,670**

Table C.6.2: Aspen Shadow Prices by Planning Period and Market for Scenario 6

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	40.19	41.72	39.27	45.29	42.67	44.88
2	37.30	42.06	43.13	49.08	45.56	45.39
3	38.06	43.63	46.19	51.96	47.65	45.77
4	38.49	45.38	47.05	53.87	48.50	45.87
5	37.88	42.80	44.08	49.25	46.28	45.11
6	36.20	40.37	40.96	46.19	43.46	43.53
7	35.71	40.41	40.24	44.67	42.80	43.25
8	36.07	39.94	39.15	43.83	42.38	42.83
9	36.44	39.56	38.64	42.78	41.94	42.45
10	36.97	38.91	38.01	41.84	41.43	42.03

Table C.6.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 6

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	I. Falls
1	17.16	21.28	20.04	26.09	16.03	22.75
2	26.40	22.34	20.10	26.40	18.76	25.63
3	27.37	22.97	21.13	26.79	20.16	26.31
4	28.58	23.89	23.10	27.55	21.39	26.53
5	30.07	24.76	24.09	28.84	22.59	26.11
6	31.81	25.78	25.00	30.03	23.78	27.33
7	33.17	26.68	26.34	31.43	25.45	28.62
8	35.37	27.97	28.46	33.11	27.59	31.29
9	38.39	30.66	31.15	35.69	30.40	33.74
10	40.00	33.23	33.67	38.46	34.00	36.36

Table C.6.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 6

MARKET							
	Pine Pulpwood			Spruce-Fir			Pine Sawlogs
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	Combined
1	31.92	45.41	40.40	58.78	56.88	50.47	28.06
2	32.30	46.07	41.68	60.95	59.72	52.60	26.70
3	33.93	48.02	43.55	62.62	61.91	54.39	23.58
4	36.00	49.46	46.66	65.90	65.56	57.67	20.64
5	38.97	48.59	44.09	69.68	70.71	61.48	18.00
6	34.18	42.90	38.52	68.23	74.12	64.75	16.40
7	24.59	33.42	27.53	71.01	73.80	66.83	19.17
8	13.04	23.92	16.60	70.35	74.27	67.28	24.87
9	4.24	15.78	6.94	69.98	74.87	67.87	32.63
10	0.92	11.82	3.61	71.03	74.00	68.14	39.93

Table C.6.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 6

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	158200	158600	157300	114400	115000	87100	74200	117200	97000	124500	**1203500**
Balsam Fir	84100	128000	104900	119600	123800	109000	121900	87300	92200	64900	**1035700**
N. White Cedar	1100	3500	1100	3300	2700	2400	2100	4700	3400	3300	**27600**
Tamarack	49300	32200	50900	37200	33500	50900	65200	28200	28900	22800	**399100**
Spruce	210300	182500	158100	214200	231500	170600	84000	192700	167800	183200	**1794900**
N. Hardwoods	153500	268000	299200	297000	348500	343100	351400	341900	337500	324700	**3064800**
Aspen	1297500	931700	891100	868200	930100	874000	806900	737300	743800	782700	**8863300**
Balsam Poplar	113900	65000	60300	77200	86400	54600	66400	54700	53900	79800	**712200**
TOTAL	**2067900**	**1769500**	**1722900**	**1731100**	**1871500**	**1691700**	**1572100**	**1564000**	**1524500**	**1585900**	**17101100**

Table C.6.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 6

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	282700	252000	253100	255400	217600	232800	226200	232600	183300	190900	**2326600**
Misc. Public	68200	38700	43100	38400	39600	54700	45900	30100	33000	43900	**435600**
State	340600	298300	308500	343800	379100	293800	257600	318100	265700	295600	**3101100**
County	530700	423400	361600	325100	376100	383400	331900	341100	334900	331200	**3739400**
Private	735500	667900	650800	642600	718300	637100	627400	547500	575500	616900	**6419500**
F. Industry	110200	89200	105800	125800	140800	89900	83100	94600	132100	107400	**1078900**
TOTAL	**2067900**	**1769500**	**1722900**	**1731100**	**1871500**	**1691700**	**1572100**	**1564000**	**1524500**	**1585900**	**17101100**

Table C.6.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 6

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1935100	1599900	1553100	1571400	1704100	1525100	1401600	1359000	1397000	1471500	**15517800**
Buffers	59700	87600	81200	84400	97700	76500	62200	74900	46500	30800	**701500**
Extended	70400	79400	86100	75300	69700	88700	103000	127500	79900	83600	**863600**
Old Growth	2700	2600	2500	0	0	1400	5300	2600	1100	0	**18200**
Reserve	0	0	0	0	0	0	0	0	0	0	**0**
TOTAL	**2067900**	**1769500**	**1722900**	**1731100**	**1871500**	**1691700**	**1572100**	**1564000**	**1524500**	**1585900**	**17101100**

Table C.6.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 6

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	77900	99300	93300	87100	77900	80900	99300	93100	76300	74900	**860000**
Becker	37200	28000	48200	29500	27900	27200	39400	25200	36100	34100	**332800**
Beltrami	131800	91000	100300	106600	94400	77500	68100	84400	78600	85400	**918100**
Benton	1800	0	2800	2300	3800	4300	2600	3400	6800	6400	**34200**
Carlton	54600	54100	62100	45300	68800	53200	57600	46000	63500	50100	**555300**
Cass	174500	131300	121900	104100	106800	125400	113500	112600	96500	101600	**1188200**
Chisago	1700	3000	2500	0	3800	5500	3600	7200	1200	2900	**31400**
Clay	0	0	0	0	0	0	0	0	1500		**1500**
Clearwater	48100	40300	36300	43500	49600	39500	31600	28200	32700	37500	**387300**
Cook	27500	44100	75900	65800	51400	33200	16800	41500	22700	24300	**403200**
Crow Wing	79800	62800	61500	46900	70800	40300	47900	43400	39000	76600	**569000**
Douglas	900	0	0	1900	4600	0	0	4000	1300	1900	**14600**
Grant	0	0	0	0	69400	0	0	0	0		**69400**
Hubbard	79200	67000	77400	62400	0	54800	42400	50500	46500	59200	**539400**
Isanti	400	3300	2700	13700	2800	1400	4400	2000	1900	4600	**37200**
Itasca	229800	207700	165200	171500	187700	192400	201100	170000	202300	178500	**1906200**
Kanabec	15000	11500	13200	13900	9500	21800	13500	22800	23000	12500	**156700**
Kittson	182600	0	0	2400	2400	1200	2400	1900	0		**192900**
Koochiching	0	147200	149700	180100	187800	171500	132500	143800	157900	147000	**1417500**
Lake	123300	101800	102900	126300	131800	103600	74600	106100	97500	90800	**1058700**
Lake Woods	45900	19800	36000	43100	23400	51100	46000	26400	15200	20400	**327300**
Mahnomen	5500	9400	10900	13900	13900	10700	13800	13800	7300	20000	**119200**
Marshall	7700	0	5500	7700	21300	3000	4400	3100	1100	2200	**56000**
Mille Lacs	10400	5600	23500	15300	13500	9800	10900	30200	14500	10700	**144400**
Morrison	36000	33300	20500	8600	17000	31500	22500	17600	9400	15700	**212100**
Norman	2300	0	0	0	0	0	3300	3300	1200		**10100**
Otter Tail	11600	6700	10700	16800	10200	15000	19600	12000	14800	10400	**127800**
Pennington	0	1100	3300	9000	900	3000	3000	1100	2200		**23600**
Pine	107200	72800	54700	64000	91300	84600	73000	54600	68600	79500	**750300**
Polk	6500	4400	4400	6600	4400	8600	1100	6400	5500	7800	**55700**
Red Lake	3300	1100	3300	5500	2200	2200	2200	4400	1100	2200	**27500**
Roseau	6600	12000	23400	31700	19000	13300	11100	4600	4000	4100	**129800**
St. Louis	539100	503200	390700	372800	473500	402200	396200	384200	361300	393600	**4216800**
Todd	8000	5100	8000	9000	10600	7300	10900	5100	12900	21800	**98700**
Wadena	11700	2600	12100	23800	19100	15700	2800	11100	20100	9200	**128200**
TOTAL	**2067900**	**1769500**	**1722900**	**1731100**	**1871500**	**1691700**	**1572100**	**1564000**	**1524500**	**1585900**	**17101100**

Table C.6.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 6

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	78589	78775	78434	79017	70336	70408	70794	73978	76519	**676850**
Brainerd	0	45775	44315	45829	43252	30109	30349	28859	27506	23453	**319447**
Cook	0	0	0	0	0	0	0	0	0	97	**97**
Duluth	0	5443	6956	6956	5242	2824	1818	1620	944	739	**32542**
G. Rapids	0	11749	12473	11300	12218	8762	7788	7788	5078	2719	**79875**
I. Falls	0	50441	49478	49478	48184	38239	37963	34487	33374	32012	**373656**
TOTAL	**0**	**191997**	**191997**	**191997**	**187913**	**150270**	**148326**	**143548**	**140880**	**135539**	**1482467**

Table C.6.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 6

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	165	165	165	88	62	62	62	62	62	**893**
0M	0	8681	8681	8681	8641	6839	6492	6307	6070	5876	**66268**
0S	0	117	117	117	107	0	0	0	0	0	**458**
0W	0	4154	4154	4154	3779	2317	2317	2317	2317	2257	**27766**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	69	69	69	69	0	0	0	0	0	**276**
2E	0	8029	8029	8029	7948	7142	7032	6539	6046	5527	**64321**
2M	0	29	29	29	29	0	0	0	0	0	**116**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	63782	63782	63782	63621	51137	51137	48654	48105	47048	**501048**
3E	0	8317	8317	8317	7390	5048	4867	4580	4391	3768	**54995**
3M	0	162	162	162	162	42	42	42	42	42	**858**
3S	0	14351	14351	14351	13486	8354	7924	7455	6925	6341	**93538**
3W	0	50702	50702	50702	50308	43000	43000	42503	42313	42246	**415476**
4E	0	1513	1513	1513	1476	1302	1252	1237	1226	1131	**12163**
4M	0	355	355	355	355	355	335	335	335	321	**3101**
4S	0	15087	15087	15087	14299	11087	10599	10445	10332	8750	**110773**
4W	0	14283	14283	14283	13977	12034	11847	11847	11499	11499	**115552**
6E	0	447	447	447	447	299	299	290	290	149	**3115**
6S	0	1501	1501	1501	1478	999	880	694	686	281	**9521**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	12	0	0	0	0	**60**
TOTAL	**0**	**191997**	**191997**	**191997**	**187913**	**150270**	**148326**	**143548**	**140880**	**135539**	**1482467**

Scenario 7: Timber Product Demands with Restricted Forest and Agricultural Lands - Brainerd Power Plant

Table C.7.1: Total Variable Costs ($) by Planning Period for Scenario 7

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	27,540,080	1,036,981,000	**1,064,521,080**
2	103,906,200	992,664,600	**1,096,570,800**
3	107,754,700	990,408,500	**1,098,163,200**
4	112,219,800	968,588,900	**1,080,808,700**
5	128,699,700	1,001,430,000	**1,130,129,700**
6	128,489,600	1,007,163,000	**1,135,652,600**
7	132,201,300	1,007,859,000	**1,140,060,300**
8	130,108,000	1,000,878,000	**1,130,986,000**
9	132,043,600	1,010,212,000	**1,142,255,600**
10	130,351,200	1,030,003,000	**1,160,354,200**
TOTAL	**1,133,314,180**	**10,046,188,000**	**11,179,502,180**

Table C.7.2: Aspen Shadow Prices by Planning Period and Market for Scenario 7

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	**I. Falls**
1	39.71	41.78	39.23	45.21	42.44	**44.76**
2	38.16	41.99	43.10	48.97	45.89	**45.73**
3	38.52	43.68	46.28	51.91	47.98	**46.10**
4	39.06	45.59	47.23	53.86	48.74	**46.23**
5	38.36	42.70	44.47	49.08	46.45	**45.51**
6	36.56	40.25	41.05	45.97	43.53	**43.83**
7	36.44	39.86	40.42	44.33	43.01	**43.69**
8	36.74	39.57	39.17	43.33	42.44	**43.06**
9	36.55	39.21	38.41	41.97	41.74	**42.56**
10	**36.04**	**38.34**	**37.52**	**40.84**	**40.99**	**41.88**

Table C.7.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 7

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	**I. Falls**
1	14.56	23.51	19.48	26.78	16.71	**21.55**
2	17.85	26.54	19.38	27.40	18.23	**22.81**
3	18.78	27.47	19.95	28.00	19.08	**22.47**
4	19.34	28.81	22.04	29.33	21.24	**23.05**
5	20.97	30.40	22.81	30.83	22.51	**23.70**
6	22.57	32.26	24.76	32.37	23.78	**24.07**
7	24.06	34.26	26.16	34.86	25.27	**24.30**
8	25.37	36.83	28.90	37.58	27.90	**28.16**
9	27.93	40.32	31.79	41.61	30.89	**31.27**
10	**30.75**	**43.84**	**35.08**	**45.67**	**35.06**	**33.82**

Table C.7.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 7

MARKET							
	Pine Pulpwood			Spruce-Fir			**Pine Sawlogs**
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	**Combined**
1	32.07	45.61	40.47	58.90	56.94	50.53	**27.98**
2	32.58	46.09	41.71	61.37	59.73	52.67	**26.86**
3	34.20	48.11	43.62	62.76	61.98	54.46	**23.69**
4	36.20	49.71	46.54	66.06	65.42	57.78	**20.52**
5	39.22	48.73	44.19	69.55	70.40	61.38	**17.87**
6	34.79	43.56	39.18	68.40	73.76	64.40	**15.69**
7	25.49	32.56	27.63	70.02	73.45	65.95	**18.26**
8	13.65	22.25	16.84	69.69	74.10	66.97	**24.25**
9	6.93	15.79	7.82	68.81	73.99	67.07	**31.09**
10	**3.69**	**11.03**	**5.28**	**70.00**	**74.08**	**69.03**	**38.1**

Table C.7.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 7

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	161700	159200	161000	115600	110700	90500	76600	120500	98300	126500	**1220600**
Balsam Fir	80800	131200	104100	121400	125800	103200	122200	91300	83900	71500	**1035400**
N. White Cedar	1100	5800	1100	3300	2700	2400	1100	4700	3400	3300	**28900**
Tamarack	49300	33100	50500	34900	34300	53600	62000	29200	28000	25800	**400700**
Spruce	211400	188100	160700	213900	227700	166100	85200	188500	169700	185600	**1796900**
N. Hardwoods	146800	284500	286900	315600	329700	349200	362400	352600	353100	399700	**3180500**
Aspen	1295000	909800	890600	842000	925300	871100	804000	733700	758300	733600	**8763400**
Balsam Poplar	112400	66200	61000	76900	77900	55400	64500	56700	55800	70800	**697600**
TOTAL	**2058500**	**1777900**	**1715900**	**1723600**	**1834100**	**1691500**	**1578000**	**1577200**	**1550500**	**1616800**	**17124000**

Table C.7.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 7

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	301600	236100	248600	263500	218000	230200	203300	245100	194000	198600	**2339000**
Misc. Public	64300	39400	35200	34400	35800	39600	40500	30800	32000	33700	**385700**
State	334200	304800	314600	328100	372800	291200	263100	324500	259400	298800	**3091500**
County	524100	417400	363700	317300	380100	371800	342000	347800	347300	332100	**3743600**
Private	723200	689000	653100	655000	693500	668500	640700	543100	580900	646600	**6493600**
F. Industry	111100	91200	100700	125300	133900	90200	88400	85900	136900	107000	**1070600**
TOTAL	**2058500**	**1777900**	**1715900**	**1723600**	**1834100**	**1691500**	**1578000**	**1577200**	**1550500**	**1616800**	**17124000**

Table C.7.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 7

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1926700	1598400	1547400	1578200	1662100	1527300	1405800	1358100	1428400	1505100	**15537500**
Buffers	59600	94900	82400	78600	99100	77800	69400	79100	41800	33200	**715900**
Extended	69500	83500	83600	66800	72900	85000	99000	137400	79200	78500	**855400**
Old Growth	2700	1100	2500	0	0	1400	3800	2600	1100	0	**15200**
Reserve	0	0	0	0	0	0	0	0	0	0	**0**
TOTAL	**2058500**	**1777900**	**1715900**	**1723600**	**1834100**	**1691500**	**1578000**	**1577200**	**1550500**	**1616800**	**17124000**

Table C.7.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 7

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	71700	114400	96000	98300	80900	100600	113000	91400	79500	73500	**919300**
Becker	38000	17500	32100	37600	20500	25000	32300	28300	31100	26000	**288400**
Beltrami	127900	73700	95500	79900	78500	62600	72400	74400	66700	72800	**804400**
Benton	1800	1000	1800	4000	4800	7500	1900	2100	8400	2800	**36100**
Carlton	56000	53800	62100	44300	71500	54600	60600	46800	59800	57300	**566800**
Cass	181300	127800	119400	109500	119200	115900	108000	115300	94600	133400	**1224400**
Chisago	1700	3000	2500	2600	3800	5500	3600	7200	2900	2900	**35700**
Clay	0	0	0	0		0	0	0	0	1500	**1500**
Clearwater	50400	31300	23600	27600	34900	39500	29500	37400	27600	17000	**318800**
Cook	26400	46400	80800	70900	46600	37100	25900	45900	23800	26700	**430500**
Crow Wing	73200	80600	76200	41600	74300	48400	46200	43000	44800	93900	**622200**
Douglas	1800	0	0	4700	7800	1500	0	900	2100	800	**19600**
Grant	0	0	0	0		0	0	0	0	0	**0**
Hubbard	84100	45100	75100	60500	41700	82900	30300	55500	46900	41600	**563700**
Isanti	400	3300	3900	15700	2800	1500	4600	4900	2600	3100	**42800**
Itasca	234900	196400	159500	179300	182200	185800	183400	171000	206900	180700	**1880100**
Kanabec	13600	15600	20100	15300	13700	24400	26000	18600	20700	14400	**182400**
Kittson	0	0	2400	1200	1200	1200	2400	1900	0	0	**10300**
Koochiching	183400	148200	138900	169400	182900	162700	132300	136500	162500	142700	**1559500**
Lake	126600	99600	110600	128100	134400	103800	76000	106900	109500	101200	**1096700**
Lake Woods	41300	22700	35100	42000	23100	47600	42600	27500	12100	23900	**317900**
Mahnomen	8300	5700	4100	6600	7000	5400	5000	7600	9900	6400	**66000**
Marshall	5500	1100	5500	9600	23200	1100	2200	2000	1100	0	**51300**
Mille Lacs	6900	17900	28700	14900	15900	10800	19700	35200	13200	13800	**177000**
Morrison	32400	44100	23900	9600	21300	27700	20500	20900	8400	36100	**244900**
Norman	1100	1200	0	0		0	900	0	0	1200	**4400**
Otter Tail	11600	7000	14900	21100	15000	22700	22000	15900	20100	12500	**162800**
Pennington	0	4400	1100	7900	900	0	1100	1100	0	0	**16500**
Pine	105200	77300	54800	67400	93400	80000	78600	65100	77100	83300	**782200**
Polk	6500	3300	2200	3300	1100	2000	4400	4200	5500	5500	**38000**
Red Lake	2200	1100	3300	5500	1100	1100	0	1100	2200	4400	**22000**
Roseau	7800	12000	21100	35100	17400	14500	8500	6300	2800	3000	**128500**
St. Louis	537200	507000	395900	376500	476100	400100	401500	385400	376000	401000	**4256700**
Todd	6900	9500	9900	8400	22000	4700	16600	6800	11400	15200	**111400**
Wadena	12400	5900	14900	25200	14900	13300	6000	10100	20300	18200	**141200**
TOTAL	**2058500**	**1777900**	**1715900**	**1723600**	**1834100**	**1691500**	**1578000**	**1577200**	**1550500**	**1616800**	**17124000**

Table C.7.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 7

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	80912	80580	80016	80561	70779	70779	71087	73201	69359	**677274**
Brainerd	0	44382	44237	45867	41567	30109	30136	30043	30069	36294	**332704**
Cook	0	0	0	0	0	0	0	0	97	97	**194**
Duluth	0	5443	6956	6956	5082	2633	1818	1275	773	533	**31469**
G. Rapids	0	12867	12366	11300	13085	8690	7320	7210	5078	1268	**79184**
I. Falls	0	50700	50165	50165	49324	42516	38610	35573	33526	29238	**379817**
TOTAL	**0**	**194304**	**194304**	**194304**	**189619**	**154727**	**148663**	**145188**	**142744**	**136789**	**1500642**

Table C.7.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 7

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	165	165	165	88	62	62	62	62	62	**893**
0M	0	9337	9337	9337	9259	6430	6274	5963	5748	5748	**67433**
0S	0	117	117	117	107	0	0	0	0	0	**458**
0W	0	4920	4920	4920	4766	2609	2609	2609	2609	2317	**32279**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	69	69	69	69	0	0	0	0	0	**276**
2E	0	8105	8105	8105	7899	7124	7032	6929	6734	6659	**66692**
2M	0	29	29	29	29	0	0	0	0	0	**116**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	64102	64102	64102	63743	54981	51599	49632	48105	44150	**504516**
3E	0	8317	8317	8317	7017	5048	4671	4631	4477	4441	**55236**
3M	0	162	162	162	162	42	42	42	42	42	**858**
3S	0	14689	14689	14689	13816	8354	7593	7593	7593	7593	**96609**
3W	0	50740	50740	50740	50175	43570	43255	42433	42313	41318	**415284**
4E	0	1513	1513	1513	1476	1302	1252	1252	1243	1058	**12122**
4M	0	355	355	355	355	355	335	335	335	335	**3115**
4S	0	15200	15200	15200	14337	11046	10448	10448	10435	10216	**112530**
4W	0	14283	14283	14283	14262	12283	12071	11847	11636	11499	**116447**
6E	0	447	447	447	447	299	299	299	299	299	**3283**
6S	0	1501	1501	1501	1359	969	880	872	872	811	**10266**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	12	0	0	0	0	**60**
TOTAL	**0**	**194304**	**194304**	**194304**	**189619**	**154727**	**148663**	**145188**	**142744**	**136789**	**1500642**

Scenario 8: Timber Product Demands with Restricted Forest and Agricultural Lands - I Falls Power Plant

Table C.8.1: Total Variable Costs ($) by Planning Period for Scenario 8

VARIABLE COSTS			
PERIOD	Production and Management	Harvest and Transportation	**TOTAL**
1	27,636,100	1,037,552,000	**1,065,188,100**
2	103,251,000	995,568,700	**1,098,819,700**
3	108,397,500	997,552,300	**1,105,949,800**
4	112,899,000	972,791,900	**1,085,690,900**
5	128,333,500	1,008,539,000	**1,136,872,500**
6	130,011,800	1,016,266,000	**1,146,277,800**
7	130,612,300	998,331,900	**1,128,944,200**
8	128,620,300	992,022,500	**1,120,642,800**
9	132,342,900	1,015,384,000	**1,147,726,900**
10	132,746,700	1,006,368,000	**1,139,114,700**
TOTAL	**1,134,851,100**	**10,040,376,300**	**11,175,227,400**

Table C.8.2: Aspen Shadow Prices by Planning Period and Market for Scenario 8

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	**I. Falls**
1	39.85	41.81	39.48	45.42	42.86	**45.11**
2	37.98	42.24	42.81	49.18	45.74	**45.42**
3	38.35	44.05	46.23	52.06	47.95	**45.72**
4	38.71	45.80	47.26	53.97	48.70	**45.86**
5	38.03	42.87	43.79	48.98	46.07	**45.06**
6	36.41	40.42	40.97	45.99	43.30	**43.47**
7	36.23	40.82	40.53	44.78	43.20	**43.55**
8	36.49	40.39	39.33	43.91	42.83	**43.24**
9	36.73	40.00	38.84	42.81	42.31	**43.58**
10	**36.34**	**39.09**	**38.34**	**41.73**	**41.79**	**43.73**

Table C.8.3: Northern Hardwoods Shadow Prices by Planning Period and Market for Scenario 8

MARKET						
PERIOD	Bemidji	Brainerd	Cook	Duluth	G. Rapids	**I. Falls**
1	15.50	20.70	23.06	26.65	17.49	**25.77**
2	20.28	21.80	26.46	27.30	20.09	**35.70**
3	22.12	22.29	27.74	27.83	20.93	**37.76**
4	22.72	23.04	29.86	28.61	22.25	**39.19**
5	25.18	24.13	31.76	29.93	23.66	**40.97**
6	26.01	25.15	33.19	31.03	25.84	**42.43**
7	27.79	25.94	34.81	32.50	26.71	**44.09**
8	29.89	27.37	37.01	34.08	29.11	**45.63**
9	31.77	29.34	39.11	36.52	31.47	**48.12**
10	**33.67**	**31.51**	**41.09**	**38.68**	**34.79**	**48.65**

Table C.8.4: Pine, Spruce-fir and Pine Sawlog Shadow Prices by Planning Period and Market for Scenario 8

MARKET							
	Pine Pulpwood			Spruce-Fir			**Pine Sawlogs**
PERIOD	Bemidji	Duluth	I. Falls	Brainerd	Duluth	G. Rapids	**Combined**
1	31.90	45.40	40.54	58.32	56.24	49.96	**27.54548**
2	32.41	45.88	41.47	60.43	58.53	51.38	**26.2593**
3	33.99	47.77	43.24	61.54	60.75	53.21	**23.43748**
4	36.02	49.55	45.99	64.78	64.57	56.45	**20.42278**
5	39.09	48.01	43.46	68.87	69.77	60.63	**18.01634**
6	33.00	41.34	36.91	68.09	73.50	64.10	**16.49991**
7	21.59	28.98	21.70	70.81	73.17	65.92	**19.53365**
8	10.17	19.82	11.87	70.70	74.19	67.04	**25.22222**
9	4.28	13.82	2.71	70.82	74.49	67.50	**32.65616**
10	**2.87**	**11.81**	**2.09**	**71.79**	**73.93**	**68.06**	**39.5**

Table C.8.5: Acreage of Forestlands Harvested by Planning Period and Cover Type for Scenario 8

PERIOD											
COVER TYPE	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Pines	144600	143500	144100	95500	113700	83800	76600	118600	104700	128600	**1153700**
Balsam Fir	79600	131900	97100	127200	124500	104900	129000	82700	88400	69900	**1035200**
N. White Cedar	1100	3500	1100	3300	3700	2400	2100	5700	3400	2300	**28600**
Tamarack	48000	33900	49900	37700	33200	54700	72200	21300	25400	18800	**395100**
Spruce	217700	162100	153100	213200	241900	186700	79900	191000	148800	199800	**1794200**
N. Hardwoods	145000	306200	308000	312100	350900	350100	355600	365700	323600	319300	**3136500**
Aspen	1300900	905000	902400	864200	935900	877100	794100	734000	798600	743300	**8855500**
Balsam Poplar	114500	68800	61300	78200	90100	54400	66200	56800	72200	82300	**744800**
TOTAL	**2051400**	**1754900**	**1717000**	**1731400**	**1893900**	**1714100**	**1575700**	**1575800**	**1565100**	**1564300**	**17143600**

Table C.8.6: Acreage of Forestlands Harvested by Planning Period and Ownership for Scenario 8

PERIOD											
OWNER	1	2	3	4	5	6	7	8	9	10	**TOTAL**
N. Forests	279200	252200	249900	264500	220400	248500	226200	226500	191800	199200	**2358400**
Misc. Public	60900	43500	37600	40300	38300	49500	56600	25000	46500	37600	**435800**
State	339900	300600	322300	339400	385800	324400	271600	309000	289000	304500	**3186500**
County	527200	424700	351200	330300	387700	364500	354100	332400	335900	326700	**3734700**
Private	738400	634800	644800	636000	719900	629700	583200	578700	577800	587200	**6330500**
F. Industry	105800	99100	111200	120900	141800	97500	84000	104200	124100	109100	**1097700**
TOTAL	**2051400**	**1754900**	**1717000**	**1731400**	**1893900**	**1714100**	**1575700**	**1575800**	**1565100**	**1564300**	**17143600**

Table C.8.7: Acreage of Forestlands Harvested by Planning Period and Treatment Class for Scenario 8

PERIOD											
TREATMENT	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Normal	1922800	1584200	1543200	1570700	1721800	1549200	1395900	1362500	1441700	1453800	**15545800**
Buffers	58100	86900	80700	88100	100000	73700	69200	77300	40600	30600	**705200**
Extended	67800	81500	90600	72600	70800	89800	106800	133400	80400	79900	**873600**
Old Growth	2700	2300	2500	0	1300	1400	3800	2600	2400	0	**19000**
Reserve	0	0	0	0	0	0	0	0	0	0	**0**
TOTAL	**2051400**	**1754900**	**1717000**	**1731400**	**1893900**	**1714100**	**1575700**	**1575800**	**1565100**	**1564300**	**17143600**

Table C.8.8: Acreage of Forestlands Harvested by Planning Period and County for Scenario 8

	PERIOD										
COUNTY	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Aitkin	76100	102900	88100	90500	72000	92600	104100	85800	74200	71700	**858000**
Becker	39100	14300	35300	27800	17300	18700	29600	23200	23500	27900	**256700**
Beltrami	123000	86800	102600	101500	107200	62900	75600	76600	81900	76300	**894400**
Benton	0	0	0	2300	3800	900	4800	2400	8000	6400	**28600**
Carlton	54600	54400	64100	43000	71700	49900	59500	48800	56900	53500	**556400**
Cass	188400	99400	107300	89700	113000	127400	94800	121800	96500	102900	**1141200**
Chisago	1700	3000	2500	1300	3800	5500	3600	7200	2900	2900	**34400**
Clay	0	0	0	0	0	0	0	0	0	0	**0**
Clearwater	47100	32200	29200	32700	44800	30900	38600	37100	30300	23200	**346100**
Cook	30300	37800	75100	72500	47100	37500	15600	40800	25000	21800	**403500**
Crow Wing	78600	59600	61400	44000	66100	50600	46300	36200	41200	68300	**552300**
Douglas	0	0	900	1900	3700	0	0	600	1300	1100	**9500**
Grant	0	0	0	0	0	0	0	0	0	0	**0**
Hubbard	82600	39500	74000	61500	74300	57100	26900	52500	47400	48000	**563800**
Isanti		1900	1700	12300	2800	2500	3400	2000	2200	4300	**33100**
Itasca	219300	233900	174900	190000	193900	203700	219100	171500	208400	162100	**1976800**
Kanabec	15000	11500	17300	13900	9800	19500	17800	27700	23500	9300	**165300**
Kittson	0	0	0	2400	2400	1200	2400	1900	0	0	**10300**
Koochiching	178100	177000	164200	181700	201700	187200	133700	153300	176300	155400	**1708600**
Lake	124100	94500	101000	130900	138800	106300	72600	97800	95500	99200	**1060700**
Lake Woods	44600	21100	42100	38400	29200	53000	49600	25600	29500	36900	**370000**
Mahnomen	8200	4700	5300	10400	9800	7300	7500	15700	11800	8400	**89100**
Marshall	5500	1100	5500	9600	20400	3000	5300	4200	2200	2300	**59100**
Mille Lacs	8600	7400	23500	15300	9700	8900	14600	27700	16200	8600	**140500**
Morrison	35300	32200	21000	8600	17000	31500	20200	19900	9700	15000	**210400**
Norman	2300	0	0	0	0	0	900	0	0	1200	**4400**
Otter Tail	11600	5500	6600	14900	6100	12800	14500	7700	5900	11600	**97200**
Pennington	0	3300	2200	7900	900	0	3000	0	2200	0	**19500**
Pine	107700	75100	57200	67400	91500	86400	69100	59700	71900	80500	**766500**
Polk	6500	3300	4400	2200	5500	4200	1100	6400	7700	6700	**48000**
Red Lake	3300	0	4400	5500	1100	1100	1100	3300	1100	4400	**25300**
Roseau	8900	13100	24000	35900	18300	19300	14300	6400	8400	19200	**167800**
St. Louis	531400	533700	399100	385000	483200	412500	414400	393400	374200	403800	**4330700**
Todd	8000	5100	9100	7900	10600	6300	9600	8500	11200	22400	**98700**
Wadena	11500	600	13000	22500	16400	13400	2100	10100	18100	9000	**116700**
TOTAL	**2051400**	**1754900**	**1717000**	**1731400**	**1893900**	**1714100**	**1575700**	**1575800**	**1565100**	**1564300**	**17143600**

Table C.8.9: Acreage of Agricultural Lands Harvested by Planning Period and Market for Scenario 8

	PERIOD										
MARKET	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Bemidji	0	80138	79583	79242	81289	70487	70487	70487	70497	70342	**672552**
Brainerd	0	46209	44844	46263	43390	30461	30701	30349	30310	24786	**327313**
Cook	0	0	0	0	0	0	0	0	0	97	**97**
Duluth	0	5527	7040	7040	4660	2633	1818	1718	944	589	**31969**
G. Rapids	0	11971	12378	11300	12218	7840	7110	7110	2747	4198	**76872**
I. Falls	0	49478	49478	49478	46311	38537	38537	38537	39784	39939	**390079**
TOTAL	**0**	**193323**	**193323**	**193323**	**187868**	**149958**	**148653**	**148201**	**144282**	**139951**	**1498882**

Table C.8.10: Acreage of Agricultural Lands Harvested by Planning Period and Land Capability Class for Scenario 8

	PERIOD										
LCS&SC	1	2	3	4	5	6	7	8	9	10	**TOTAL**
0E	0	165	165	165	165	62	62	62	62	62	**970**
0M	0	9231	9231	9231	8696	6722	6566	6473	6277	6189	**68616**
0S	0	117	117	117	107	0	0	0	0	0	**458**
0W	0	4338	4338	4338	3963	2317	2317	2317	2317	2317	**28562**
1	0	38	38	38	38	38	38	38	38	38	**342**
2C	0	69	69	69	69	0	0	0	0	0	**276**
2E	0	8029	8029	8029	7972	7124	7032	7012	6368	5466	**65061**
2M	0	29	29	29	29	0	0	0	0	0	**116**
2S	0	102	102	102	102	102	102	102	102	102	**918**
2W	0	63935	63935	63935	63780	51275	51275	51255	51255	51255	**511900**
3E	0	8317	8317	8317	7390	4852	4671	4671	4205	3712	**54452**
3M	0	247	247	247	162	42	42	42	42	42	**1113**
3S	0	14351	14351	14351	13473	8006	7622	7593	5614	4500	**89861**
3W	0	51056	51056	51056	50346	43258	43258	43258	43255	43095	**419638**
4E	0	1513	1513	1513	1476	1302	1252	1252	1237	1097	**12155**
4M	0	355	355	355	355	355	335	335	335	335	**3115**
4S	0	15087	15087	15087	13741	11051	10730	10440	10039	9027	**110289**
4W	0	14283	14283	14283	13977	12071	12071	12071	12071	12071	**117181**
6E	0	447	447	447	447	299	299	299	290	220	**3195**
6S	0	1501	1501	1501	1467	969	880	880	674	322	**9695**
6W	0	101	101	101	101	101	101	101	101	101	**909**
7E	0	12	12	12	12	12	0	0	0	0	**60**
TOTAL	**0**	**193323**	**193323**	**193323**	**187868**	**149958**	**148653**	**148201**	**144282**	**139951**	**1498882**