Michigan State Forest Timber Harvest Trends

A Review of Recent Harvest Levels
and
Factors Influencing Future Levels

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FORWARD

Michigan's 3.9 million acres of state forest land are managed for a broad range of uses and benefits. The objective is to have healthy, sustainable forest ecosystems, which support fundamental ecological processes and functions, and are available to current and future generations to provide services for a variety of human values.

Within this context, this report focuses on timber harvest trends. It brings together a wealth of data and analyses[1] to offer a snapshot of current and future trends. It will serve as a base to track future activities, and a jumping off point for further detailed analyses, such as the upcoming collaboration with the USDA Forest Service on analysis of the recently completed FIA data.

There are many biological, social, and economic influences on timber availability and timber harvesting. A review of past analyses and assumptions confirms that it is difficult to accurately project social and economic trends over multiple decades. Over the next two to three decades, timber harvesting on State Forests will be most strongly influenced by the level of treatments in five primary forest types: aspen, jack pine, oak, red pine, and northern hardwoods. This assessment concludes there will be lower harvest levels in the jack pine forest type. Northern hardwood treatments and availability will remain relatively stable, while the quality and subsequent value of timber removed will increase. Acres dominated by oak, red pine and aspen will have increased harvest potential. Additional potential for increased harvest levels in other types such as spruce-fir, mixed swamp conifer, and white pine exists.

The confluence of forest growth and multiple socio-economic demands will be played out over time. Increased urbanization will bring in a host of influences -- including second homes, fragmentation of the landscape, and increased recreational demands -- that will influence forest management. Tracking and understanding such trends is important to long-term management of the State's resources. Analytical tools that have been under development are being implemented across the state. These will aid in more informed decision making along with our management review process. Plans are also being developed with our stakeholders and partners that will further guide the direction of management on Michigan State Forest lands. Together, the analytical tools, planning processes, and interaction with our stakeholders will assure a sound, sustainable future for Michigan's State Forests.

[1] The majority of this data, including tables, charts, and graphs, is captured within the Appendices (A through K).

INTRODUCTION

Michigan has 19.3 million acres of forest covering more than half its lands. Private land owners hold more than 12 million acres, the State of Michigan holds approximately 4 million acres and the federal government just under 3 million acres. The majority of forests in Michigan is owned by private non-industrial landowners and is managed in varying intensity for timber. The DNR manages the largest single forest resource ownership. State Forest timber resources and their harvests provide wood fiber, habitat, and local and state economic stability in addition to preventing forest health problems. There is continued interest and controversy surrounding the management of these resources.

Substantial interest in -- and controversy over -- the management of Michigan's State Forest timber resources exists. This stems from many sources. One is heightened competition for timber resources in the Lake State's region (Wisconsin, Minnesota, Ontario, and Michigan). This competition has created a situation where price increases in 2005 for some timber products have literally exceeded the annual rate of inflation by a factor of ten, having increased 50% levels of a year ago. (See Appendix A for a recent DNR white paper prepared on Wood Product Trends and Michigan's Forests.) An increase in the timber supply could help dampen these runaway prices. And the single largest source of timber in Michigan is the State Forest system.

Michigan's timber growth is estimated to be increasing while timber harvests in the state are estimated to be fairly steady. This results in the State of Michigan having one of the greatest absolute amounts of timber net growth in excess of removals[2] of any state. Michigan may lead the nation in this regard; both the absolute amount and the ratio of growth exceeding removals has increased according to the latest data available. From a timber utilization perspective, this represents untapped potential. This potential, in turn, could contribute to a stronger wood products industry which is vital for jobs and community wellbeing throughout much of Michigan and especially in the northern two-thirds of the State.[3]

The role of the State Forest is not static, it changes as society changes. This creates challenges for forest planning. Michigan's State Forest's are managed for multiple objectives, benefits, products and values but the balance of these values and products changes. For example, some believe that State Forest timber harvests can be increased while other are concerned about even maintaining current harvest levels. Other people would prefer State Forests be managed primarily for ecological functions and be returned to pre-European settlement conditions.

Other people simply do not want State Forests to be managed for wood fiber, but would prefer the forests to return to more of their pre-European settlement condition, with more large, older trees. Others are just concerned about logging and the changes it engenders near their homes or the forests they visit. Some concerns are that other values of the forest may not be adequately protected or that there has been inadequate long-run planning.

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[2] The USDA Forest Service is responsible for surveying forest conditions across all ownerships. It carries out this responsibility through its Forest Inventory and Analysis (FIA) offices. Their forest inventory statistics tend to use the term "removals" rather than "harvests." While the majority of removals are harvests and vice versa, the terms are not perfectly synonymous. There are some tree removals (e.g. land clearing) that may not wind up being utilized for wood products and there are also harvests and utilization of woody products (such as dead wood) that are not captured in timber removals statistics.

[3] The importance of the wood products industry to Michigan was brought home in late summer of 2005 when three separate mills announced their sale or closure within one week of each other.

While the extent and condition of the State Forests provide a wider range of choices than existed even a few decades ago, the range of these choices engender differences of opinion and value conflicts. Michigan has vast forests which have recovered in large part from the devastation they endured many decades ago. Thus, from a relatively straightforward mission of shepherding the recovery of our forests, our mission and objectives are now more diversified and openended.

One of DNR's responsibilities and roles is to clarify what the range of choices and consequences are for State Forest management as well as to develop realistic expectations of what influences will be encountered in making the choices. As this report is being prepared, several related efforts are ongoing. As this report is being prepared, several related efforts are ongoing. On May 28, 2004, Governor Granholm signed into law PA 125 requiring Michigan's State Forests to be certified as being sustainably managed. The Act also requires a report on the number of harvestable acres in the state forest, the number of acres of the state forest that were harvested and the number of cords of wood that were harvested from the state forest. As part of the certification effort, Forest Management Unit (FMU) analyses are being developed to assess long-run and landscape-level forest trends and incorporate them into tactical Compartment Review decision processes. Ecoregional plans will further delineate choices and objectives and may influence long-run timber trends. The new Operational Management Guidance for State-Owned Forest Lands and Conservation Area Management Guidance documents will also impact processes and the level of timber operations.

Future tools, including the new IFMAP and VMS systems, will provide much greater precision in projecting trends. These tools are both desirable and necessary for a broad array of ecosystem management issues besides timber management. Also, with the completion in 2005 of the USDA Forest Service's fifth year of a five-year inventory cycle covering all Michigan forest ownerships, the DNR will be working with the Forest Service to analyze broad trends with respect to Michigan's forests and timber-related concerns. This is a future opportunity to examine issues in more depth.

This report is not meant to be the final word on State Forest timber harvest trends, especially in light of all these ongoing and upcoming activities. However, it is intended to set the stage for future analyses and reports. It begins with a section describing the paper's purpose, then proceeds to provide additional background on the issue of harvest trends, followed by specific sections that shed light on aspects of the trends themselves. The trends are recapped and summarized in the conclusions section. Additional data and information is provided in appendices.

PURPOSE

The overall intent of this report is to discuss what timber is available from Michigan's State Forests, what influences that availability and the direction of those influences. The intent is to develop realistic expectations regarding future timber harvests, not simply allowable cut estimates or projections based upon limited information or grossly simplified assumptions. A wealth of Michigan DNR vegetation inventory and timber sale data exists and was tapped for this analysis. Additionally, the report incorporates descriptions of processes in place which will continue to monitor, evaluate, and report timber harvest activity levels. Many of these are alluded to in the Appendix B paper, "Michigan DNR Timber Harvest Determination Process."

Timber availability is dependent upon many factors besides biological growth and supply factors. These other factors may have an even greater impact on the level of timber harvests than timber growth and supply. As the past several decades have shown, this is especially true of timber harvests from public lands. In any case, factors other than timber growth and supply should be taken into account if the exercise is to develop realistic projections of expected timber harvests.

Past projections of Michigan timber harvest trends were examined as part of this analysis (see Appendix C: Past Michigan Timber Harvest Projections). These serve as a backdrop for the current projections presented here. Most past projections of timber harvests do not address the issue of availability; they sometimes explicitly state they are not addressing it. This is largely understandable in that data pertaining to factors that constrain timber harvest availability were not well-developed and are much less definitive than the physical factors which form the basis of traditional timber analyses.

This situation changed dramatically for Michigan's State Forests in the late 1990s. A "Silvicultural Analysis" was conducted that attempted to project the availability of timber from Michigan's State Forests. Following some initial calculations which implied that State Forest harvests could practically triple in the coming decade, an intensive examination of stand data for three Forest Management Units (Shingleton, Gaylord, and Escanaba) revealed substantial harvest constraints. Over several years, this initial examination of harvest constraints evolved into the integration of what are termed "limiting factors" into the State Forest inventory system and an elaborate accounting framework that, in turn, is part of an ongoing timber treatment plan of work process.[4] When combined with extensive State Forest timber sale and inventory data, including required data on when every stand is expected to be next treated[5], limiting factor information provides a substantial basis for assessing State Forest timber availability now and into the future.

The annual plan of work process has recently been supplemented by processes intended to meet sustainable forest management certification standards. Specifically, FMU analyses of cover type conditions, prescriptions, and trends aggregated from year-of-entry data are reviewed at the outset of every inventory year and after initial draft prescriptions are compiled. Additionally, harvest levels are also reported annually to the legislature, examined through the newly instituted management review system, and reported on the web, in addition to discussed in formal and informal meetings with stakeholders.

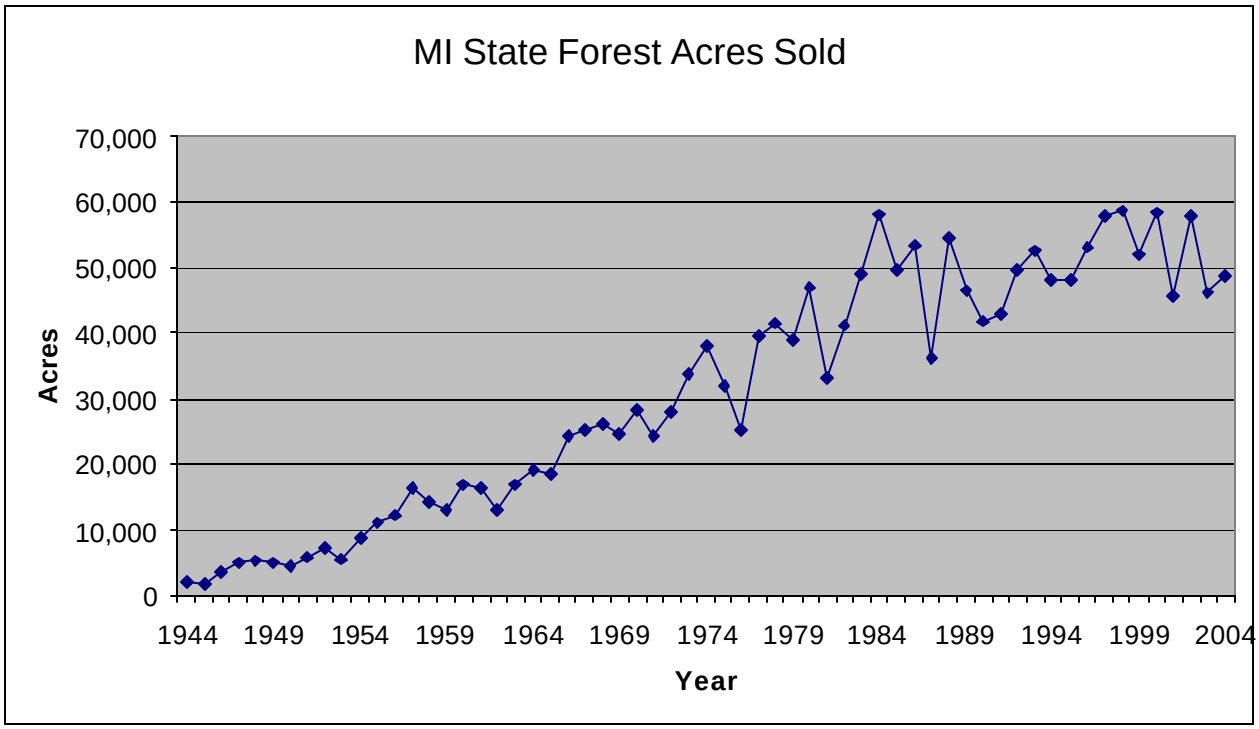
New information allows for the updating and closer examination of past projections and the Silvicultural Analysis. The incorporation of additional availability information does not negate the importance of timber growth and supply data, but rather supplements such data. Estimates of timber harvests are extracted directly from the DNR's timber sale database. Other sources of data related to harvests can come from State Forest prescriptions (method-of-cut codes) and removals data from FIA.

[4] This process is described more fully in the report "MI DNR Timber Harvest Determination Process."
[5] through a "treatment period" field in the inventory system which requires estimates by decade through 89 years or a "not scheduled or not productive" parameter.

Michigan State Forest Timber Harvest Trends

BACKGROUND

The Michigan DNR has historical information on timber sales going back over 60 years. The chart below displays information in terms of timber acres sold. While there is variability from year to year, the number of timber acres sold has increased appreciably over the period. Almost 10,000 more acres have been added to each successive decade. Declines over the period have tended to be followed by substantial increases. This was true of a decline between 1984 and 1989 which was followed by increases throughout most of the 1990s. Since 1999, the level of sales has dipped slightly, fluctuating between just shy of 60,000 acres and just below 50,000 acres, with an average close to 55,000 acres.



The graph begs the question: "Where are timber harvests heading?" To address this question, three primary approaches were taken. The approaches and their associated steps were:

Treatment Period Assessment:

1) Treatment Period values for 1979-1988, 1988-1997, and a recent 1997-2006 State Forest inventory database were contrasted to each other.
2) Differences in expectations were examined by type to determine their correlation to age classes and basal area or other factors.
3) The extent which different cover types were coded as not scheduled/not productive was examined.
4) The overall reasonableness of the coding was evaluated against known trends and additional timber sale and inventory data at state and substate levels.

Forest Type Assessment:

1) Timber sale data for 1994 through 2004 were extrapolated and major forest cover types identified. These data were supplemented with timber sale prescriptions coded in 2005 and 2006 inventories which have not yet transitioned into timber sales.
2) For age class and total basal area, past and current data were compiled from inventory data.
3) The age class and basal area data was contrasted against current harvests and historical data.
4) Treatment period data for the major cover types was revisited. It was evaluated along with other factors to arrive at the likely direction of change.
5) Forest types which account for only a small fraction of timber sales were evaluated and general observations of their trends noted.

Plan of Work and Limiting Factor Assessment:

1) The consistency (variance) across five years of limiting factor information was examined.
2) Limiting factors were then qualitatively evaluated to determine their likely near-term direction (stay the same, increase or decrease).

In addition to the above approaches, a comparison of State Forest to the USDA Forest Service's FIA (Forest Inventory and Analysis) inventory data for Michigan was prepared. This information is of great interest both because it addresses forest conditions and trends across all Michigan ownerships and the new DNR IFMAP inventory system (Integrated Forest Mapping, Assessment, and Prescriptions) incorporates it into its structure. Unfortunately, substantial differences between FIA forest type acre estimates and DNR's inventory estimates make comparisons difficult. These differences will be cooperatively addressed with Forest Service staff through the course of an analysis of the most current FIA data in coming months. Comparisons of FIA and DNR inventory data along with additional FIA data are presented in Appendix D.

TREATMENT PERIOD ASSESSMENT

The most direct way to address what levels of harvests are expected in future years is to summarize the inventory data that captures similar information. The Michigan DNR has a required "treatment period prediction" field. It is described in Chapter 3 of the OI Manual as "an estimate for the earliest treatment needed. It may be pruning, non-commercial thinning, harvest etc." As the DNR engages in very little pruning and non-commercial thinning, well over ninety percent of the estimates refer to timber harvests.

Generally, the "prediction" part of the field name is dropped and the field is simply referred to as the "treatment period." The estimates are not strict predictions of when stands will be treated and the interpretation of when a treatment is "needed" is somewhat open to interpretation. Codings for the current decade are closely aligned with current prescriptions for treatments, representing that treatments are expected. Codings for future decades represent approximations of when treatments may or should occur based on professional judgment.

Choices for the Treatment Period field are one-digit parameters from zero through nine, corresponding to the next decade when treatment is expected to occur, with a "0" representing treatment is expected in the coming decade, an "8" represents the next treatment is not expected for 80 or more years and a "9" indicates the stand is not scheduled or non-productive. Treatment

period is a required field, therefore the entire State Forest acreage is coded for some treatment period or tagged as not scheduled or non-productive.

Most forecasts naturally become more tenuous the further they extend into the future, but the treatment period data has a built-in feature that makes the sums of treatment estimates for each successive future decade increasingly unreliable. Given that it captures only expectations for the next treatment, it does not reflect all of the treatments for stands that will occur after the next expected one. For example, often upland hardwood stands will have selective cuts within them every twenty years. However, the treatment period field will only have recorded the next expected treatment. Subsequent expected treatments will not be captured or reflected by the treatment field data. Although treatment field parameters go out to eighty-plus years, only recently cut stands with long rotations (for example, oak or mixed swamp conifer stands) might have treatment period values in the higher ranges. In contrast, most upland hardwood stands will have treatment periods of 0, 1 or 2.

This illustrates a distinction in the use of the treatment period data: with respect to the sum of all harvests across cover types, it is most useful for evaluating total expected treatments in the current decade and possibly the next decade as it becomes less reliable for successive decades. However, for particular cover types managed on an evenaged basis (rather than more frequent selective cuttings), the treatment period may be useful to validate age class imbalances across decades and future decades beyond the initial two decades may hold relatively reliably data. However, if the purpose is to evaluate age class imbalances and the degree future harvests may be affected by them, it may make more practical sense to go directly to age class data than to assess that indirectly through treatment period data.

The reason treatment period data should also be considered is that it also directly relates how much of the land base is considered not eligible for harvests through the "not scheduled, nonproductive" parameter 9. This is done below with respect to changes in the extent of acres coded as not scheduled or not productive from earlier inventories to the current one.

Acres may be given the not scheduled/nonproductive code for several reasons. An obvious reason is that they are not forested acres. The operations inventory has over 700,000 acres of nonforested lands, ranging from rock and water through grass and brush. Another reason is that the land may be identified with special conservation considerations, e.g. potential old growth, protected species, habitat management, water quality protection or others. Finally, it may be deemed too problematical to treat at any time in the next eighty-plus years due to a variety of limiting factors such as being too wet, too steep, or very inaccessible and too small of acreage to ever get to.

The table below shows that the total amount of Forest Land acreage that was not expected to be treated in the next eighty years increased by 21% between the 1979-88 inventory (referred to simply as "1988" to denote the last year of the inventory) and 1997-2006 (referred to as "2006") inventory. An examination of specific forest types reveals some interesting trends.

The balsam poplar, black spruce, cedar, lowland hardwoods, mixed swamp conifers, and tamarack communities all show significant increases in the amount of land not expected for treatment, which is consistent with a large percentage of land in the 2002-2006 years of entry that were assigned a limiting factor for excessive wetness.

The forest type that experienced the largest percentage increase (371%) in the amount of land not scheduled for treatment was hemlock. This is partially a reflection of the small number of Hemlock acres to begin with, but is also likely due to management efforts to preserve that small base of hemlock remaining in the landscape as seed trees for continued regeneration of the species.

White pine experienced a 195% increase in the amount of land not scheduled for treatment. This is primarily the result of designation of many white pine stands as potential old growth. Spruce/fir and white birch have also experienced trends away from treatment.

Conversely, fewer acres of aspen, jack pine, oak, and red pine have been placed in the not scheduled/nonproductive category since the 1979-1988 inventory. This does not mean, however, that more of these acres are expected to be harvested this decade or next. Indeed, in the case of jack pine, its reduction in total acres (approaching 33,000 acres) far exceeds the acres removed from the not scheduled/not productive category.

Change in Treatment Period "not scheduled or not productive," 1988 – 2005

Cover Type	1988	1997	2006	1988-06 Change	% Change
Aspen	62,332	51,449	44,070	-18,262	-29%
Black Spruce	13,290	16,394	21,599	8,309	63%
Bog or Marsh	46,819	41,864	33,253	-13,566	-29%
Cedar	58,963	90,085	120,737	61,774	105%
Grass	91,357	88,933	72,713	-18,644	-20%
Hemlock	1,397	3,991	6,577	5,180	371%
Jack Pine	28,035	16,585	18,545	-9,490	-34%
Local Name	6,791	15,562	5,611	-1,180	-17%
Lowlnd Brush	195,578	189,853	193,963	-1,615	-1%
Lowlnd Poplr	6,253	8,339	15,037	8,784	140%
Marsh	91,371	112,966	110,938	19,567	21%
Mx Swmp Cnfr	78,907	97,667	133,016	54,109	69%
Non Stocked	28,808	32,259	22,111	-6,697	-23%
Oak	33,595	24,912	24,685	-8,910	-27%
Paper Birch	4,193	6,797	9,478	5,285	126%
Red Pine	24,853	17,053	19,516	-5,337	-21%
Rock	1,066	1,218	1,052	-14	-1%
Sand Dune	720	780	1,081	361	50%
Spruce Fir	4,497	7,137	11,346	6,849	152%
Swamp Hrdwds	21,744	40,740	61,243	39,499	182%
Tamarack	3,267	8,640	11,791	8,524	261%
Treed Bog	59,021	58,719	62,314	3,293	6%
Upland Brush	26,482	27,425	29,440	2,958	11%
Upland Hdwds	45,623	30,213	41,473	-4,150	-9%
Water	35,793	43,311	46,691	10,898	30%
White Pine	5,624	10,183	16,603	10,979	195%
totals	976,379	1,043,075	1,134,883	158,504	16%

The next table displays additional information on the treatment period data. It contrasts the amount of data predicted to be treated in the immediate decade in 1979-1988 versus the amount predicted to be treated in the immediate decade according to the 1997-2006 database (the most current statewide database). Additional information for other decades and the EUP, NLP, and WUP regions are shown in Appendix H.

Treatments Predicted in the Coming Decade

	1988	2006	Change	% Change
Aspen	246,503	77,771	-168,732	-68%
Black Spruce	7,482	4,741	-2,741	-37%
Bog or Marsh	2,082	1,853	-229	-11%
Cedar	20,782	2,258	-18,524	-89%
Grass	63,941	35,735	-28,206	-44%
Hemlock	5,126	1,320	-3,806	-74%
Jack Pine	110,527	76,021	-34,506	-31%
Local Name	249	542	293	118%
Lowlnd Brush	3,577	1,068	-2,509	-70%
Lowlnd Poplr	25,054	10,486	-14,568	-58%
Marsh	1,671	2,080	409	24%
Mx Swmp Cnfr	29,860	5,292	-24,568	-82%
Non Stocked	1,484	590	-894	-60%
Oak	33,790	52,650	18,860	56%
Paper Birch	19,790	8,894	-10,896	-55%
Red Pine	83,586	67,922	-15,664	-19%
Spruce Fir	33,094	7,518	-25,576	-77%
Swamp Hrdwds	21,876	8,819	-13,057	-60%
Tamarack	3,491	1,493	-1,998	-57%
Treed Bog	277	72	-205	-74%
Upland Brush	10,042	13,050	3,008	30%
Upland Hdwds	185,725	120,158	-65,567	-35%
Water	91	1,028	937	1030%
White Pine	16,064	10,092	-5,972	-37%
totals	926,173	511,460	-414,713	-45%

The change in the totals for the two periods is dramatic. From close to one million acres, the predicted treatments for the coming decade drop to just over a half million acres. On an average annual basis, the predicted treatments would be dropping from close to 93,000 acres to about 51,000 acres. Three reasons are readily identifiable that account for this change:

1) As described above, more acres have been placed into the "not scheduled, non-productive" category than in 1988. This is particularly true for lowland wet types, but it applies to other types as well that are now coded as potential old growth.
2) Harvests were considerably less during the 1979-88 period than they are today, yet the prescriptions (as reflected by the expected treatment data) were considerably higher. A substantial change in coding has taken place. It used to be the practice well into the 1990s to prescribe acres for cut whether they could be harvested or not. With the advent of coding limiting factors, this is no longer the case; what is expected to be cut today much closer approximates what will be cut; it is closer to a prediction, not a silvicultural possibility.

3) Another factor affecting the change is the difference in what is biologically available. As will be discussed below in the Forest Type Assessment section, five cover types account for most (about 90%) of timber sales from State Forests. These five are aspen, jack pine, oak, red pine, and upland hardwoods. Four of these types show declines between the earlier 1979-1988 inventory and the more current 1997-2006 inventory; oak increases. Jack pine, red pine, and upland hardwood declines may be largely due to changes in coding practices, but much of the aspen decline can be traced to the actual change in the availability of mature aspen, which will be described below in the Forest Type Assessment section.

The increase in the predicted oak treatments warrants closer examination. Relative to the earlier 1979-1988 inventory, more acres of oak are expected to be treated in the coming decade than were expected to be treated in the past. Further examination of oak treatment period data reveals another observation about oak: over the past several decades, expected higher treatments for the next decade are not achieved. Estimates are shown below for three inventories: one covering 1979-88, an intermediate inventory from 1988-97, and a current one covering 1997-2006 years of entry. The expected treatment data for these are as follows:

Years covered by inventory	Acres Predicted to be treated in current decade	Acres Predicted to be Treated in the next decade
1979-88	33,790	92,529
1988-97	55,189	93,491
1997-06	52,650	84,589

As shown, from the perspective at the time of the inventory in 1979-1988, 33,790 acres were expected to be treated in the current decade. What the treatment period data also shows is that 92,529 acres were "predicted" to be treated in the subsequent next decade. Instead of coming close to this level, the 1988 to 1997 inventory has only 55,189 acres in the coming decade, but 93,491 acres were "predicted" to be treated in the subsequent next decade, virtually the same as the previous decade's inventory. For 1997-2006, the inventory once again contains fewer acres to be treated in the coming decade relative to the "next decade" estimate from the previous decade's inventory. It does, however, drop the next decade's estimate down slightly to 84,589. Thus, higher treatments predicted for "next decade" are never reached.

On an average annual basis, if treatments or sales were at the level predicted by the current decade treatment period estimates, they would be in the 5,265 to 5, 519 range. Actual oak timber sales for 1994 to 2004 averaged 6,738 acres. This is higher than the current decade prediction, but considerably below what has been predicted for the next decade, which would be over 9,000 acres on an average annual basis.

In sum, the treatment period field provides a basis for assessing possible harvests in coming decades. Its interpretation can be compounded by changes in coding practices over time, but it also generally reflects attitudes and practices such as considering fewer lowland acres for harvest at any time in the future. Given the tighter match of today's prescriptions to what is actually

harvested, it is not surprising that the current coming decade total (511,460) is very close to current levels of harvest (between 50,000 and 55,000 acres per year).

Treatment period data show a treatment prediction increase from the 511,460 of this decade to 815,348 acres next decade. The question arises as to whether more precise prescriptions carry over to that next decade and it is a reasonable prediction or if this 815,348 amount is inflated as the predictions have been from previous inventories. The 1979-1988 and 1988-1997 inventories had very similar "next decade" totals of 827,566 and 827,497, yet those harvests did not materialize.

The question of the reasonableness of the 1997-2006 "next decade" treatment prediction can not be answered without examining additional information. Besides tracing the source of the tremendous reduction in expected aspen harvests, the next section will consider what can be expected in the next decade from the 1997-2006 inventory by examining trends with specific forest types.

FOREST TYPE ASSESSMENT

A completed inventory data set is available for the 2006 year-of-entry.[6] Appendix I contains treatment period data from 1988 and 2005, for the Western UP (Baraga, Gwinn, and Crystal Falls FMUs), the Eastern UP (Escanaba, Shingleton, Newberry, and Sault Ste. Marie FMUs), FMUs in the Northern lower peninsula, and all FMUs (the entire State Forest).

Planted Stands

One of the basic distinctions between forested acres is whether they are planted or have been established and maintained through natural regeneration. There are about 367,000 acres of jack pine and 280,000 acres of red pine in the 3,900,000 acre State Forest or 9% and 7%, respectively. Some of the acres typed as jack or red pine are in natural, mixed stands, though many of these acres were established by planting. The exact amount of planted acres is difficult to determine because the method of stand establishment is not recorded in the Operations Inventory. It should be noted that our new inventory system (IFMAP) does make that distinction, but as that database is incomplete, so is our inventory of planted verses natural stands. Many planted stands were established by the CCC's (Civilian Conservation Corps) in the 1930's as reclamation and reforestation projects. In addition, during the 1950's, there was a Department effort to reforest non-stocked and under-stocked areas. We continue to plant jack pine, red pine and to a lesser degree white pine, but plant few other species except those needed for 'special projects'. Only indigenous species from a Michigan seed source are planted.

Once a planted stand is established, maintenance activities are limited. Commercial thinning starts in red pine between ages 30 to 40. Jack pine is not managed after stand establishment until the final harvest, usually a regeneration cut between ages 40 and 60. After stand establishment, there are few activities to interfere with natural processes.

[6] When inventory for a year is completely across all FMUs it is archived and labeled as "frozen". The 2006 year-of-entry has been "frozen," As it was compiled largely in calendar year 2005, it is sometimes referenced as 2005 data. Technically, only one-tenth of the data was collected in 2005 (the 2006 YOE). Overall, the data is, on average, roughly five years old as it contains data from 1997 through 2006 years of entry, with the exception of updates to the inventory which have occurred as a result of completed treatments. Fortunately, this issue does not affect the key age class variable – stand year-of-origin – but it does affect other estimates including total basal area and average dbh.

It should be noted that much of the jack pine acreage is managed for Kirtland's warbler (KW) rather than for wood production. Kirtland's warbler is a federally protected endangered species with a species recovery plan overseen by the US Fish and Wildlife Service. Planting is done at a spacing and in a pattern that is beneficial to the KW, but is not optimal for timber production. For example, jack pine is planted at a spacing of 1,600 to 2,000 trees per acre, whereas planting for timber would be done at 800 to 1,000 trees per acre.

Subtracting the KW lands and estimating the acres of natural stands, less than ten percent of the forest has been established by planting. Planted red pine stands have a predictable yield and harvest schedule. Harvest trends for planted KW jack pine are not as predictable. The first KW stands will not reach their planned harvest age of 40 for another 10 to 20 years. With the high density of trees per acre, their harvest volumes and value are difficult to predict.

Five Major Timber Sale Cover Types

Over the past twenty years[7], five forest types have consistently accounted for roughly 90% of State Forest Timber Sales. These five types distinctively influence the level of sales.

The 1994 – 2004 timber sales of the five major types and their percent of total sales each year are presented below. (Additional sales information for all types is presented in Appendix F.)

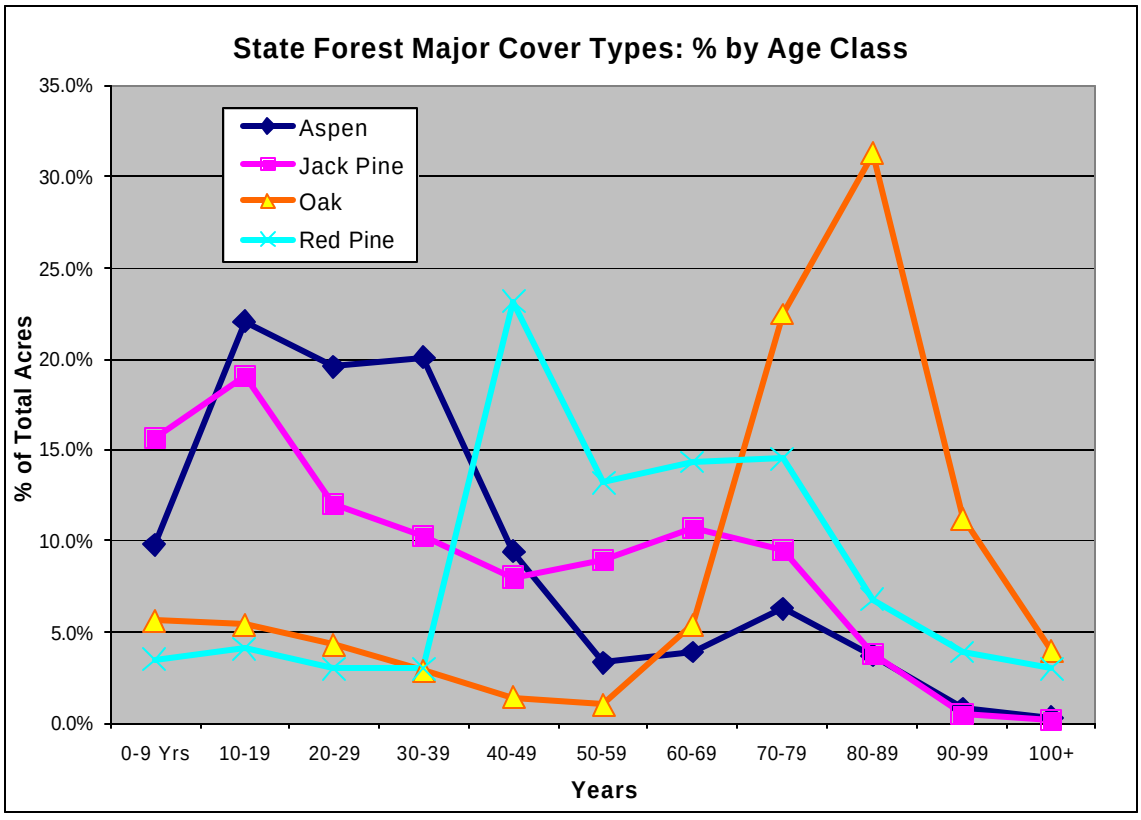
Total State Forest Acres Sold by Covertype, 1994 – 2004

Fiscal Year	Sum	Aspen	Jack Pine	Upland Hdwds	Oak	Red Pine
1994	53,703	12,628	10,729	11,350	6,814	7,988
1995	51,064	12,600	7,529	11,670	8,207	6,352
1996	58,291	12,788	10,456	12,595	6,621	9,276
1997	58,387	11,356	9,964	15,101	5,732	10,984
1998	55,096	10,317	7,357	16,563	7,521	9,092
1999	59,054	11,239	8,549	19,225	6,385	8,975
2000	50,230	6,427	7,471	15,546	7,111	8,471
2001	54,917	8,948	9,017	13,994	7,008	8,900
2002	54,178	8,446	8,974	19,169	5,780	6,699
2003	48,650	8,391	7,861	14,142	6,025	7,211
2004	53,649	10,122	8,580	15,565	6,920	8,006
Average:	54,293	10,297	8,771	14,993	6,738	8,359
05 Trend:	52,434	7,510	7,918	17,581	6,271	7,869

[7] Eleven years are reported here because cover type records can only be tracked reliably in the timber sale database back to 1994; however additional species and product data in the timber sale database extends back to 1986 and paper records and reports indicate the dominance of the five cover types back to at least the mid-1980s.

Percent of Timber Sales by Fiscal Year and Major Cover Type						
Fiscal Year	Sum of 5 Types	Aspen	Jack Pine	Upland Hdwds	Oak	Red Pine
% of Total Acreage:	58%	22.5%	9.3%	13%	6.2%	7.1%
1994	92%	24%	20%	21%	13%	15%
1995	91%	25%	15%	23%	16%	12%
1996	89%	22%	18%	22%	11%	16%
1997	91%	19%	17%	26%	10%	19%
1998	92%	19%	13%	30%	14%	17%
1999	92%	19%	14%	33%	11%	15%
2000	90%	13%	15%	31%	14%	17%
2001	87%	16%	16%	25%	13%	16%
2002	91%	16%	17%	35%	11%	12%
2003	90%	17%	16%	29%	12%	15%
2004	92%	19%	16%	29%	13%	15%
Average:	91%	19%	16%	28%	12%	15%
05 Trend:	90%	14%	15%	34%	12%	15%

As the above table illustrates, upland hardwoods comprise the largest single share of timber sales, followed by aspen, and then jack pine, red pine and oak. These percentages have remained relatively stable over the past eleven years although aspen continued its slide and upland hardwoods continued to increase.



For several of these types (red pine, aspen, oak, and jack pine) which are primarily managed on an even aged basis, age class provides a good indication of the likely future direction of timber sales. For upland hardwoods, total basal area is used and age class has little bearing. The following addresses each of the five major types.

Oak

As the State Forest Major Cover Types figure illustrates, oak has the most unbalanced age class structure of the primary four timber sale cover types (not counting upland hardwoods which tend to be managed on an unevenaged, selection basis). Approximately 65% of State Forest oak stands are between 70 and 100 years of age with to 32% concentrated in the 80 to 90 year old age class. The State Forest uses a silvicultural rotation age of eighty which means that for stands older than eighty, a limiting factor must be coded into the inventory database if it is not prescribed for treatment.

Predictions regarding future harvests of this type are tenuous, as illustrated by the discussion of oak in the Treatment Period section. There are substantial wildlife and regeneration concerns about treatments in this type. This has contributed to treatments being put off to "next decade" with the next decade's treatment never materializing.

Oak-dominated stands common on moderate to low quality, sandy soil sites are anomalies which resulted from the removal of the pre-settlement pine forest and the unnatural catastrophic fires that followed. Maintenance of this cover type at its current level is not possible without replicating the events of the past. That said, oak is a valuable resource to maintain on the landscape. On moderate and low quality oak sites, silvicultural practices that encourage its establishment and recruitment as part of a mixed-pine-oak cover type should be employed. Continued existence of an oak component on higher quality northern hardwood sites will require silvicultural practices that benefit oak's mid-tolerant shade characteristics and its difficulties in out-competing other, more shade tolerant, northern hardwood species.

As these practices have not been widely implemented, the State Forest is experiencing natural succession of oak to white pine and red maple on moderate to low quality sites, and to sugar maple-beech types on high quality sites. An understanding and acceptance that the best approach to maintaining oak is through managing it as part of a mixed pine-oak cover type will likely lead to an increase in oak acres being treated; most of these treatments will be with higher volume regeneration harvests. For the time being, however, the direction of oak harvests is not certain beyond that it is not likely to decline in the near-term. Over the long-term (three or more decades from now), oak harvests are likely to decline as the number of acres decline and the species is more integrated with other species.

Red Pine

The DNR's Red Pine Project[8] brought attention to the skewed age class structure of the State Forest's red pine. Much of the resource is between forty and sixty years of age, with an

[8] Northern Lower Michigan Ecoteam. 2004. The Red Pine Project: Draft guidelines for red pine management based on ecosystem management principles for State Forestland in Michigan. Michigan DNR.

appreciable amount between sixty and eighty years of age. This correlates with intensive planting programs by the CCC and the state of Michigan. This has resulted in the majority of the red pine resource being in public forests (the State Forests and the National Forests) unlike most other forest types. Very little red pine exists under thirty years of age.

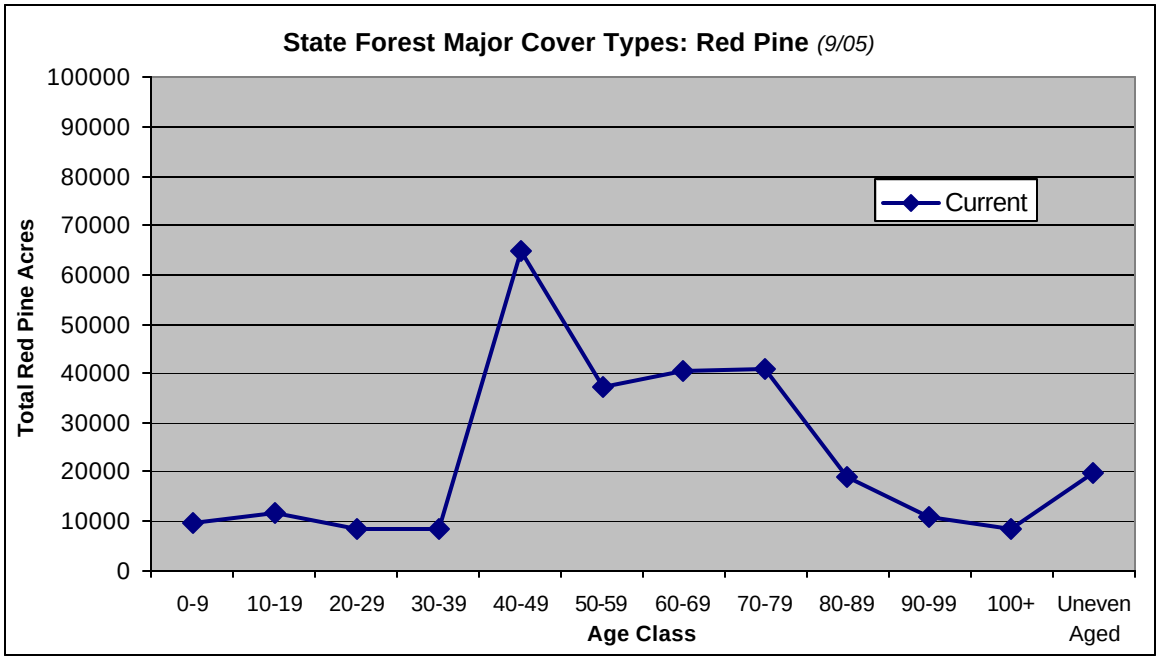
Between 1994 and 2004 an average of 8,359 acres were harvested annually. Most red pine harvests (approximately 80%) have entailed thinning stands rather than stand regeneration harvests. Thinnings tend to occur every twenty to forty years, depending upon site quality and stand condition. State Forest regeneration harvests will generally occur between 60 and 90 years of age. Markets are currently best for utility pole-size stands; the highest returns are on fourteen to sixteen inch trees. Bids decline for larger sizes.

Artificial regeneration (planting) is required for reliable re-establishment of most stands due to unpredictable seed production and the specie's shade-intolerance.

For red pine, there has been a decline in the treatment period prediction in the coming decade, but there has been an increasing prediction that more stands will be treated in the next decade.

Years covered by inventory	Acres Predicted to be treated in coming decade	Acres Predicted to be Treated in the next decade
1979-88	83,586	63,536
1988-97	78,841	88,365
1997-06	67,922	112,174

The genesis of the Red Pine Project was to restore some balance to the age class structure and reduce the pressures for much higher treatments in two to four decades by engaging in more harvests now. A major outgrowth of the project was to differentiate the site suitability of where red pine is located and where it should be considered for re-establishment based on (Kotar) habitat typing. This information is helpful in clarifying the basis for where red pine is a poor choice because of physical factors. Often where it is well-suited, other forest species also are well-suited and preferred over red pine for wildlife values. It is expected that further clarification and procedures for weighing timber values against wildlife values at the stand, landscape, and state level will come in the years ahead through established planning, public participation and management review processes.



Increases in prescriptions for red pine regeneration harvests are be beginning; from an average of under 700 acres for the previous decade they reached 1552 acres in 2005 and were 1136 acres in 2006. Ideally, they would increase to over 2000 acres per year during the next decade. This would foster a smoother transition and balancing of age classes. The "next decade" should not be avoided; it will come and it is just a matter of whether or not the DNR takes steps now to minimize negative market, resource, and manpower impacts. The social, economic, and ecological stakes are high.

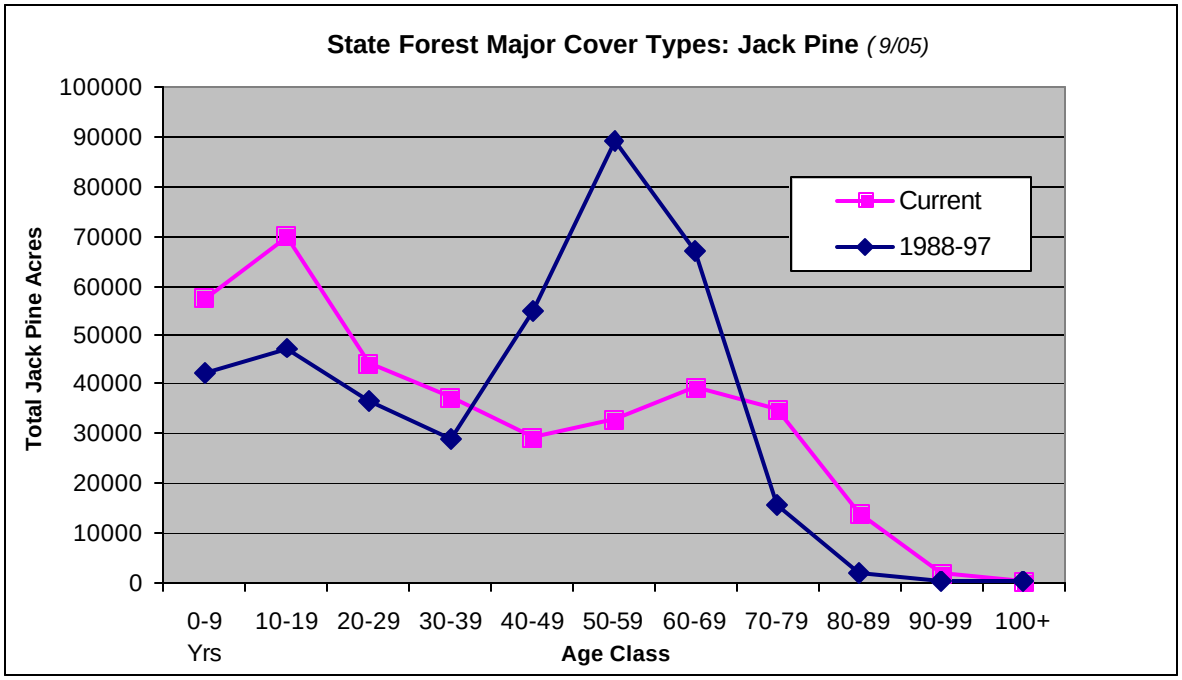
In sum, during the next decade, the number of red pine acres treated may not increase, but there should be a transition to more regeneration harvests. Thinning treatments will continue to outnumber regeneration harvests, but the ratio will fall from the current ratio of more than 8 to 1. This will increase volume outputs as regeneration cuts entail two to four times the volume of thinnings. This higher volume output should continue for at least three decades and then begin to level off again.

A conversion of a sizeable fraction of red pine stands to other types and mixed types will also occur during this period. These conversions will be due to site suitability, wildlife and biodiversity concerns. They will likely entail negative impacts on logging. Red pine is a fast growing species and higher values are received for logging in pure, uniformly-sized stands. But the negative harvest impacts from such conversions will not be felt for many decades.

Jack Pine

The age class structure of jack pine is more balanced than aspen and red pine, although there are more acres in the 0-20 year age classes. This reflects higher levels of harvest activity in the past two decades. Many stands of jack pine are being intensively managed under the guidelines set forth in the Kirtland's Warbler Recovery Plan. In contrast to red pine, the vast majority of jack

pine stands (over 80%) are managed on an evenaged, 60-year rotation. Some acres are harvested sooner and others later depending upon stand and local site conditions.



A contrast of the 1994-2004 information to the jack pine age class structure reveals that recent levels of jack pine harvests will not be maintained. In recent years, there has been a substantial effort to harvest a large quantity of jack pine in the older age classes before jack pine budworm health threats, mortality, and succession occurred. There is still some over-mature stands in the 70+ range and these may continue to add to the level of harvests for a few more years. However, the age classes that harvests will be drawn from for the next 3 decades are less than 40,000 acres. This results in an average annual acreage of less than 4,000 acres.

Even the current 60-69 year age class has less than 40,000 acres. The contrast to the recent timber sales average of 8,576 acres is quite stark and portends the current level of timber sales being cut approximately by half or more. In any case, there is no getting around the fact that commercial jack pine timber harvests will decline and remain at a lower level, closer to 4,000 acres. The major question is how soon harvests will decline. In turn, the answer to this question depends upon how much of (and how soon) the older age class jack pine will be harvested. Some of the older jack pine stands still exist because they have limiting factors constraining their harvests. Even if the vast majority of the older jack pine can be harvested, it will not postpone a decline in harvests for more than a decade. Budworm and associated mortality concerns are generating considerations of using a 50-year rotation rather than the current 60-year standard, but this too will only moderate the inevitable reduction in harvests. The bottom line is that the long-run sustainable harvest for jack pine is closer to 4,000 acres per year and the DNR is heading in that direction.

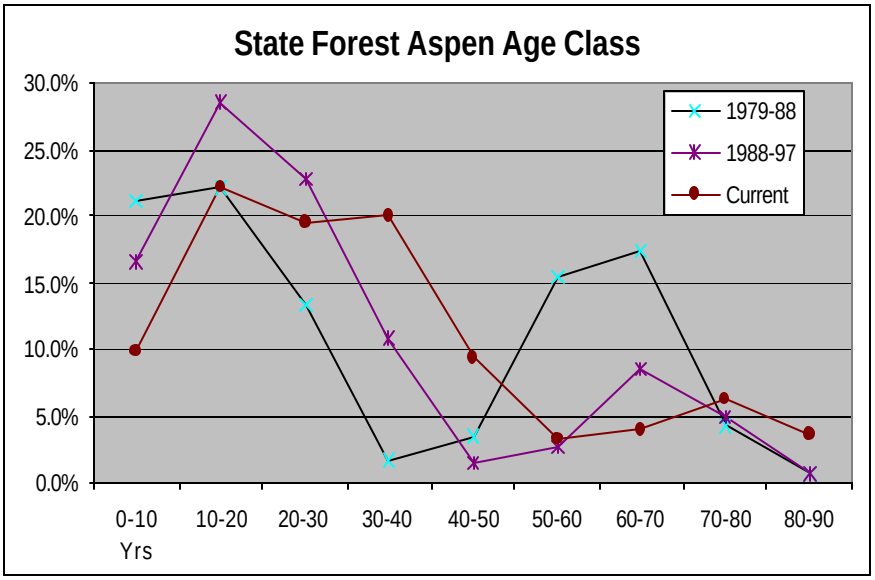
Aspen

Aspen is the State Forest cover type with the most acres. Unlike most other ownerships, there has only been a negligible decline in the total number of aspen acres over the past couple of decades.

As noted above in the treatment period section, it has the greatest absolute reduction in the number of acres predicted to be harvested in the coming decade. The decline dwarfs all other declines. Not only does the current decade's treatment prediction decline, but so does the treatment prediction for the next decade.

Years covered by inventory	Acres Predicted to be treated in current decade	Acres Predicted to be Treated in the next decade
1979-88	246,503	154,292
1988-97	142,589	120,577
1997-06	77,771	113,166

The situation with aspen is fairly well known, although there may be differences over some of the details. The age class chart and table below illustrates the situation facing the possibility of aspen harvests.



Aspen 10 year age classes by inventory dataset

	Total Acres	Not Coded	0-9 Yrs	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	Uneven Aged
1979-1988	893,279	467	137,084	200,046	103,416	28,642	61,369	163,463	136,346	31,358	6,287	2,102	2,303	19,196
1988-1997	903,964	1,611	158,341	176,715	133,200	86,816	23,843	53,740	108,456	70,680	14,400	3,487	2,103	10,572
1997-2006	884,822	389	86,386	135,327	173,151	177,058	83,371	29,588	34,441	55,611	32,605	7,374	2,333	5,388

As the graph and table depict, the 1979-1988 inventory contains close to 300,000 acres of aspen in the commercial age classes of 50-59 and 60-69. Less than twenty years later, there is less than one-fourth of this amount (60,000 acres) in the same age classes. Not all of it was harvested; some acres are in older age classes and remain to be cut, but some of these are also not yet cut due to harvest limiting factors.

It is important that older acres in the 70-79 and 80-89 year age classes be prescribed if they are still viable for sale, there are not objections to cutting, and site conditions are conducive. Besides a desire to not lose their commercial value and avoid mortality, they can play a role over the next decade in helping to balance aspen age classes. Aspen in younger age classes (30 – 50) should be looked at for operable stands on appropriate sites.

The problem with not increasing aspen sales now is that it leaves a more skewed age class. Based upon a fifty-year rotation, if acres were evenly distributed (or what foresters refer to as having reached "regulation" or "area regulation") 20% of the total acres would be in each ten-year age class. In the case of aspen, because harvests have fallen off so sharply in the past decade, the youngest (0-9) age class has slightly less than ten percent. That is creating a "boom and bust" legacy problem for wildlife habitats and populations as well as the wood products industry -- and DNR management.

As the graphic suggest, over the past decade, DNR management has created a very large difference between the number of acres in the current 0-9 age class (86,986) and the 10-19 age class (195,327). This difference should not be allowed to worsen.

Given the number of acres in the older age (>80 years) classes, it is likely the pace of losing aspen may accelerate for a while. Assuming conversions drop the total acreage down towards 850,000 that would still leave 170,000 acres as the area regulation decade sum for five age classes or 17,000 acres as the annual harvest target. Annual State Forest aspen sales have averaged 10,063 since 1994, but they were falling over that period. This should be reversed soon, with an emphasis on the balancing of age classes, rather than waiting for the "bubble" in the age class structure to come around again over the next ten to twenty years. In the near-term, a reasonable target range would be between 12,000 to 15,000 acres. In two to four decades when the DNR finds itself in the reverse situation and it is awash in aspen, it needs to give closer scrutiny to the appropriateness of maintaining the type within the context of the site, landscape, region, and State. Stands from younger age classes, should be scrutinized for treatment as well.

Upland Hardwoods

Upland hardwoods replaced aspen as the type with the most annual timber sale acres about a decade ago. Unlike aspen, it is most often harvested through single-tree marking and selection. This requires more labor and yields less volume but, with continued management, can achieve high returns. The predicted current decade treatments for upland hardwoods for the 1988-97 inventory and the 1997-06 inventory are 179,315 and 120,158 acres respectively. On an average annual basis, these would amount to 18,000 and 12,000 acres. Actual upland hardwood sales for 1994 through 2004 have been 14,993 acres which corresponds very closely to the average of these two estimates.

Years covered by inventory	Acres Predicted to be treated in current decade	Acres Predicted to be Treated in the next decade
1979-88	185,725	181,509
1988-97	179,315	193,846
1997-06	120,158	212,090

The fall in the current decade treatment prediction (from close to 180,000 to almost 120,000) is the second largest decline behind aspen but, unlike aspen, this decline is combined with a very steep increase for the next decade treatment prediction to over 212,000. Another item of note is that actual upland hardwood prescriptions for 2006 amount to only 12,727 acres, considerably down from recent prescriptions in excess of 17,000 acres. Sold sale acres of upland hardwoods tend to be 90% of prescription; if that holds true for the 2006 prescriptions, upland hardwood sales would fall to 11,000 from their 1994-2004 15,000 acre average.

To consider the trend in more detail, changes in total basal area were examined. Unlike the other four major timber sale cover types, total basal area is more of a key variable than age class for State Forest upland hardwood harvest predictions.

Upland Hardwoods Acres by Basal Area

Inventory	Total Acres	BA <60	BA 60	BA 70	BA 80	BA 90	BA 100	BA 110	BA 120	BA 130	BA 140	BA > 150
1979-1988	499,262	56,803	34,750	46,154	66,590	78,969	68,015	58,483	43,641	22,861	10,898	12,098
1988-1997	503,371	47,601	29,874	40,432	66,719	79,332	73,568	64,817	44,922	28,013	15,539	12,554
1997-2006	508,302	42,958	25,260	52,295	89,042	76,281	71,696	54,132	43,397	26,877	14,755	11,609

The acres within each basal area class are relatively stable across the three inventories (as are the total acres). Exceptions to this include:

- The most recent inventory has fewer acres in the two smallest basal area categories shown (<60 and 60); however, it has more acres in both the next size categories (70 and 80).
- There are fewer acres in the 110 basal area class for 1997-2006 than in the previous inventory.

In general though, on the basis of this assessment, it appears the current inventory would come close to supporting the treatment decisions of the past two inventories when annual sales averaged 15,000 acres. This is further supported by the general sense that the inventory has been maintained better in recent years. This implies that the earlier inventories may have had slightly fewer acres in the higher basal area brackets, overstating their harvest potential relative to the 1997-2006 inventory.

While harvests are not likely to drop much this decade, there will only be a modest increase in acres treated next decade . There is 22,000 (33%) more acres in the 80 ba category for the 1997-2006 inventory than the earlier inventories and much of that may become available for treatment next decade. However, this is not of the same magnitude as the "next decade" increase from 120,158 to 212,090.

One major source of a possible increase in acres would be for the DNR to operate outside of the compartment review ten-year cycle. The current process focuses attention on a particular year-of-entry, approximately one-tenth of the State Forest rather than the entire forest. This tends to put upland hardwood stands on a twenty-year selection cut harvest schedule as the amount of growth in ten years is usually inadequate for a commercial sale. However, the additional basal area gained may be adequate at some time in the intervening years. The problem is that sites and growth rates would be variable, so that to optimally time harvests with this variable growth, the DNR would have to be inventorying, preparing sales, and monitoring most of the forest on a continual basis. Wildlife Division and DNR stakeholders would need to keep up with this process.

On the face of it, this appears to be a daunting task, but it is being considered. With the advent of plans and software in coming years it may be possible with additional resources, but it will not be something the DNR will be able to shift to in the near-term. It may be as much or more of a problem for the stakeholders and partners with whom we manage the forest.

In sum, upland hardwood harvests are expected to remain close to their recent 15,000 acre average with an increase more likely to occur than a decline, but change in either direction is not expected to be large.

Other Minor Timber Sale Cover Types

No other forest type averages more than two percent of sales during this period and seldom does any other type reach 3 percent of the sales for any given year (see table below). Two primary reasons that types fall into this "other" category are that there are many fewer State Forest acres of them and/or they are lowland types. These minor sale types, their acres, the percent of sales they accounted for between 1994 and 2004, the average acres sold for that period, and the level of sales that would be sold in 2005 if the 1994-2004 trend were maintained are:

Minor Timber Sale Cover Types, Acres, Percent of State Forest, Percent of Sales, Average Sale Level and Trend Extrapolation for 2005

	Paper Birch	Cedar	Swamp Hrdwds	Spruce Fir	Hemlock	Lowlnd Poplr	Mxd Swmp Cnfr	Black Spruce	Tamarack	White Pine
Total acres:	35,462	228,397	135,912	51,504	17,479	71,655	261,183	35,163	22,256	93,568
% of State Forest acres:	0.9%	5.8%	3.5%	1.3%	0.4%	1.8%	6.6%	1.7%	0.6%	2.4%
Percent of Total State Forest Sales by fiscal year										
1994	1.9%	0.3%	1.2%	1.2%	0.2%	0.8%	0.2%	0.6%	0.0%	1.5%
1995	2.7%	0.6%	1.1%	1.0%	0.2%	1.3%	0.8%	0.2%	0.1%	1.4%
1996	2.7%	0.5%	0.8%	1.4%	0.4%	1.4%	1.0%	0.6%	0.1%	2.4%
1997	1.4%	0.2%	0.9%	1.6%	0.2%	1.6%	0.5%	0.5%	0.0%	2.1%
1998	2.2%	0.2%	1.2%	0.6%	0.0%	0.9%	0.8%	0.2%	0.0%	1.6%
1999	1.5%	0.1%	1.0%	1.2%	0.0%	1.1%	0.6%	0.3%	0.0%	2.3%
2000	1.8%	0.2%	1.2%	1.2%	0.3%	1.0%	0.5%	1.1%	0.0%	3.1%
2001	1.3%	0.4%	1.8%	2.1%	0.2%	3.8%	0.8%	0.3%	0.0%	2.2%
2002	1.7%	0.4%	1.6%	1.6%	0.4%	0.7%	0.4%	0.3%	0.2%	2.3%
2003	1.4%	0.1%	0.9%	1.4%	0.2%	0.7%	1.1%	0.6%	0.4%	2.0%
2004	1.2%	0.1%	1.1%	1.5%	0.1%	1.3%	0.7%	1.4%	0.4%	0.8%
1994-04 Average Acres Sold:	971	141	631	733	107	731	359	300	58	1,071
'05 Trend:	584	60	713	862	89	784	412	448	139	1,031

The average acres sold and the '05 trend estimates should be put within the context of total State Forest sales exceeding 50,000 acres each year. As the "'05 Trend" indicates, there is a slight upward trend in many of these types, but the amounts are not dramatic. The most notable exception to this is paper birch which has a decline related to its overall decline in total acres.

Lowland types have more and greater factors affecting their treatment than upland types. These range from access, Best Management Practices and environmental issues, through wildlife

concerns, markets and regeneration issues. A past lack of really good markets dampened interest in working in lowland types, but now there are clear market opportunities and pressures to evaluate possibilities. These may hold some promise and focused pilot studies and attention to harvest possibilities is planned. To make progress, a fairly aggressive effort will need to be made to develop criteria and standards of where it is viable to operate and how. However, expansion of DNR activity in these types will receive extensive scrutiny by a wide array of interests and will need to be done in a very measured fashion. Such an approach with these types is not likely to lead to them overtaking the role of the traditional timber harvest types in the coming decade. Some modest increases in harvests will likely be experienced with some of these, for example with spruce fir and white pine, and mixed swamp conifers.

PLAN OF WORK AND LIMITING FACTOR ASSESSMENT

The current inventory land base of the State Forest has 3,936,085 acres. The types, their acres and percents in 1988, 2006, and the change over these time periods are presented in the table below.

Cover Type	1988 Acreage	2006 Acreage	1988 Percent	2006 Percent	Absolute Change 1988-06	Percent Change from 1988
Aspen	893,279	884,822	23.2%	22.5%	-8,457	-0.9%
Balsam Poplar Swamp	52,536	71,655	1.4%	1.8%	19,119	36.4%
Bedrock	1,066	1,065	0.0%	0.0%	-1	-0.1%
Black Spruce Swamp	69,082	68,636	1.8%	1.7%	-446	-0.6%
Bog or Marsh	49,045	35,163	1.3%	0.9%	-13,882	-28.3%
Cedar Swamp	187,115	228,397	4.9%	5.8%	41,282	22.1%
Emergent Marsh	93,285	113,355	2.4%	2.9%	20,070	21.5%
Grassland	177,114	125,288	4.6%	3.2%	-51,826	-29.3%
Hemlock	12,580	17,479	0.3%	0.4%	4,899	38.9%
Jack Pine	401,705	367,034	10.4%	9.3%	-34,671	-8.6%
Local Name	7,611	6,544	0.2%	0.2%	-1,067	-14.0%
Lowland Hardwoods	107,890	135,912	2.8%	3.5%	28,022	26.0%
Mixed Swamp Conifers	260,426	261,183	6.8%	6.6%	757	0.3%
N. Hdwds	499,262	508,302	12.9%	12.9%	9,040	1.8%
Non Stocked	30,499	22,791	0.8%	0.6%	-7,708	-25.3%
Oak	243,010	243,691	6.3%	6.2%	681	0.3%
Paper Birch	55,246	35,462	1.4%	0.9%	-19,784	-35.8%
Red Pine	235,249	279,973	6.1%	7.1%	44,724	19.0%
Sand Dune	729	1,106	0.0%	0.0%	377	51.7%
Scrub-Carr Wetland	201,154	197,448	5.2%	5.0%	-3,706	-1.8%
Spruce Fir	65,281	51,504	1.7%	1.3%	-13,777	-21.1%
Tamarack Swamp	16,540	22,256	0.4%	0.6%	5,716	34.6%
Treed Bog	60,594	62,692	1.6%	1.6%	2,098	3.5%
Upland Brush	43,351	53,008	1.1%	1.3%	9,657	22.3%
Water	36,173	47,751	0.9%	1.2%	11,578	32.0%
White Pine	55,703	93,568	1.4%	2.4%	37,865	68.0%
Totals	3,855,525	3,936,085	100.0%	100.0%	80,560	2.1%

In any given year of entry a portion of the land base meets silvicultural criteria for a prescribed treatment. However, not all of the acreage that meets silvicultural criteria is suitable for management. A number of multiple limiting factors are often present that constrain silvicultural

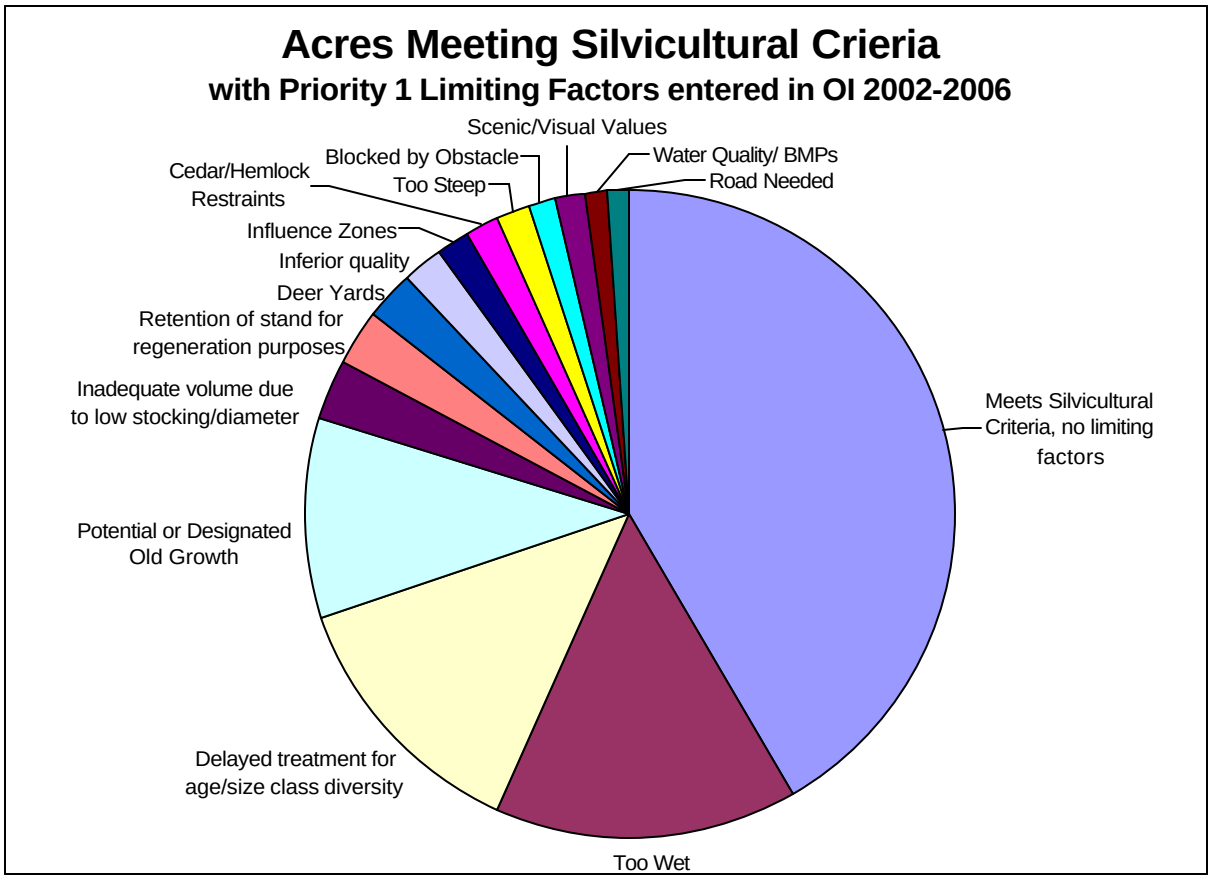
practices and obviate treatment on many areas of the forest. The table below presents a list of primary limiting factors in descending order of their prominence, which are a summary of data from the 2002 through 2006 years of entry. (Appendix I displays the acres and percentages for limiting factors for each of the years between 2002 and 2006.) Between these years, roughly half of the State Forest was inventoried.

It can be seen from the table that 440,030 acres of the roughly 2 million acres in these years of entry met silvicultural criteria. Of the 444,030 acres meeting silvicultural criteria, 274,830 acres (62%) were subject to limiting factors. The most prevalent limiting factors are excessive wetness (13.7%), delay for age/size class diversity (11.9%), and potential or designated old growth (9.1%). Figure 11 provides a graphic representation of this discussion.

DNR Forest Land 2002-2006 Year of Entry Primary Limiting Factors.
(from DNR inventory data)

Limiting Factor	Acres	Percent
Too Wet	60,676	13.7%
Delayed treatment for age/size class diversity	52,803	11.9%
Potential or Designated Old Growth	40,585	9.1%
Inadequate volume due to low stocking/diameter	12,016	2.7%
Retention of stand for regeneration purposes	11,333	2.6%
Deer Yards	10,010	2.3%
Inferior quality	7,676	1.7%
Influence Zones	7,127	1.6%
Cedar/Hemlock Restraints	7,064	1.6%
Too Steep	6,669	1.5%
Blocked by Obstacle	5,444	1.2%
Scenic/Visual Values	5,166	1.2%
Water Quality/ BMPs	4,908	1.1%
Road Needed	4,645	1.0%
Other Special Wildlife Habitat	3,965	0.9%
Denied Access	3,748	0.8%
T&E Species Concerns	3,318	0.7%
Delayed - exceptional site quality or growth	3,236	0.7%
Regeneration technology inadequate	3,070	0.7%
Land Survey Needed	2,740	0.6%
Inadequate volume due to small acreage	2,653	0.6%
No market for species or product	2,308	0.5%
Military lease/easement/ long term agreement	1,833	0.4%
Recreational Site	1,690	0.4%
Bridge Needed	1,525	0.3%
Other Dep/Div Policy/Procedure	1,500	0.3%
Quiet Area/Natural Area/ Wilderness	1,484	0.3%
Local Law or Policy	1,033	0.2%
State Law or Policy	848	0.2%
Rare or unique landforms	813	0.2%
Existing Bridge out or unsafe	531	0.1%
Other Agency concern	472	0.1%
Interest Group	451	0.1%
Neighbor	395	0.1%
Non-military easement/ lease/long term agreemt	362	0.1%
Historical or Archeological Sites	353	0.1%
Harvesting technology not available	307	0.1%
Timber contractors not available	63	0.0%
Utilization technology inadequate	10	0.0%
Total meeting Silv. Criteria, with limiting factors	274,830	61.9%
Total meets Silv. Criteria, with NO limiting factors	169,200	38.1%
Total acres meeting silvicultural criteria	444,030	100.0%
Total acres meeting silvicultural criteria	444,030	22.3%
Total acres NOT meeting silicultural criteria	1,550,032	77.7%
Total acres in Years of Entry	1,994,062	100.0%

Note: Limiting Factors are as entered into OIPC during the compartment examination and review process. Additional limitations found while preparing stands for harvest are not included. These additional acres constrained from timber sales tend to range between one to three thousand acres (two to five percent of the total prescribed for treatment) per year.



. DNR Forest Land - Acres meeting silvicultural criteria with limiting factors for the 2006-2006 Year of Entry.

As shown in the table below, what is striking about the first five years of limiting factor data is the incredibly uniform consistency in terms of key percentages:

1) the percentage of acres which meet silvicultural criteria. With one exception, this estimate has been either 21 or 22 percent; the one exception was 25%, still quite close.

2) even more striking is the consistency with which the acres meeting silvicultural criteria have consistently been divided between those with limiting factors and those without. Specifically, the acres meeting silvicultural criteria, but with limiting factors have been between 61 and 63%. The corollary to this is that those acres meeting silvicultural criteria and not having limiting factors have fallen between 37 and 39%.

Such tight bounds are quite remarkable given the variability of data from one year of entry to the next and having found them so consistently close over all five years to-date.

2002-6 Acres Meeting Silvicultural Criteria - Limiting Factor Distribution

Entry Year:	**2002**		**2003**		**2004**		**2005**		**2006**		**02-6 year total ***	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Total acres in YOE	387,644		409,571		410,873		410,775		375,199		1,994,062	
Total meets silvicultural criteria	85,383	22%	89,334	22%	103,675	25%	85,809	21%	80,289	21%	444,490	22%
Meets silvic. criteria, NO limiting factors	31,418	37%	33,672	38%	39,939	39%	32,996	38%	31,175	39%	169,200	38%
Meets silvic. criteria WITH limiting factors	53,965	63%	55,662	62%	63,736	61%	52,813	62%	49,114	61%	275,290	62%

* This is a 5 YEAR total or roughly half of the ten year cycle. It does not contain some IFMAP compartments.

Evaluation of Limiting Factors

Preliminary observations on the most common limiting factors as coded between 2002 and 2006 are presented below. It includes a qualitative assessment of whether acres in the category will increase or decline. This assessment describes how the factors are being addressed, the ease with which they can be addressed or issues associated with addressing them, and their likelihood for increasing or decreasing. Shown beside the factor is the sum of acres with this limiting factor between 2002 and 2006 (divide by five to arrive at an approximate annual average or multiply by 2 to extrapolate a decade total based upon the 2002 to 2006 period).

All limiting factors will receive additional scrutiny and review in upcoming months and years. This may lead to further decrease in the use of limiting factors than discussed below. However, an appreciable decrease in acres associated with such limiting factors is not expected, but rather it is believed that the level of acres is more likely to remain fairly constant.

Too Wet (60,676 acres): some decline
The sheer number of acres within this category and its broad and variable nature will receive a substantial amount of attention in coming years. Because of its size, acres within this category are prime candidates for review and validation by quality control foresters.

There is intense interest in timber outputs from lowland sites. A likely contributing factor to increasing the number of acres available for potential harvest in this "too wet" category is the availability of producers who have the specialized equipment to operate under certain wet conditions. These producers will also need to have flexibility to take advantage of seasonally dry opportunities to complete timber sales in the timely manner DNR timber sale contracting procedures require.

There are also several factors which will perpetuate the large number of acres coded with this limting factor. There will be greater attention paid to water quality concerns such as rutting (although BMPs are a separate limiting factor). Substantial declines in this category may also be modest because of internal business practices. To achieve substantial declines, it would need to become a widespread practice to operate outside of the State Forest ten-year

compartment review cycle. Similar to upland hardwoods, to operate in many more acres when they are not too wet requires more internal and external resources than are currently devoted to a particular year-of-entry (roughly ten percent of the forest). Such resources are necessary at the inventorying, sale preparation, and monitoring stages. Also, planning documents (some of which will be prepared through initiatives underway) will need to be in place to assure all interests are safeguarded and users of the State Forest understand planned activities and intentions.

Delayed treatment for age/size class diversity (52,803 acres): slight decline
Due to certification and the FMU Analyses, more attention is being paid to age/size class diversity. Because of this, the flip side of this limiting factor is also getting attention: ***accelerated*** treatment for age/size class diversity. This is the case for both aspen and red pine types which currently have fewer acres in the youngest age class and more treatments now could bring future treatments more in balance.

A question related to this limiting factor is whether or not an increased amount of attention will be given to older age class restoration. In any case, the use of this limiting factor will receive more attention in the future and there will likely be less coding of this factor for certain types such as jack pine and aspen.

Potential or Designated Old Growth (40,585 acres) increase
The amount of acreage designated as potential old growth (or Operations Inventory code stand condition 8) has expanded since the year 2000 by 126,100 acres, to a total of 262,552 acres, or 6.7% of the 3.9 million acre State Forest (Table 20). Future trends will likely continue an increase in the number of stands coded with stand condition 8 as the designation has been expanded to include other biodiversity values such as Ecological Reference Areas, High Conservation Value Areas, Special Conservation Areas. Additional biodiversity values will be determined by the using the Biodiversity Conservation Planning Process.

There is substantial variability in the acreage of designated potential old growth in each peninsula or Forest Management Unit (FMU) (See appendix K). The greatest proportion of designated old growth (197,175 acres, or 75%) is located in the Upper Peninsula. Old growth in the Upper Peninsula almost doubled over the past 5 years to 197,175 acres, or 10.3% of the land base. Old growth in northern Lower Michigan almost doubled to 65,377 acres, or 3.2% of the land base. When considering individual FMU's, the Gwinn, Escanaba and Newberry unit stand out with 22.9%, 17.7% and 13.5% of their respective land bases designated for old growth. By comparison, the FMUs with the largest portion of potential old growth land base in northern Lower Michigan are the Atlanta (6.6%) and Gaylord (4.4%) units respectively. The reason for these large differences in percentages is due to intensive efforts at designation in the Gwinn and Escanaba units for many years, whereas designations have only occurred at an increased rate on the remainder of the FMUs in the past 5 years.

Potential or designated old growth has been incorporated into the Special Conservation Area protocol system that also includes High Conservation Forest Areas and Ecological Reference Areas. The Special Conservation Area designation described in the Forest Certification Biodiversity Work Instruction 1.4 and the Conservation Area Management Guidelines -- along with ecoregional planning, the Wildlife Conservation Strategy and other DNR initiatives -- will

result in an increase in acres identified with and managed for specific conservation objectives and values.

It should be noted that while use of this limiting factor generally reduces harvests, in some instances timber harvesting is compatible with conservation objectives. In other words, this limiting factor coding does not automatically preclude harvesting. (This is true with the limiting factor codes generally, hence the qualified "limiting" tag.)

Inadequate volume due to low stocking/diameter (12016) possibly some decline
With continued strong markets, the development of new markets (e.g. bioenergy), utilization innovations and monitoring, there may be more opportunities to reduce the acres in this category and improve the productivity of some of these sites.

Retention of stand for regeneration purposes (11333) stay the same

Deer Yards (10010) stay the same
Localized changes in deer yard designations may occur based on herd impacts to forest regeneration, herd health and ecosystem management considerations.

Inferior quality (7676) possibly some decline
With continued strong markets, the development of new markets (e.g. bioenergy), utilization innovations and monitoring, there may be more opportunities to reduce the acres in this category and improve the productivity of some of these sites.

Influence Zones 7127 increase
Similar to "Potential or Designated Old Growth", influence zone acres may increase as a result of planning initiatives. These acres may be rolled into the "potential or designated old growth" category as a Special Conservation Area.

Cedar/Hemlock Restraints (7064) unknown and uncertain
There are many more State Forest cedar acres than hemlock, so most of this limiting factor's acres are associated with cedar. This will receive ongoing attention as polar views exist on how to manage cedar and the need for management.

Too Steep (6669) stay the same
Acres with this limiting factor will be reviewed and better documented.

Blocked by Obstacle (5444) decrease but will not be eliminated
It is anticipated that the acres blocked by obstacles will decrease with DNR adding foresters ("quality control foresters") who can focus on identifying and resolving impediments. The acres coded as blocked by obstacle will decrease to an extent, but will not be eliminated.

Scenic/Visual Values (5166) increase
This factor is closely aligned with planning and acres are, by definition, special conservation areas. Harvesting may not be precluded, but rather altered to accommodate the values present.

Water Quality/BMPs (4908) increase

See "Too Wet." Additional focus and sale specifications will assist with management and protection.

Road Needed (4645) decrease
It is expected that road budgets and processes for addressing road construction and maintenance may improve as a result of certification and planning highlighting this area.

In sum, there are several minor categories (e.g. blocked by obstacle and road needed) and one major category (too wet) where more resources devoted to reducing or eliminating the limiting factor is likely to have an impact. However, there are several influences working in the opposite direction that will increase the coding of limiting factors and reduce harvests. These influences include additional planning processes and greater formal coding and implementation of biodiversity practices. The major limiting factor that will reflect these influences is "potential or designated old growth" which now has a broader use to designate special conservation areas. This designation is slated to grow in the years ahead even as many other limiting factors are likely to decline.

Limiting factors are only part of the mix of what determines the availability of timber from State Forests. Overall, in contrast to the issues and changes discussed for the five major timber cover types, the changes anticipated here for limiting factors do not appear that large. It is acknowledged, however, that broad social and political policy and markets could have a greater long-run impact than is currently anticipated, greatly affecting how limiting factors are applied in the future, specifically and in the aggregate.

CONCLUSIONS

In the past decade, the acres of Michigan State Forest timber sales have leveled off. The composition of these sales have changed however. More upland hardwood acres were sold as aspen acres declined. This tradeoff resulted in the loss of some volume and increased labor requirements due to the tradeoff entailing selective cutting (single-tree marking in the place of clearcuts.

There are more acres of aspen on the State Forest than any other type. Multiple markets began developing for Michigan aspen in the 1960s. By the mid-to late 1990s, most of the commercially desirable acres of what at one time was described as a "weed tree" were harvested. In comparison to the 1960s to mid-1990s, during this past decade, the DNR has had less than half the commercial aspen acres to choose from for harvests. It will be another five to fifteen years before the aspen acres in commercially desirable ages amount to what they once were. When those larger numbers of acres are available again for harvests, the DNR will face more environmental and biodiversity-related demands; the synergy of game and wood product interests for aspen management won't be as strong as it was last time around; and there will likely be more public concerns about a variety of issues like esthetics and clearcutting.

Jack pine is closer to where it should be in terms of age class balance than oak, aspen, or red pine. However, the harvesting in this type over the past two decades has been greater than the long-run sustainable level. The harvesting was necessary to avoid losing much of the jack pine to budworm and because much of the jack pine resource was in an overmature state, facing mortality and conversion to other types, including nonforested types. This harvesting has resulted in age classes being skewed towards the 0-9 and 10-19 year age classes. This bias towards younger age classes is also propelled in part by Kirtland's Warbler (KW) habitat work which engages in shorter rotations. There remain stands over sixty years of age for which mortality from budworm continues to be a concern. Between efforts to reduce acres in older age classes and KW work, harvests may be maintained at higher levels for a few more years or even up to a decade, but, overall, timber sale harvests in this type are expected to drop by 25% to 50% not long after that, given the jack pine age structure.

The upland hardwoods story is similar to jack pine in that the level of harvests for upland hardwoods are anticipated to be similar to what they have increased to in recent years. Changes occurred in the past decade as markets developed throughout much of the state. It appears that there is not the desire or opportunity to do much more unless substantial resources were applied to enable business practices and procedures to achieve optimal timing on harvests. Internally, it is questioned that there would be appreciable gains while organizational, travel, labor, and possibly political capital and other costs would be substantial.

Red pine opportunities (and challenges if we put off harvests) have been spelled out previously, but despite several years of communications on it, only a small increase in sales have taken place. Prescriptive guidelines for identification of stands to be regenerated (especially those in the 50-60 year age classes) may also be an outgrowth of work to revise Silvicultural Guidelines. These will help expedite the decision-making process. Monitoring and analysis should lead to sales increasing by an average of 10% to 20% more per year, resulting in a doubling of outputs within 4 to 8 years. This level or higher should then be maintained for several decades. This may be helped along by a high level endorsement of the role of red pine, economic development, and wood fiber

production on a portion of State Forest lands. This issue may possibly come to the fore again through the ecoregional planning process. In any case, a number of forces are leading to higher red pine harvest volumes. It should be reiterated that the time for more intensive regeneration activity is best now; as postponing creates more work and possibly lower prices later (due to greater supplies from DNR ownership and National Forest ownership hitting the market at the same time).

Timber treatments within the oak cover type are likely to increase given its concentration of acres in the 70-100 year range and as more mortality and conversions to other forest types are observed. Opportunities to increase acres in oak also exist, but acceptance of the fact that it will mostly exist as part of a mixed oak-pine cover type in the future needs to be understood by resource professionals and the public together. To enhance the health and maintenance of the oak component in the State Forest, treatments should not be put off until the "next decade."

There are appreciable acres lowland types (both coniferous and deciduous) and very little harvesting activity occurring within them. However, to avoid bmp, regeneration, and other problems, a cautious but concerted effort with a variety of partners should examine possibilities for responsible, sustainable harvest activities within them. Otherwise, DNR personnel will avoid the potential pitfalls of increased timber sale activities in these types and there will be little change in timber outputs from them.

DNR timber harvest trends differ by species. To recap what this examination has concluded: Timber sales have likely leveled off somewhat on jack pine and upland hardwoods and are not likely to continue an upward climb. Jack pine harvests, in particular, may stay at current levels for a few more years, but they are likely to decline for a period starting in the coming decade and lasting for at least three decades. This is simply because the age classes approaching commercial readiness are half or less the average amount which has been harvested in recent years. In contrast, sales for aspen may have bottomed out and may be gradually starting up before long, especially if DNR personnel take to heart age class balancing. Red pine holds the most near-term promise on a percentage increase basis, but it only has half the number of acres that upland hardwoods have and less than one-third of the aspen acres. Harvest increases are likely, but more uncertain in oak and lowland types.

APPENDICES

A. Wood Product Industry Trends and Michigan Forests

B. Michgan DNR Timber Harvest Determination Process[9]

C. Past Michigan Timber Harvest Projections

D. FIA Estimates & Comparisons with DNR Inventory Data

E. MI DNR Timber Production, fy 1989 - 2004

F. Timber Sales: 1986-2004 FMU Total Acres and Volume

G. Timber Sales: 1994-2004 Cover Type Acres, WUP, EUP, NLP, SF

H. Age Class Tables For Major Cover Types *(BA for No. Hrdwd):* 1988 vs. 2005

I. Treatment Period Data: 1988 – 2005

J. Limiting Factor Data, 2002-06

K. Potential Old Growth Designations by FMU

L. Michigan DNR Inventory and Timber Program Summaries

[9] This document describes the annual "plan of work" process which focuses on preparing acres for sale which have been prescribed for treatment during the inventory process. For more on the inventory prescription process, see the OI manual, especially chapter 7 on "Compartment Reviews." Two flow charts are companion documents to this paper and highlight the inventory and treatment-decision process which lead to timber sales and harvests. The Appendix F_5_02OImanual.doc from the OI manual provides a treatment decision tree description and the RAP Flow Chart 1_03.doc (Resource Assessment Process Flow Chart) details the inventory steps leading up to the annual plan of work described in this document.

Appendix A: **WOOD PRODUCT INDUSTRY TRENDS AND MICHIGAN FORESTS**

Global Influences

The last decade has seen a significant number of corporate mergers and acquisitions, creating large global forest products companies that are more responsive to market fluctuations. Paper and wood products companies are also downsizing and divesting themselves of "non-core" businesses and assets to increase their competitive advantage and profits. Corporate decisions are made for global market and business positioning, as opposed to regional or local considerations.

Investing in forests and operations overseas provides numerous business advantages over North America and the United States:

- Low risk investment for capital.
- Favorable new construction incentives.
- Proximity to world markets.
- Less government regulation.
- Lower labor costs.
- Lower forest harvesting costs.
- Reduced or no environmental protection costs (e.g. streamside management, Threatened and Endangered species).

Forests in tropical and sub-tropical areas have higher wood fiber productivity than Michigan's temperate forests. In addition, wood technology processes are being developed to better utilize the characteristics of the faster growing tropical species more so than for the slower growing Michigan species.

- Fiber growth rates[10] up to 6 times Michigan's average rate.
- Shorter fiber production rotations (35 years).
- Engineering and manufacturing innovations that are compatible with fast growing fiber characteristics.
- Technological innovations that increase fiber productivity.
- Plantation wood fiber that can be certified under forest certification systems (notably Forest Stewardship Council).

Worldwide, forestry is adopting an agricultural production model for growing timber through tropical and subtropical Intensively Managed Forest Plantations (IMFPs). These forests are geared towards maximizing fiber outputs with minimal consideration of other social, economic and biological benefits. There has been unprecedented investment in

[10] More than 6 times Michigan's average growth rate. Intensively Managed Forest Plantations (IMFPs) achieve 300 cubic feet per acre per year (ft^3/ac/yr) where growth rates of forest stands in Michigan range from 25 (ft^3/ac/yr) in northern hardwoods to 75ft^3/ac/yr in single species red pine plantations. Jack pine and Aspen growth rates are 30ft^3/ac/yr and 48ft^3/ac/yr respectively.

IMFPs in the last 20 years. The fiber from these plantations will form a "wall of wood" by 2020 that is expected to provide nearly one-half the world's industrial wood (today it is 1/3 of the supply).

National Influences

Forests in the United States are valued for a broad range of public values and benefits. These include water and air quality, biological diversity, recreation, aesthetics, spiritual values, habitat, and ecological/natural processes, as well as wood fiber. Most private forest landowners hold forest land for non-timber reasons: recreation, aesthetics, residence.

Unlike the global trend toward wood fiber plantations, most U.S. forests are managed as "natural forests". Natural forests are forests where natural processes, aesthetics, habitat, species diversity, water, soil and stream outputs are desired and part of the management mix.

Forests in the United States have several competitive disadvantages related to global timber production:

- Higher cost of labor.
- Higher cost of owning timber land including taxes.
- Higher cost of environmental compliance.
- Environmental protection regulations have limited access to timber, for example along streams, soil and sedimentation restrictions and wildlife habitat protection.
- Higher transportation costs to new world markets (e.g. China).
- Higher cost of harvesting.
- Lower annual growth rates (relative to world forests).
- Forests are becoming valued more for non-timber services and products such as recreation.
- Forest landowners exclude industrial wood production to favor other values: recreation, second homes, biodiversity.

State Influences

Michigan's 19.3 million acres of forestland is a significant asset to the State, communities, citizens and forest-based industry. Collectively, these forests are a massive base (growing stock) that can provide stable annual harvests of wood fiber.

Michigan and the Great Lakes region have several influences that are favorable for the wood industry:

- Positive growth-to-removals (harvest) ratio.
- Highly educated workforces.
- Favorable location relative to population centers and major North American markets.
- Likelihood of continued growth in wood product consumption in the U.S. and worldwide.

Disadvantages include:

- Reduction in wood fiber from Michigan's national forests.
- Parcelization of (dividing up) large forestland holdings.
- Low level of harvesting from private forests (non-industrial owners) relative to growing stock and annual growth rates.
- Slower annual growth rates compared to other parts of the world.

The most recent forest inventory estimates net annual forest growth in Michigan to be about 930 million cubic feet per year, while removals represent approximately 1/3 that growth. There are a variety of factors that contribute to this statistic. Much of the growth is on private lands and timber harvesting is a low priority for most private landowners. National forests have expanded their protection of recreational and ecological values which are contributing factors to reduced harvests from federal holdings.

In addition, forest growth rates vary by stand age. Rates remain stable or increase until the forest stand reaches maturity when annual growth rates and forest health begin to decline. A young aspen stand will have a higher growth rate, but less volume, than a mature aspen stand that has a slower growth rate and significant wood fiber. A forest comprised of younger-aged stands will have greater growth rates and less wood available for harvest than older stands. Growth-to-removal ratios vary considerably by tree species.[11]

The favorable growth-to-removals ratio has provided opportunities for out-of-state forestry companies that have entered into the Michigan logging market. Mills in Michigan are facing significantly increased competition from out-of-state forest companies and much higher prices than in the recent past. More central and western Upper Peninsula timber is going to Wisconsin and Minnesota mills. A major international firm with several mills in Wisconsin is even considering barging hardwood pulpwood from the northern Lower Peninsula across Lake Michigan to supply their Wisconsin mills.

The potential to increase removals is constrained by the decrease in local logging firms available to remove timber. Barriers include high capital outlay, labor and liability costs, high harvesting costs, business uncertainty and risk, and more profitable paying business alternatives.

State Forest System Influences

In 2004, the State of Michigan, with strong support from the forest products industry and their customers, reaffirmed and codified the intent of State Forest System management (Part 525, P.A. 451, 1994) to provide a mix of ecological/biological, social and economic values and benefits. In a global context, State Forest System management would be akin to natural forest management, as opposed to that of Intensively Managed Forest Plantations. This policy decision reflects the importance of timber and non-timber forest

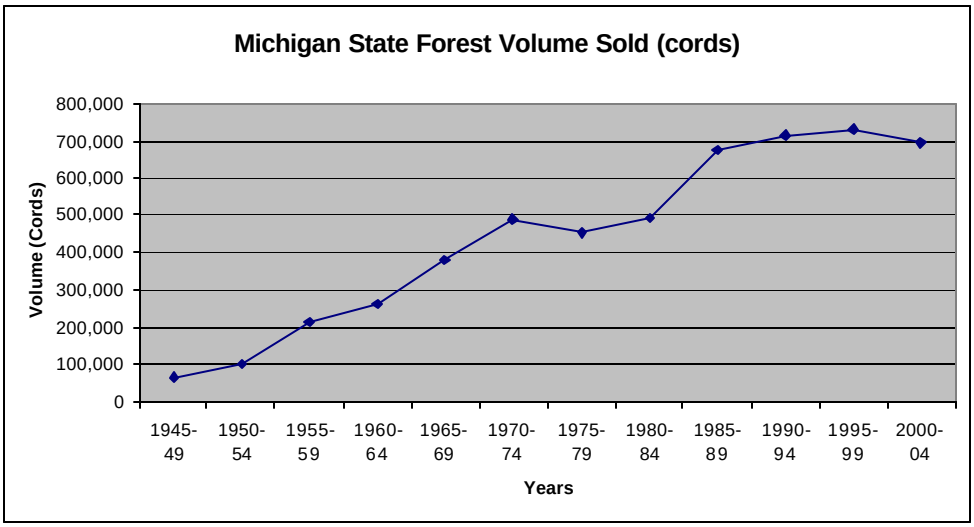
[11] Tree species that are harvested using a clearcut method tend to have a lower growth-to-removals ratio than species that are harvested using selection or single tree methods.

values and precludes optimization of any single output on the State Forest System as a whole. For example, managing single species red pine plantations on a large scale to optimize fiber production (requiring use of fertilizer, herbicides) is not an acceptable forest management regime under State Forest management guidelines or forest certification principles used in the United States.

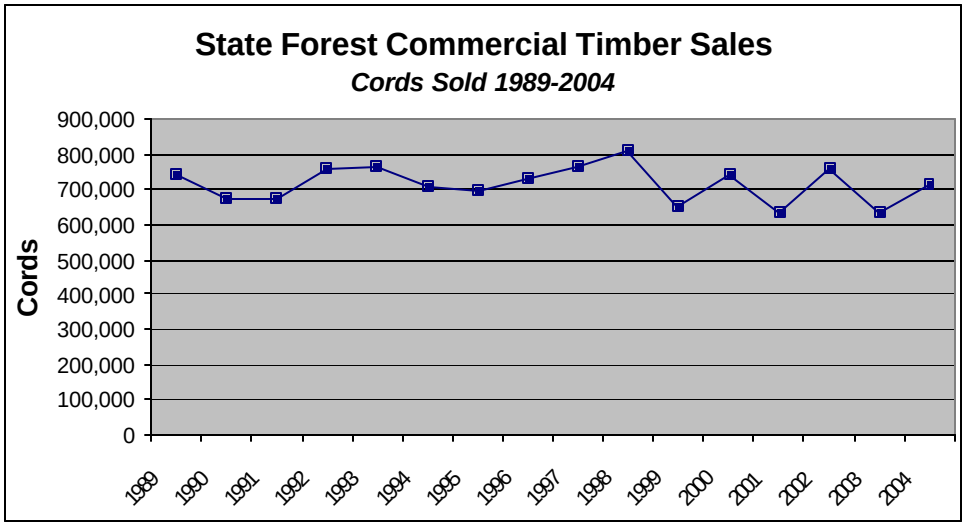
State Forest Management

Historically, Michigan forests were logged too heavily and created a "boom and bust" situation. In the late 1970's the Natural Resource Commission provided clear direction for State Forests to consider "all the values of forest resources."[12] The Statewide Forest Resource Plan of 1983 promoted "stabilized timber supplies from public land".[13] The goal for timber supplied from State Forests is to have a stable level of fiber available over time. Area regulation is employed to provide a continuous yield of timber over time.

The even flow of fiber from State Forests helps stabilize the forest products industry in Michigan. Below are timber sale volumes from State Forests from 1945. Since 1989, timber sale production from the State Forest System has consistently remained in the range of 600,000 cords/year to 800,000 cords/year.



[12] NRC Policy 2207 adopted 1979.
[13] Michigan's Forest Resources: Direction for the Future A Statewide Forest Resource Plan, Michigan Department of Natural Resources, 1983.



In the 1980s, much of the aspen on State Forests reached maturity. Most of these stands were harvested, but some were not, in order to have an even age-class distribution for future timber supply and wildlife habitat. Red pine that was planted by the CCC in the 1930s is maturing today. In order to avoid a boom and bust, the plan is to spread harvests out over at least two decades. This will provide a stable fiber supply and a variety of wildlife habitat conditions.

There are numerous variables that affect the ability to harvest timber from the forest, including resource protection and sustainability, environmental compliance, legal constraints and accessibility. These variables and their influence are expected to increase as non-timber activities increase and private forests are converted to other high value uses. Landowners are becoming less tolerant of timber harvests near their property. This has led to visual and other buffers reducing harvestable State Forest acres and access to State land being denied by adjacent landowners.

At any given time, the Department typically has open timber sales contracts with 1.2-1.6 million cords of timber. That is, the Department has sold timber for harvesting, but that timber has not been cut and removed. The amount of sold standing timber is a reasonable barometer for wood fiber market demand. If supplies are not keeping pace with demand, it should translate into smaller backlogs to cut, in turn, reducing the amount of uncut standing timber on sold timber sales. There had not been a reduction in the amount of uncut standing timber on Department open timber sales until March, 2005 when a dip in standing sold timber was noted.

Recommendations

In the global sphere, Michigan and the Great Lakes region have significant disadvantages in timber production that may outweigh short and long-term advantages. Movement away from plantations -- as we are doing on public forests -- and toward greater biodiversity and environmental protection will move our forests toward slower growth rates and higher costs; while most of the rest of the world is moving toward plantations, faster growth rates, and lower costs. While this is not necessarily a threat to some firms as they derive lower cost wood inputs from outside the region or make new investments elsewhere, it

may be debilitating to the forests and communities in which these firms are currently located.

Recommendations include:

1. Establish a national forest policy framework recognizing the need to balance social, economic and biological values. Reiterate the importance and value of timber harvesting as a forest treatment tool for long-term forest health.

2. Work with USDA Forest Service to revise forest regulations so that they are proactive rather than reactive.

    a. Support annual, ongoing funding for implementation of national forest plans.
    b. Convene a blue ribbon committee to recommend NEPA revisions.
    c. Develop forest planning processes that reflect current and future forest management in a global context. Current regulations have created management paralysis. The National Forest planning framework is outdated and ineffective.

3. Improve the quality, reliability and availability of forest sustainability related data[R2]. Support increased funding ongoing funding of:

    a. Forest Inventory and Analysis (FIA) data.
    b. Timber Products Output (TPO) surveys.
    c. Forest management research.

4. Promote forest certification on non-industrial private forest lands and National Forests[R1]

    a. Increase funding for technical and financial assistance in the areas of planning, utilization and marketing for states and private landowners.

5. Reduce the costs of managing private forests[R3].

    a. Restructure Federal and state tax policy for income, estate, and property tax to support long-term forest tenure and active forest management.
    b. Stabilize the forest regulatory environment. Changing environmental regulations increase risk and serve as a disincentive to long-term management.

6. Provide federal funding to support increased investment and research in new technology – technology that is cutting edge and environmentally and economically competitive.[R2]

7. Maintain a viable domestic forest industry and create new markets for important forest goods and services.[R3]

a. Provide federal tax credits and incentives for alternative forest values, including watershed protection, carbon sequestration, recreation and oxygen production.

8. Develop regional transportation policy. Current road, rail and water transportation regulations are inconsistent and a disincentive to industry.

9. Explore Bio-Energy options, research, regulations and incentives from research roles on carbon credits to regulatory barriers and other matters affecting cogeneration.[R1]

References:

[R1]Sustaining the Future of the Forest Industry in the Upper Great Lakes Region: 2004. 6 pgs. A Resource Issue Paper of the Great Lakes Alliance, Inc. http://www.lsfa.org/news_notes.html

[R2]Forests and Forestry in the United States – 2050: Points to Ponder. 16 pgs. Gerald Rose. May, 2003.

[R3]Forests Face New Threat: Global Market Changes *An overhaul of forest policy is needed to deal with the economic and environmental consequences of globalized production*. Franklin, Jerry F; Johnson, K Norman. Issues in Science and Technology Online. Summer, 2004 http://www.issues.org/issues/20.4/franklin.html

Appendix B: Michgan DNR Timber Harvest Determination Process[14]

For the last few decades, approximately 10% of the State Forest (or 390,000 acres) are scheduled to be reviewed each year, but only about 60,000 acres are prepared for commercial timber treatments. Differences of opinion exist over whether or not and how much the amount prepared for treatment can be expanded.

The 1998-99 Silvicultural Analysis addressed this question by establishing an accounting framework for the categorization of acres examined and appling this framework to a 10-year projection of the State Forest inventory. The projection was for the period 1999 to 2008.

The accounting framework developed through the Analysis has since been incorporated into the Division's inventory and annual work plan processes[15]. This permits a close examination of how Analysis projections compare to what is actually being achieved during the projection period. Over time, a substantial, in-depth timber management review system has become established.

Following Compartment Reviews, when a Management Unit finishes their inventory updates and all quality control checks are completed, the inventory for that Unit is combined with the inventories of other Units' that have completed the process for that year. In this manner, a complete, up-to-date, statewide inventory for what is referred to as an "entry year" (YOE, or “year of entry”) is compiled despite the fact that the Management Units are on slightly different schedules. In turn, this "frozen" database is used as the basis for work planning for the entry year.

This process was begun with the 2000 entry year. Prior to the 2000 entry year, State Forest inventory databases (including the one used for the Silvicultural Analysis) were frozen at a particular point in time, with the Units at different stages of updating their inventories and completing their quality control work. Each year's statewide "frozen" database contains the most accurate inventory available for the entry year for which it was compiled. (The frozen database contains inventory data for other years, but earlier years may or may not have been updated to reflect timber sales and later years might not reflect inventory changes as a result of treatments or the passage of time. Taking the current inventory year's data from the frozen databases provides the most accurate contrast to the annualized projections of the Silvicultural Analysis.)

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[14] This document describes the annual “plan of work” process which focuses on preparing acres for sale which have been prescribed for treatment during the inventory process. For more on the inventory prescription process, see the OI manual, especially chapter 7 on “Compartment Reviews.” Two flow charts are companion documents to this paper and highlight the inventory and treatment-decision process which lead to timber sales and harvests. The Appendix F_5_02OImanual.doc from the OI manual provides a treatment decision tree description and the RAP Flow Chart 1_03.doc (Resource Assessment Process Flow Chart) details the inventory steps leading up to the annual plan of work described in this document.

[15] Appropriations language for FY 01 and FY 02 calls for the Division's continuation of the silvicultural analysis

This process updates an overview of the forest on an annual basis and, unlike more conventional means of determining “allowable cut:” based on abstract calculations, assures that annual harvest targets are achievable and sustainable.

The current (2005) process to develop the plan of work (POW) is:

1. Units update OIPC to reflect compartment review decisions
2. Planner verifies that information is correct and approves database
3. Statewide Inventory Specialist (SIS) queries OIPC for information needed for “Acres Available” portion of plan of work (POW). This information is broken down by Unit and includes:

2005 Timber Sale Preparation Plan of Work (Part 1 - Acres Available)

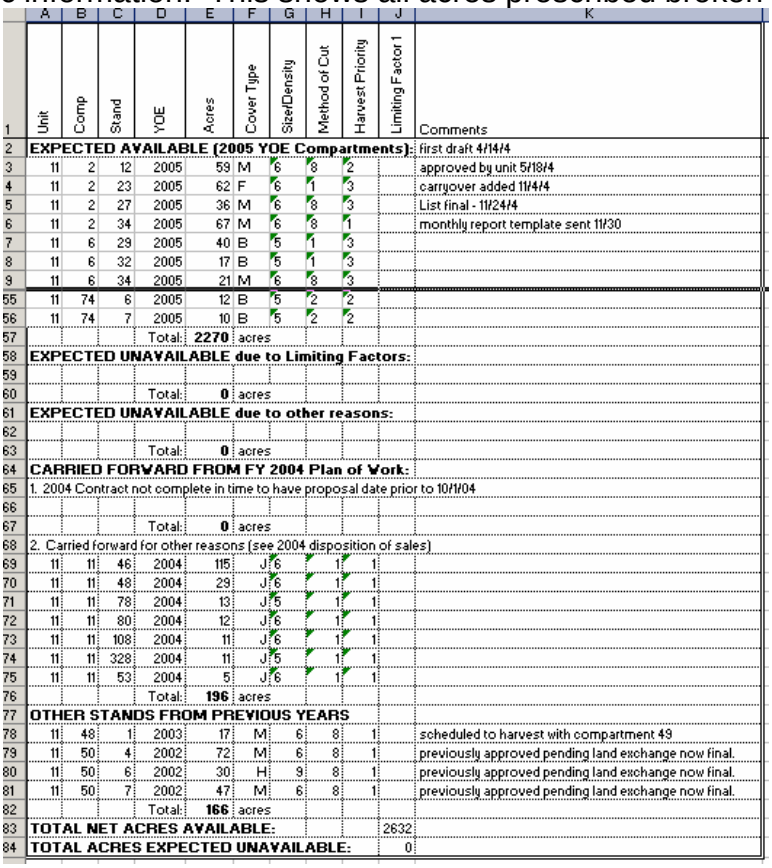
UNIT	All Acres Examined 2005 YOE[1]	Not Prescribed (not managerially desirable)			All Acres Prescribed for harvest in OI[3]	Prescribed (treatment managerially desirable)					Net Available 2005 YOE[4]	Additions[5]		TOTAL ACRES[7]	Carried from 2004 work plan unfinished contracts[3]	NET ACRES E
						Expected Available			Unavailable			Carried from 2004 work plan[4]	Other Additions			
		Non-Forest Types[1]	Forested acres not meeting silvicultural criteria[2]	silvicultural criteria, but restrained by limiting factors[2]		Non-Forest Types[1]	Does not meet silvicultural criteria[4]	Does meet silvicultural criteria[4]	Restrained by limiting factors[1]	Other[1]						
Baraga	14,026	2,255	6,188	3,313	2,270	0	847	1,423	0	0	2,270	196	166	2,632	0	2,632
Crystal Falls	28,284	4,005	15,800	4,646	3,833	0	357	2,953	88	435	3,310	267	0	3,577	0	3,577
Gwinn	29,754	2,892	17,638	6,094	3,130	0	837	1,593	700	0	2,430	733	0	3,163	0	3,163
WUP Totals:	72,064	9,152	39,626	14,053	9,233	0	2,041	5,969	788	435	8,010	1,196	166	9,372	0	9,372
Escanaba	11,686	713	7,692	1,425	1,856	0	901	810	72	73	1,711	9	0	1,720	0	1,720
Shingleton	43,011	13,678	20,339	3,772	5,222	16	1,849	2,965	335	57	4,830	99	41	4,970	0	4,970
Newberry	41,734	16,547	16,186	5,682	3,319	0	486	2,497	336	0	2,983	0	240	3,223	0	3,223
Sault	30,015	8,068	14,108	3,193	4,646	0	1,028	2,002	1,471	145	3,030	0	790	3,820	0	3,820
EUP Totals:	126,446	39,006	58,325	14,072	15,043	16	4,264	8,274	2,214	275	12,554	108	1,071	13,733	0	13,733
UP Totals:	198,510	48,158	97,951	28,125	24,276	16	6,305	14,243	3,002	710	20,564	1,304	1,237	23,105	0	23,105
Gaylord	36,828	4,379	21,802	4,509	6,138	0	1,517	3,059	1,562	0	4,576	323	171	5,070	0	5,070
Pigeon River	11,198	1,458	7,476	661	1,603	0	218	1,191	8	186	1,409	28	0	1,437	0	1,437
Atlanta	29,266	3,517	18,521	2,992	4,236	0	1,554	2,577	105	0	4,131	1,104	0	5,235	0	5,235
Roscommon	24,671	4,537	11,056	6,868	2,210	0	796	1,374	40	0	2,170	0	0	2,170	0	2,170
Grayling	28,493	3,051	15,927	3,844	5,671	27	2,333	3,056	248	9	5,414	1,473	0	6,887	0	6,887
ELP Totals:	130,456	16,942	74,782	18,874	19,858	27	6,418	11,257	1,963	195	17,700	2,928	171	20,799	0	20,799
Traverse City OI	31,808	4,016	20,024	1,973	5,795	5	2,525	3,224	31	10	5,754	987	0	6,741	0	6,741
TC IFMAP*	1,869	256	1,084	283	246	0	57	186	3	0	243	0	0	243	0	243
Cadillac	24,891	2,803	14,691	2,045	5,352	0	2,634	2,421	297	468	4,587	1,467	224	6,278	0	6,278
Gladwin	23,241	4,568	13,512	1,513	3,648	0	1,153	1,992	270	233	3,145	1,221	0	4,366	0	4,366
WLP Totals:	81,809	11,643	49,311	5,814	15,041	5	6,369	7,823	601	711	13,729	3,675	224	17,628	0	17,628
NLP Totals:	212,265	28,585	124,093	24,688	34,899	32	12,787	19,080	2,564	906	31,429	6,603	395	38,427	0	38,427
State Totals:	410,775	76,743	222,044	52,813	59,175	48	19,092	33,323	5,566	1,616	51,993	7,907	1,632	61,532	0	61,532

- All acres examined in this year of entry (YOE). Of those, the acres without prescriptions are broken into: non-forested, forested that do not meet silvicultural criteria, and forested that do meet silvicultural criteria that are restrained by limiting factors.
- All acres prescribed for harvest in OIPC, Of those, prescribed acres that are available for harvest that:
    a. are classified as non-forested
    b. do not meet generic silvicultural criteria but are approved and prescribed for treatments
    c. do meet generic silvicultural criteria
- The rest of the prescribed acres are unavailable acres that are:
    a. prescribed but unavailable due to limiting factors

b. prescribed but unavailable for other reasons (already on contract, planned to treat with adjacent compartment in other years, planned to treat other years for other reasons, etc.)

- Net available from the YOE.
- Additions. These include stands carried from the previous year's POW and other additions from previous years (see final bullet in step 4)

4. SIS creates tab within POW for each unit that shows all prescribed stands with stand specific information. This shows all acres prescribed broken into:



	A	B	C	D	E	F	G	H	I	J	K
1	Unit	Comp	Stand	YOE	Acres	Cover Type	Size/Density	Method of Cut	Harvest Priority	Limiting Factor 1	Comments
2	**EXPECTED AVAILABLE (2005 YOE Compartments):**										first draft 4/14/4
3	11	2	12	2005	59	M	6	8	2		approved by unit 5/18/4
4	11	2	23	2005	62	F	6	1	3		carryover added 11/4/4
5	11	2	27	2005	36	M	6	8	3		List final - 11/24/4
6	11	2	34	2005	67	M	6	8	1		monthly report template sent 11/30
7	11	6	29	2005	40	B	5	1	3		
8	11	6	32	2005	17	B	5	1	3		
9	11	6	34	2005	21	M	6	8	3		
55	11	74	6	2005	12	B	5	2	2		
56	11	74	7	2005	10	B	5	2	2		
57				Total:	**2270**	acres					
58	**EXPECTED UNAVAILABLE due to Limiting Factors:**										
59											
60				Total:	**0**	acres					
61	**EXPECTED UNAVAILABLE due to other reasons:**										
62											
63				Total:	**0**	acres					
64	**CARRIED FORWARD FROM FY 2004 Plan of Work:**										
65	1. 2004 Contract not complete in time to have proposal date prior to 10/1/04										
66											
67				Total:	**0**	acres					
68	2. Carried forward for other reasons (see 2004 disposition of sales)										
69	11	11	46	2004	115	J	6	1	1		
70	11	11	48	2004	29	J	6	1	1		
71	11	11	78	2004	13	J	5	1	1		
72	11	11	80	2004	12	J	6	1	1		
73	11	11	108	2004	11	J	6	1	1		
74	11	11	328	2004	11	J	5	1	1		
75	11	11	53	2004	5	J	6	1	1		
76				Total:	**196**	acres					
77	**OTHER STANDS FROM PREVIOUS YEARS**										
78	11	48	1	2003	17	M	6	8	1		scheduled to harvest with compartment 49
79	11	50	4	2002	72	M	6	8	1		previously approved pending land exchange now final.
80	11	50	6	2002	30	H	9	8	1		previously approved pending land exchange now final.
81	11	50	7	2002	47	M	6	8	1		previously approved pending land exchange now final.
82				Total:	**166**	acres					
83	**TOTAL NET ACRES AVAILABLE:**									2632	
84	**TOTAL ACRES EXPECTED UNAVAILABLE:**									0	

- Expected Available.
- Prescribed but Unavailable due to Limiting Factors. First priority limiting factor is listed for individual stands.
- Unavailable for other reasons. Reasons are individually documented.
- Carried forward from the previous POW.
- Other stands from previous years that were not on a prior work plan – such stands that were planned to treat with adjacent compartments in this YOE and other stands that were planned to treat in this YOE.

5. POW as assembled is verified by units.

6. Verified POW is forwarded to Field Coordinators. Estimates are made for expected carry-over, if any. The Field Coordinators then work with District Supervisors and Unit Managers to determine what resources will be needed to accomplish approved treatments. The Resource Needs tab of the POW is used to document resource needs.

2005 Timber Sale Preparation Plan of Work (Part 2 - Resource Allocations) April 25, 2005

		TOTAL ACRES AVAILAB	TOTAL POSSIBLE WITH CURRENT RESOURCES: Minimal resources needed (balance of work done last year)	No FMD resources needed (wildlife division will accomplish)	Regular Time Acres Unit Staff	Regular Time Acres District Staff	Carried over 2004 wk plan contracts[1]	Contract Acres and Dollars	Student Acres and Dollars	Overtime Acres and Dollars	TOTAL PLANNE ACRES and Additio Dollars[4]	Acres not scheduled due to lack of resources
Baraga	Acres	2,632			1,040	200		1,392			2,632	0
	Dollars							$64,687			$64,687	
Crystal Falls	Acres	3,577			1,919	600		1,058			3,577	0
	Dollars							$38,000			$38,000	
Gwinn	Acres	3,163			2,295	200		668			3,163	0
	Dollars							$24,000			$24,000	
WUP	Acres	9,372	0	0	5,254	1,000	0	3,118	0	0	9,372	0
	Dollars						$0	$126,687	$0	$0	$126,687	
Escanaba	Acres	1,720			1,720						1,720	0
	Dollars										$0	
Shingleton	Acres	4,970			3,176	418		1,376			4,970	0
	Dollars							$56,000			$56,000	
Newberry	Acres	3,223			1,667	240		1,216		100	3,223	0
	Dollars							$43,700		$4,000	$47,700	
Sault	Acres	3,820			2,620	400		500		300	3,820	0
	Dollars							$7,000		$12,000	$19,000	
EUP	Acres	13,733	0	0	9,183	1,058	0	3,092	0	400	13,733	0
	Dollars						$0	$106,700	$0	$16,000	$122,700	
UP Totals:	Acres	23,105	0	0	14,437	2,058	0	6,210	0	400	23,105	0
	Dollars						$0	$233,387	$0	$16,000	$249,387	
Gaylord	Acres	5,070			3,350			1,720			5,070	0
	Dollars							$60,000			$60,000	
Pigeon River	Acres	1,437			1,000			437			1,437	0
	Dollars							$17,000			$17,000	
Atlanta	Acres	5,235			2,000	1,000		1,000		1,134	5,134	101
	Dollars							$48,000		$40,000	$88,000	
Roscommon	Acres	2,170			1,170			1,000			2,170	0
	Dollars							$16,000			$16,000	
Grayling	Acres	6,887			2,400	888		1,737		1,300	6,325	562
	Dollars							$66,500		$45,750	$112,250	
ELP	Acres	20,799	0	0	9,920	1,888	0	5,894	0	2,434	20,136	663
	Dollars						$0	$207,500	$0	$85,750	$293,250	
Traverse City	Acres	6,984			3,280	1,800		632		1,272	6,984	0
	Dollars							$23,000		$45,000	$68,000	
Cadillac	Acres	6,278			2,700	1,800		899		300	5,699	579
	Dollars							$20,000		$10,500	$30,500	
Gladwin	Acres	4,366			1,600			1,798		400	3,798	568
	Dollars							$49,000		$13,750	$62,750	
WLP	Acres	17,628	0	0	7,580	3,600	0	3,329	0	1,972	16,481	1,147
	Dollars						$0	$92,000	$0	$69,250	$161,250	
LP Totals:	Acres	38,427	0	0	17,500	5,488	0	9,223	0	4,406	36,617	1,810
	Dollars						$0	$299,500	$0	$155,000	$454,500	
State	Acres	61,532	0	0	31,937	7,546	0	15,433	0	4,806	59,722	1,810
	Dollars						$0	$532,887	$0	$171,000	$703,887	

[1]All acres not finished on time by sale prep contractor to be completed in FY 2005. If FY2005 dollars are to be used to pay for any of the prep contract carry-over, include them here.

7. The list of treatments in step 4 is put into a monthly report format for the Unit. Throughout the year, the unit tracks the treatments as timber sale contracts are prepared on a stand by stand basis. Actual timber sale acres are reconciled to the inventory acres, with any differences documented. Some stands are found to be factor limited and treatments are not prepared. These are documented as well. The monthly report also provides progress updates to District and Lansing staff.

From Operations Inventory: Unit	Comp	Stand	YOE	Stand Acres	Cover Type	Size/Density	Method of Cut	Harvest Priority	Source[1]	From Timber Sale Proposal (update this column as sales are submitted): Timber Sale Name	Timber Sale Number X	Local Use	Stand Acres within sale	Acres Difference (If positive, either of next 2 columns should be negative)	Expected to be unavailable for future: Minor Acreage Changes[2]	Factor Limitations[3] (To be Updated in OIPC) Acres	r	Expected to be available for next year's plan (acres)	Acres not accomplished, Available for next year - Reasons not prepared this year: Not scheduled due to lack of resources	Weather[4]	Staff on Western Fires beyond	Staff on Michigan fires	Contractor prepared sales - not finished	Expected survey not completed	Special Assignments[5]	Unexpected vacancies, moves, injuries, etc.	Workload shift due to salvage,	Other acres not completed (describe)	Total Acres to Carry Over to 2006 Plan of Work[6]	Commen
63	6	50	2005	54	A	6	3	1	A					-54.0				54.0											0.0	
63	6	52	2005	21	O	6	3	1	A					-21.0				21.0											0.0	
63	6	53	2005	64	O	6	1	1	A					-64.0				64.0											0.0	
63	6	60	2005	57	J	6	1	2	A					-57.0				57.0											0.0	
63	6	62	2005	11	O	5	1	2	A					-11.0				11.0											0.0	
63	6	63	2005	21	R	6	4	1	A					-21.0				21.0											0.0	
63	6	65	2005	11	O	9	3	2	A					-11.0				11.0											0.0	
63	6	77	2005	50	J	6	1	1	A					-50.0				50.0											0.0	
63	6	82	2005	21	O	6	1	2	A					-21.0				21.0											0.0	
63	9	47	2000	24	J	6	1	1	C	Twin Creek East Jack	63-012-05-01		19	-5.0	5			0.0											0.0	
63	10	56	2004	34	O	8	3	1	B2	Trailside Oak	63-051-05-01		27	-7.0	7			0.0											0.0	
63	10	60	2004	9	O	6	8	3	B2	Syers Oak & Pine	63-023-05-01			-9.0				9.0											0.0	
63	10	95	2004	21	O	9	3	1	B2					-21.0				21.0											0.0	
63	10	117	2004	114	O	9	3	1	B2	Syers Oak & Pine	63-023-05-01			-114.0				114.0											0.0	
63	10	165	2004	39	J	8	1	1	B2	Syers Oak & Pine	63-023-05-01			-39.0				39.0											0.0	
63	12	15	2003	49	O	9	1	1	B2	Twelve Oaks	63-050-05-01		40	-9.0	9			0.0											0.0	
63	12	90	2003	37	J	6	1	1	B2	Three Oak Jack	63-046-05-01			-37.0				37.0											0.0	
63	12	92	2003	23	O	6	1	1	B2	Three Oak Jack	63-046-05-01			-23.0				23.0											0.0	
63	13	23	1999	10	J	6	1	1	C	C13 Jack Pine	63-015-05-01		11	1.0	-1			0.0											0.0	
63	13	28	1999	57	J	6	1	1	C	C13 Jack Pine	63-015-05-01		49	-8.0	8			0.0											0.0	
63	13	40	1999	18	J	6	1	1	C	C13 Jack Pine	63-015-05-01		24	6.0	-6			0.0											0.0	

8. Throughout the year, additional stands may be added to this list due to disturbances such as wind storms and insect damage. Also, stands thought to be factor limited (step 3, bullet 5a) may become available and will be added as well.

Example – landowner previously denied access to a stand, ownership changes and access is now available.

9. At the end of the fiscal year, this list of treatments (the Stand List of the monthly report) is reconciled. Stands that were not completed either by timber sale or factor limitations are carried over into the next year's POW as shown in step 3 above.

10. A year end disposition is prepared that shows how many acres were treated, as well as a breakdown of OI vs. timber sale acres.

11. Recently, the Michigan legislature has required two timber harvest-related annual reports:

> Public Acts of 2003 Act No.147 Approved by the Governor: August 7, 2003 Filed with the Secretary of State: August 8, 2003 EFFECTIVE DATE: August 8, 2003
>
> Sec. 801. Of the funds appropriated in part 1, the department shall prescribe appropriate treatment on 63,000 acres, plus or minus 10%, at the current average rate of 12.5 to 13 cords per acre provided that the department shall take into consideration the impact of timber harvesting on wildlife habitat and recreation uses. The department shall endeavor to increase marking or treatment of hardwood timber by 10% over 2003 levels. In addition, the department shall take into consideration silvicultural analysis and report annually to the legislature on plans and efforts to address factors limiting management of timber.

The appended three-page report "Plans and Efforts to Address Factors Limiting Management of Timber" addresses the report requirement of this legislation.

There is also language in statute to report acres and cords harvested from state forest land:

> Part 525, P.A. 451, 1994, as amended. Sec. 52506. By January 1 of each year, the department shall prepare and submit to the commission of natural resources, the standing committees of the senate and the house of representatives with primary jurisdiction over forestry issues, and the senate and house appropriations committees a report that details the following from the previous state fiscal year:
>
> (b) The number of acres of the state forest that were harvested and the number of cords of wood that were harvested from the state forest.

The "Michigan State Forest System Acres and Cords Cut Summary" addresses this requirement and is appended at the end of this paper.

Department of Natural Resources
Plans and Efforts to Address Factors Limiting Management of Timber

Prescribed and Planned Timber Harvest Treatments

Department of Natural Resources (Department) staff develop work plans each fiscal year to implement activities on the state forest system that have been approved through the resource assessment and inventory process. Work plans for commercial timber sales on the state forest system are developed by the Forest, Mineral, and Fire Management Division, based on the resources and time available to accomplish the work during the fiscal year. The fiscal year Plan of Work (POW) for timber sales details which forest stands will be prepared for sale. Sale preparation includes sale layout, volume and product estimation, value calculations and developing the sale prospectus and bid information.

In Fiscal Year 2003-2004, timber harvest treatment was approved for 69,110 acres on state forest lands. The POW for FY 2003-2004 was comprised of 62,088 acres, as shown in Table 1.

Table 1
Fiscal Year 2003-2004 Plan of Work

Description	Acres
Total approved prescribed harvest treatments	69,110
Acres not planned, no resources	3,795
Acres not planned, added during the year	3,227
Acres planned, resources available	**62,088**

Timber sales were prepared for 60,730 acres[16], or 98% of the acres scheduled on the POW in Fiscal Year 2003-2004.

Hardwood Timber Treatment

Year of Entry (YOE) 2003 included treatments or prescriptions for 33,304 hardwood[17] acres. YOE 2004 included treatments or prescriptions for 40,129 hardwood acres. This 20% increase over YOE 03 was much higher than the 10% increase targeted in statute.

Factors Limiting Management of Timber and Efforts to Address Factors

[16] These POW acres correlate to 55,074 acres on proposals for bid in the timber sale tracking system (Tsale). The difference (5,656 acres) is comprised of minor acreage adjustments (stand boundary changes—3 %), and other physical and biological factors that prohibited treatment (fens, swales, steep slopes, too wet, etc.—6 %).

[17] Hardwood cover types include aspen, birch, mixed northern hardwoods, oak, and lowland hardwood.

An accounting of factors that impact timber availability on state forest lands was begun with a Silvicultural Analysis (SA) project in 1999. This initial attempt was further refined by a peer review analysis of the project's methods, as well as a comparison of the SA projections to actual on-the-ground conditions.[18] The comparison found that, given the Department's silvicultural criteria and standards, the SA over-estimated timber availability on state forests.

The most common factors limiting timber management documented by the SA were as follows:

- The land was too wet
- Insufficient age or size diversity of the forest
- Potential old growth (biodiversity)
- Low stocking, diameter
- Regeneration concerns

Many forest stands have multiple limiting factors. Although there may be a primary barrier to commercially harvesting a forest stand, there will typically be multiple limiting factors to be resolved before a commercial harvest treatment may occur. Some limiting factors may be temporary, while others may be more permanent. For example, age and size diversity refers to maintaining a balanced range of forest types in all stages of growth. This provides a sustainable even flow of forest benefits, particularly timber and wildlife habitat, and a diversity of forest covers over time. A forest stand that is not cut in one ten-year cycle may be cut in the next ten-year cycle to maintain forest diversity.

The Department is taking several strategic steps to address factors limiting timber availability including:

- Development of Geographic Information Systems (GIS) layers that correspond to limiting factors. This data will improve analysis and help validate the nature, magnitude, and trends related to limiting factors.
- Development of habitat information (Kotar system) and timber growth and yield projection capabilities to refine timber availability analysis.
- Development of an old growth and biodiversity stewardship strategy that identifies biological and social values and compatible forest treatments.
- Establishment of an interdisciplinary Vegetative Management Team (VMT) to examine technical silvicultural issues in an ecosystem context.
- Creation, in 2005, of a broad-based, twenty-member interdisciplinary forest advisory group to advise the Department on statewide forestry issues and state forest system concerns.
- An annual review of road, bridge, and land survey projects. Priorities and costs will be identified to most effectively use resources.

[18] These findings are in the *Silvicultural Analysis Review Team Final Report*, Peer Review Committee, May 2003 and *Developing Sustainable Forestry in Michigan: Assessing Timber Availability from State Forest Land*, Larry Pedersen, August 2003.

In addition, the Department is working with Minnesota, Wisconsin, the Great Lakes Forestry Alliance, and the United States Department of Agriculture Forest Service on developing non-industrial private forest lands (family forest) forest certification methodologies. This is supplemental to Department efforts to increase active management and timber harvesting on family forests.

Finally, the Department is working toward third-party forest certification by January 1, 2006, for the 3.9 million acre state forest system. This effort is essential in order for primary wood producers in Michigan to have continued access to national and international markets. The investment the Department is making in forest certification will strengthen Michigan's forest products sector.

Michigan State Forest System Acres and Cords Cut Summary
FY 2004: October 1, 2003 to September 30, 2004
Required under Part 525, P.A. 451, 1994 MCL 324.52506 (b)

State Forest Management Unit	Payment Unit Value	Cords	Acres	Cords/acre
Baraga Management Unit 1104	$2,261,723	44,752	4,173	10.72
Crystal Falls Management Unit 1204	$1,920,939	60,303	3,419	17.64
Gwinn Management Unit 3204	$1,845,577	59,257	3,712	15.96
Escanaba Management Unit 3304	$818,607	24,757	2,020	12.25
Shingleton Management Unit 4104	$2,174,601	47,700	3,925	12.15
Newberry Management Unit 4204	$1,853,779	40,107	2,661	15.07
SSM Management Unit 4504	$1,791,176	56,370	4,543	12.41
Gaylord Management Unit 5204	$1,925,661	50,430	4,356	11.58
Pigeon River Country Management Unit 5304	$278,520	14,984	1,005	14.90
Atlanta Management Unit 5404	$1,124,920	28,012	2,369	11.83
Traverse City Management Unit 6104	$2,650,205	51,378	4,879	10.53
Cadillac Management Unit 6304	$2,761,993	65,850	4,513	14.59
Roscommon Management Unit 7104	$2,854,798	67,004	4,395	15.24
Grayling Management Unit 7204	$3,757,675	89,220	6,223	14.34
Gladwin Management Unit 7304	$913,469	21,458	1,327	16.17
Totals	**$28,933,643**	**721,579**	**53,522**	**13.48**

Appendix C: Past Michigan Timber Harvest Projections

In addition to the DNR's "Silvicultural Needs Analysis" three past projections of Michigan timber harvests are readily available. They are:

i. Michigan's Forest Resources (DNR-sponsored1983 Statewide Plan, hereafter referred to as the "1983 Plan")
ii. Michigan's Predicted Timber Yields, 1981-2010 (Forest Service Research Paper, hereafter referred to as "Predicted Yields")
iii. Michigan's Forests 1993: An Analysis (Forest Service, FIA with DNR, hereafter referred to as the "1993 Analysis")

The first two of these were written in the early 1980s. The 1983 Plan contains projections to 2000 while Predicted Yields, as the title suggests, has 2010 as the end of its projection. The 1993 Analysis has a thirty-year projection to 2023. Both the 1980 projections significantly exceed the rate of increase in timber removals that Michigan is experiencing this decade (and last). This is true for the state as a whole (across all ownerships) as well as for the 1983 Plan projections which split out State Forest ownership. The 2023 verdict is not in for the 1993 Analysis, but it was written following significant growth estimates associated with the 1993 FIA inventory cycle. It has a relatively optimistic "accelerated removals" option, but it also reflects some realism in mentioning other non-timber impacts upon forest management. In contrast to the other three projections, the more recent DNR Silvicultural Needs Analysis overestimated (State Forest) growth, but attempted to quantify availability factors on harvests.

The 1983 Michigan DNR-sponsored statewide forest resources plan titled, Michigan's Forest Resources: Direction for the Future, incorporates estimates of 1977 timber harvests and "targets" for the year 2000 (table 4, page 32). Estimates are provided for both softwood and hardwood, pulpwood and sawtimber, and then totaled. The totals are shown below both in their original million cubic feet units and converted to 1000 cords:

1983 Michigan Forest Plan
Estimated Total Harvests

	in million cubic feet:		rounded to 1000 cords:	
Source	Estimated 1977*	Projected 2000	Estimated 1977*	Projected 2000
National Forest	23.7	68.1	296	851
State Forest	34.9	103.3	436	1,291
Industrial Private	32.1	73.2	401	915
Nonindustrial Private	110.0	262.4	1,375	3,280
Totals	200.7	507.0	2,509	6,338

* a note with the table states later figures indicate that 214 million cubic feet were harvested but this amount could not be broken down by ownership.

The text for the estimates states "the percentage provided by each of the major landowners remains approximately constant, reflecting the goal of maintaining public lands as important suppliers of timber while upgrading nonindustrial private forests as sustained timber producers." However, the changes between the estimated 1977 removals and the projected 2000 targets are

greater on a percentage basis for the two public forest ownerships and the least for the industrial private forests:

Source	MI Plan 1977-2000 % Change in Harvests
Ntl Forest	287%
State Forest	296%
Industrial Private	228%
Nonindustrial Private	239%
Totals	253%

A contrast to current (1993 – 2003) estimates of timber removals reveals the 1983 harvest target was considerably higher than what occurred, especially for the National Forest ownership.

Source	MI Plan Projected 2000	1993 Rounded FIA * Removals	2003 Rounded FIA * Removals	Ratio of 2003 FIA Removals to MI Plan Projected 2000
National Forest	68.1	40	23	3.0
State Forest	103.3	55	61	1.7
Combined Private**	335.6	173	200	1.7
Other***		4	27	
Totals	507.0	272	311	1.6

**from FIA Mapmaker website http://ncrs2.fs.fed.us/4801/fiadb/*
*** FIA data no longer routinely reports a separate industrial private and nonindustrial private categories.*
**** "Other" is a category broken out in the 1993 and 2003 FIA estimates, but not in the 1983 Michigan Plan.*

In sum, the level of total harvests actually experienced close to the year 2000 were roughly three-fifths of the "target" set by the 1983 plan.

Despite the title, Michigan's Predicted Timber Yields, 1981-2010 (Jakes and Smith, USDA Forest Service, North Central Forest Experiment Station, Research Paper NC-243, 1983) focuses on a wood fiber production scenarios rather than an explicit prediction of timber yields. It notes two assumptions are essential to the study (page 1):

1) all commercial forest land is available for treatment and
2) markets exist for all species and products.

After noting these two assumptions, the text goes on to state,

> "The analysis does not consider possible economic, social, or political constraints on timber removals. Nor does it address increased utilization through improved technology, intensified management, or genetically improved stock. Harvest treatment opportunities

> and predicted yields are based on an area control model – assuming that it is desirable to have an even distribution of acreage by age class within each forest type by the end of one rotation."

Based on the above, under the heading of "Sustained Yield for Michigan," the study reports (page 11):

> "By the year 2010, Michigan's average annual growing stock removals will be nearly 580 million cubic feet. Although growing-stock harvest volume may be approaching sustainable yield, opportunities exist for further increasing the State's wood-fiber potential."

Subsequently, the authors note this estimate is the potential growing stock yield from more intensive management and that even higher estimates of sustainable yield -- between 710 and 1104 million cubic feet -- could be achieved if other non-growing stock trees (e.g. rough and rotten trees) are harvested.

The Predicted Yield's results rest upon questionable assumptions. The assumptions are either overly optimistic (all commercial forest land being available for treatment and markets existing for all species and products is said to be essential for the study) or dismissive of significant influences on timber harvests (e.g. economic, social, and political constraints). Given this, it is not surprising that its estimate for the year 2010 of 580 million cubic feet appears in line with the unrealized, overly optimistic projection for the year 2000 from the 1983 Plan.

Timber growth and volume do exist such that Michigan's average annual growing stock removals *could be* nearly 580 million cubic feet by 2010, but given that they are closer to 300 million cubic feet now, it is highly unlikely that they *will* be. Economic, social, and political constraints cannot simply be assumed away for actual harvests. Doubling the current State Forest timber removals by 2010 (a feat that could not begin to be accomplished in five years and would not be sustainable) would only add about 60 million cubic feet. Even accomplishing such a doubling with State Forest harvests would leave more than three times that amount (180 million cubic feet) to come from other sources to reach the 580 million cubic feet level.

Michigan's Forests 1993: An Analysis (USDA Forest Service, North Central Forest Experiment Station, Resource Bulletin NC-179, Schmidt, Spencer, and Bertsch, 1997) is the analysis of 1993 Forest Inventory and Analysis (FIA) data and its implications for Michigan's forests. It includes a section titled, "Michigan's Future Timber Resource: Projections Suggest a Great Future Timber Supply" (page 26).

Among the assumptions used in developing the projections are:

1) the availability of timberland for harvest will remain the same as it was in the recent past and
2) there will be no change in the economic, social or political structure."

Two thirty-year projections are developed out to the year 2023 – a consistent removals option and an accelerated removals option. Under both, growth continues to exceed removals, but the gap is closed somewhat under the accelerated removals option.

(million ft3)	1992	2023 consistent	2023 Accelerated
Growth	825	1,364	1,234
Removals	360	588	960

As indicated, although an "accelerated" scenario was developed, the 2023 "consistent projection is quite similar to the Predicted Yields estimate of 580 million cubic feet, except that the 1993 Analysis was projecting this level to be reached thirteen years later. The accelerated scenario's removals level of 960 million cubic feet is close to three times the 2003 FIA estimate.

Written a decade later than the 1983 Plan and Predicted Yields, the 1993 Analysis reflects the experiences of the 1980s and it is more realistic in its conclusions. It wisely notes that "Projections made for the first decade are more dependable than those for the last 2 decades because the **fast-changing economic, political, and market conditions tend to make long-range projections less reliable"** (page 28, bolding added). The concluding comment is:

> "The use of Michigan's forests, like the use of forests around the country, is coming under closer scrutiny from the public. Wildlife, recreation, esthetic beauty, clean water, biological diversity – commodity and non-commodity products of the forests – are important now, but will be increasingly important in the future. The mix of products we choose will significantly impact the way forest lands are managed in the years ahead, and will largely determine the future issues that will be debated by commodity and non-commodity users of the forest."

This comment acknowledges factors which are not dealt with in the Predicted Yields projection. At the same time, the factors cited are what make achieving the consistent scenario more likely and the accelerated removals levels less likely. Refining predictions of timber removals will depend upon further scrutiny of these factors and their potential influences on timber availability.

The analysis and estimates prepared for the MI DNR 9/16/05 State Forest Harvest Trends report indicate modest harvest increases could and may occur. However, based on the report, it does not appear likely that factors constraining harvests will decline sharply. Also, forest conditions (age class and basal area) reviewed in the Harvest Trends report do not lend themselves to a tripling of harvest levels over the next two decades making the achievement of the 1993 Analysis' 2023 "accelerated" scenario unlikely.

Statewide Forest Conditions and Trends

Five statewide Michigan forest inventories were conducted by the U.S. Forest Service during the last century, and data from a new sixth cycle is available in 2005. These inventories indicate that forest acreage has remained relatively stable since the 1950s. The only exception to this was a slight decrease between 1966 and 1980, followed by an expansion between 1980 and 1993 (Figure 6). Losses or conversions out of forestland between 1980 and 1993 were made up for by other lands being converted into forestland. The predominant land type converting into forestland was agricultural. In contrast to the stable forest acreage, total standing timber volumes have almost tripled since the middle of the last century, reflecting a maturing forest. The expanding volume also indicates that much more growth has been continuously added to the forest than what has been removed or died through natural causes. This is shown in Figure 1, where annual growth has steadily increased over the past 50 years. In contrast, the 2003 estimate for removals appears to be reversing what had been an upward trend and is less than what it was in 1993. This situation will be further examined and clarified through an upcoming analysis of the most current sixth cycle inventory in conjunction with a survey (the 2004 timber product output) of all Michigan wood-using mills.

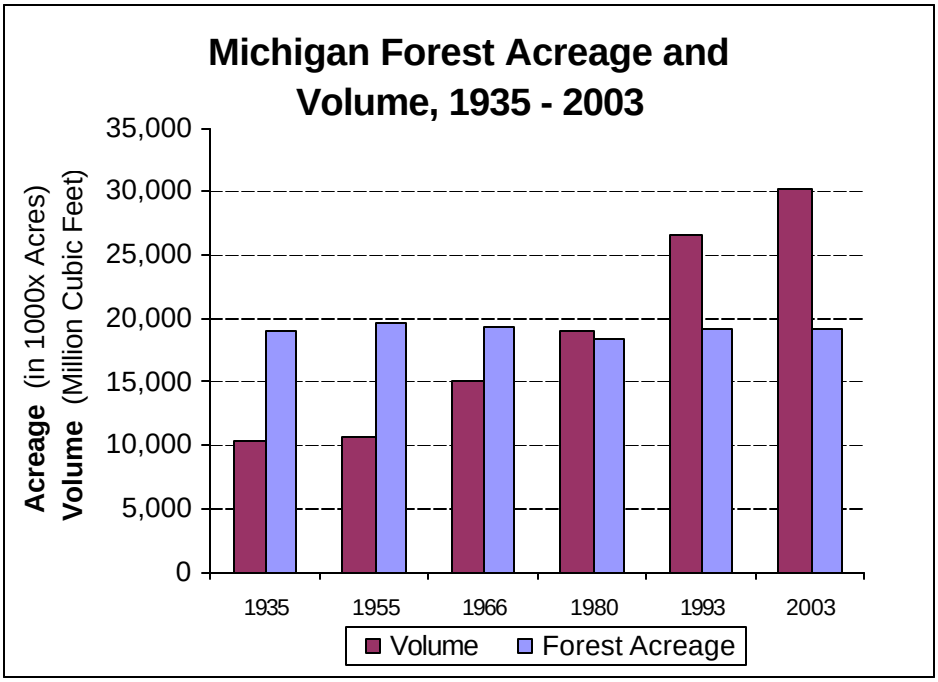


Figure 1: Michigan Forest Acreage and Volume 1935 – 2003

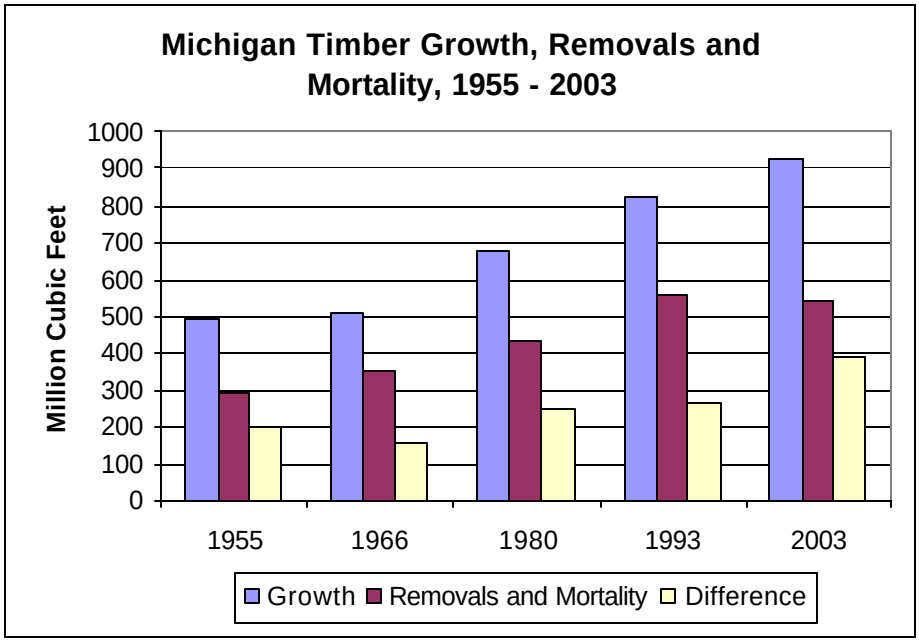


Figure 2: Michigan Timber Growth and Removals 1955 – 2003

Michigan's surplus growing stock (annual net growth less harvests and mortality) is among the largest in the nation (if not the largest), with forests currently growing 1.5 times more wood than is being harvested each year (Figure 2). The majority of annual net growth occurred in the hard and soft maple, white and red pine, and cottonwood and aspen communities.

The FIA sampling methodology is established to inventory and analyze forest information at the statewide level and, in general, is the only source for this type of information. Michigan FIA data includes a "state" ownership category. While estimates at the State level have narrow confidence intervals, substate estimate have larger confidence intervals. In addition, whereas the FIA system is based on statistical estimates, the State Forest system has an inventory system based on 100% coverage. Each system has similar and uniquely different attributes. Can the FIA data be used to leverage the information from the DNR inventory data?

FIA Estimates and DNR Inventory Data

The table below shows the large absolute and percentage differences between many of the Forest Service's FIA estimates and the Michigan DNR's operations inventory (OI). Blanks indicate there is not a comparable FIA type category to the OI category.

This comparison points to the possible complications with using FIA data to extrapolate State Forest harvest levels. While the total acreage is close on a percentage basis, only the white pine acres are within 20% of each other. The coding of lowland types is often quite difficult and it is not surprising discrepancies are found with them, including black spruce and cedar. However, it will be important to address the large discrepancies between the two inventory systems in upcoming work to prepare an FIA sixth cycle analysis report. Types of special concern include

the upland hardwoods (with its 350,000+ acre difference), oak, aspen, paper birch (because of FIA showing almost triple the acres in OI) and jack pine. Note that FIA shows the reverse jack pine and red pine acreages as are found in OI.

Contrast of DNR OI Data to 2003 FIA Data	1997 OI	2006 OI	2003 FIA MI State Ownership		Absolute Difference	% Difference
Aspen	909,964	884,822	737,197		-147,625	-20%
Black Spruce	68,145	68,636	161,795		93,159	58%
Bog or Marsh	43,267	35,163				
Cedar	206,954	228,397	390,242		161,845	41%
Grass	151,514	125,288				
Hemlock	14,810	17,479				
Jack Pine	375,220	367,034	276,848		-90,186	-33%
Local Name	16,611	6,544				
Lowlnd Brush	193,822	197,448				
Lowlnd Poplr	60,641	71,655				
Marsh	113,866	113,355				
Mx Swmp Cnfr	263,205	261,183				
Non Stocked	32,665	22,791				
Oak	246,966	243,691	398,322		154,631	39%
Paper Birch	47,395	35,462	90,189		54,727	61%
Red Pine	263,945	279,973	357,272		77,299	22%
Rock	1,218	1,065				
Sand Dune	795	1,106				
Spruce Fir	51,718	51,504				
Swamp Hrdwds	121,442	135,912	199,265		63,353	32%
Tamarack	20,732	22,256				
Treed Bog	60,430	62,692				
Upland Brush	46,657	53,008				
Upland Hdwds	**503,371**	**508,302**	**860,588**		352,286	41%
Water	43,980	47,751				
White Pine	77,428	93,568	94,623		1,055	1%
SUMS	3,936,761	3,936,085	4,055,401		119,316	3%

FIA age class data is aggregated by 20 years. DNR data was similarly aggregated for those forest types where there is some consistency in coding across the two inventories. As can be seen, there are also substantial differences by age class between the two inventories. In particular, where one inventory has much higher percentages in young age classes while the other has much more in older age classes. This can be seen for half or more of the types, including birch, black spruce, jack pine, lowland hardwoods, cedar, oak and red pine.

Forest Type	Source	0-20 years	21-40 years	41-60 years	61-80 years	81-100 years	>100 years
Aspen	FIA	30%	23%	34%	11%	0%	1%
	DNR	32%	40%	13%	10%	5%	0%
Birch	FIA	6%	25%	35%	30%	2%	3%
	DNR	7%	3%	5%	41%	38%	5%
Black spruce	FIA	5.3%	39.2%	30.1%	19.3%	6.1%	0.0%
	DNR	3%	3%	7%	36%	36%	15%
Eastern white pine	FIA	4.3%	5.1%	32.4%	45.8%	12.5%	0.0%
	DNR	5%	8%	28%	21%	25%	12%
Jack pine	FIA	2.2%	4.8%	13.1%	38.7%	30.6%	10.5%
	DNR	35%	23%	17%	20%	4%	0%
Lowland hardwoods	FIA	43.1%	56.9%	0.0%	0.0%	0.0%	0.0%
	DNR	6%	8%	9%	38%	33%	7%
Northern hardwoods	FIA	5.8%	6.9%	26.5%	43.9%	13.9%	3.0%
	DNR	9%	10%	10%	36%	32%	2%
Northern white-cedar	FIA	6.0%	10.4%	42.7%	27.8%	9.1%	4.1%
	DNR	0%	0%	1%	12%	36%	50%
Oak	FIA	0.0%	73.7%	17.3%	0.0%	9.0%	0.0%
	DNR	12%	8%	3%	29%	45%	4%
Red pine	FIA	24.4%	37.1%	14.9%	23.7%	0.0%	0.0%
	DNR	8%	6%	39%	31%	12%	3%
Total	FIA	25.8%	31.9%	23.3%	6.1%	9.4%	3.4%
	DNR	19%	19%	13%	21%	19%	8%

FIA Estimates and State Forest Land

The following table shows growth, removals and mortality as estimated by the most recent FIA inventory data. Note that this is for all State owned forested land, not just the State Forest system. This data indicates a growth to mortality plus removals ratio of 1.5; the State is growing about 50% more wood then is being harvested or that is dying.

Growth, mortality and removals by forest type on DNR Forest Land (in cubic feet from 2003 data).

Michigan State Forest Timber Harvest Trends

Forest Type	State Growth	State Mortality	State Removals	Total Mortality & Removals	Growth to Total Mort & Remvl Ratio	Growth to Mortality Ratio	Growth to Removal Ratio	Mortality to Removal Ratio
Aspen	35,263,662	13,255,237	6,888,334	20,143,571	1.8	2.7	5.1	1.9
Balsam fir	1,109,695	464,282	1,807,010	2,271,292	0.5	2.4	0.6	0.3
Balsam poplar	2,972,021	134,548		134,548	22.1	22.1		
Birch	901,710	136,841		136,841	6.6	6.6		
Black spruce	6,748,311	1,370,791	288,190	1,658,981	4.1	4.9	23.4	4.8
Cottonwood / Willow	1,094,569							
Eastern white pine	3,024,009	298,372	2,520,544	2,818,916	1.1	10.1	1.2	0.1
Jack pine	7,855,067	1,737,656	6,209,000	7,946,656	1.0	4.5	1.3	0.3
Lowland hardwoods	3,881,930	5,565,047	1,237,743	6,802,790	0.6	0.7	3.1	4.5
Non stocked	1,459,919	584,980	5,040,497	5,625,477	0.3	2.5	0.3	0.1
Northern hardwoods	47,330,507	8,919,055	18,409,438	27,328,493	1.7	5.3	2.6	0.5
Northern white-cedar	8,835,188	6,088,584		6,088,584	1.5	1.5		
Oak	11,904,777	5,818,525	14,130,589	19,949,114	0.6	2.0	0.8	0.4
Other	6,933,560	1,490,077		1,490,077	4.7	4.7		
Other softwoods	655,748		167,161	167,161	3.9		3.9	0.0
Red pine	18,534,527	3,002,901	4,594,272	7,597,173	2.4	6.2	4.0	0.7
Tamarack	2,754,434	520,184		520,184	5.3	5.3		
White spruce	1,780,917							
Totals	163,040,552	49,387,081	61,292,779	110,679,860	1.5	3.3	2.7	0.8

Note: Sampling error estimate of most data is greater than 50%.

Appendix E: MI DNR Timber Production, fy 1989 - 2004

MICHIGAN DNR
TIMBER PRODUCTION
fiscal years 1989 - 2004

	ACRES				VOLUME(cds. unless noted)									REVENUE M $'s					
Fiscal	Rx'ed	Prp'ed	Sold	Hrv'ed	Rx'ed	Prp'ed	Sold*7	Prep'ed	Annual Bid Volume(Sell)*8				Hrv'ed	Timber Receipts*10			Annual "Sold" Value*11		
Year	*1	*2	*3	*4	*5	*6	Mbf+Cds	Cds./ac	Mbf	Mbf(cds.)	Cords	Total Cds	*9	Tot. $M's	$'s/cd.	$'s/ac.	Tot. $M's	$'s/cd.	$'s/ac.
1989	90,887	45,706	46,559	43,582	1,427,000	716,898	740,186	15.7	38,587	77,174	623,911	701,085	702,438	$8,600	$12.24	$197	$8,993	$12.15	$193
1990	75,559	48,777	41,691	46,286	1,247,000	802,781	673,055	16.5	60,209	120,418	536,546	656,964	764,604	$8,500	$11.12	$184	$8,829	$13.12	$212
1991	67,000	40,931	42,848	41,604	991,000	605,066	670,778	14.8	35,844	71,688	571,751	643,439	687,076	$9,200	$13.39	$221	$10,099	$15.06	$236
1992	73,376	49,077	49,569	41,259	1,093,000	732,538	756,644	14.9	35,718	71,436	584,492	655,928	671,489	$9,500	$14.15	$230	$11,741	$15.52	$237
1993	72,444	52,702	52,470	46,350	1,029,000	751,049	762,470	14.3	40,191	80,382	619,788	700,170	719,207	$9,900	$13.77	$214	$14,706	$19.29	$280
1994	71,994	52,537	48,124	46,211	1,044,000	763,549	708,170	14.5	36,390	72,780	592,305	665,085	653,413	$13,900	$21.27	$301	$19,087	$26.95	$397
1995	69,603	53,828	48,122	44,254	974,000	756,758	694,390	14.1	39,389	78,778	638,446	717,224	675,161	$16,500	$24.44	$373	$21,215	$30.55	$441
1996	73,017	59,521	53,112	43,493	1,022,000	810,799	731,203	13.6	45,607	91,214	617,316	708,530	692,494	$19,100	$27.58	$439	$20,091	$27.48	$378
1997	64,388	59,819	57,813	50,380	872,000	815,574	765,163	13.6	50,220	100,440	655,500	755,940	747,553	$21,500	$28.76	$427	$22,930	$29.97	$397
1998	61,585	58,521	58,612	54,667	819,000	772,670	809,440	13.2	57,099	114,198	626,657	740,855	802,360	$22,800	$28.42	$417	$25,846	$31.93	$441
1999	65,114	60,973	52,071	50,799	781,000	725,209	650,265	11.9	50,232	100,464	572,931	673,395	685,494	$20,600	$30.05	$406	$20,046	$30.83	$385
2000	66,413	49,763	58,241	56,385	899,416	647,442	741,278	13.0	55,019	110,038	625,599	735,637	777,065	$26,050	$33.52	$462	$26,174	$35.31	$449
2001	67,075	55,230	45,581	54,258	927,353	763,589	633,430	13.8	46,998	93,996	568,744	662,740	731,951	$24,530	$33.51	$452	$24,861	$39.25	$545
2002	62,666	55,189	57,656	57,800	800,897	705,338	758,194	12.8	50,789	101,578	654,057	755,635	724,931	$26,211	$36.16	$453	$28,815	$38.00	$500
2003	61,771	48,639	46,160	50,859	898,341	707,360	633,760	14.5	58,775	117,550	518,722	636,272	643,942	$23,240	$36.09	$457	$26,146	$41.26	$566
2004	62,088	55,192	48,924	48,251	916,149	814,394	715,700	14.8	57,786	115,572	598,158	713,730	623,736	$30,602	$49.06	$634	$30,674	$42.86	$627

*1 Rx'ed Acs.: "Prescribed" acres transcribed from graphs through 1998. Estimates from 1999 onward based upon acres to be treated in fiscal year plan of work.
*2 Prpe'd Acs.: from 4/30/97 graphs. Derived from Timber Sale program. Estimates based upon timber sale proposal date with 10/1 the fiscal year cutoff date.
*3 Sold Acs.: from the t-sale program; only original sale volumes and values are shown (reassignments are not). Based on contract issue dates.
*4 Hrv'ed Acs.: from 4/30/97 graphs. "Harvested" acres and volumes are actually based upon sales completed in any given year.
*5 Rx'ed Cds. from 4/30/97 graphs; volume from 2001 on is estimated based on prepared cords per acre (col. i) times Rx'ed acres (col. B) as volume is NOT prescribed.
*6 Prp'ed Cds.: from 4/30/97 graphs
*7 Sold Cds.: from "Timber Prepared For Sale" report; previously sales included reassignments; now only original sale volumes and values are shown.
*8 Annual Bid Volume(Sell): from "Avg. Stumpage Price Report." These differ from sold volumes due to reassignments & volume exclusions that fall outside of normal ranges
*9 Hrv'ed Cds: from 4/30/97 graphs. Estimates shown are not actually harvested volume, but volume of sales completed during a fiscal year.
*10 Total Timber Receipts: originally "Annual Harvest Receipts" from 4/30/97 graphs - not the same as harvested acres & volumes as they include down payments & penalties.
*11 Annual "Sold" Value: originally from "Timber Prepared For Sale" report; now from sales sold in the fiscal year.

Appendix F

Timber sales: 1986-2004 FMU Acres

Fiscal Year	BARAGA	CRYSTAL FALLS	GWINN	ESCANABA	SHINGLETON	NEWBERRY	S. STE MARIE	U.P. Sum
1986	1,096	2,986	2,890	3,619	5,825	539	2,574	21,515
1987	1,139	3,505	2,507	2,349	5,194	2,182	2,994	21,857
1988	1,525	5,305	5,736	3,111	4,869	2,743	3,719	28,996
1989	1,899	4,435	3,312	2,606	4,138	2,552	3,317	24,247
1990	2,863	3,349	4,348	2,624	3,643	2,744	3,338	24,898
1991	1,638	4,113	3,775	2,145	3,315	1,882	2,740	21,597
1992	2,824	4,359	3,820	2,236	5,447	2,342	4,034	27,053
1993	1,986	4,495	4,046	2,409	4,209	2,357	5,054	26,549
1994	1,394	3,148	3,750	2,667	4,817	1,450	3,634	22,853
1995	1,972	3,105	4,168	1,612	6,097	2,668	3,969	25,585
1996	2,589	3,387	3,412	3,161	6,623	2,444	3,791	27,403
1997	2,309	3,809	3,792	2,322	5,856	1,979	4,840	26,903
1998	2,101	3,040	5,867	1,497	8,449	3,567	5,206	31,725
1999	3,421	3,395	2,791	1,728	4,202	2,948	5,162	25,645
2000	3,494	3,162	3,138	2,258	5,861	3,459	5,050	28,421
2001	1,741	1,890	3,288	1,922	3,395	2,839	4,376	21,451
2002	4,157	3,971	4,329	2,504	2,363	2,868	6,396	28,590
2003	4,062	2,326	2,741	1,967	3,478	2,530	3,493	22,599
2004	2,418	2,816	2,421	1,292	3,759	4,095	3,969	22,774
average	2,349	3,505	3,691	2,317	4,818	2,536	4,087	25,298
05 Trend	3,449	2,725	3,392	1,655	4,369	3,398	5,195	26,188

Fiscal Year	GAYLORD	PIGEON RIVER	ATLANTA	TRAVERSE CITY	CADILLAC	ROSCOM-MON	GRAYLING	GLADWIN	N.L.P. Sum	State Sum:
1986	3,037	1,143	3,048	2,507	3,547	3,630	5,942	2,860	3,037	1,143
1987	3,757	2,159	2,876	3,371	1,870	2,479	4,680	2,668	3,757	2,159
1988	4,847	1,508	2,729	4,067	3,124	4,940	4,456	4,432	4,847	1,508
1989	3,483	1,219	3,060	2,975	2,037	3,133	4,270	4,123	3,483	1,219
1990	3,046	1,473	2,997	1,652	1,731	2,332	3,307	2,246	3,046	1,473
1991	3,519	718	2,324	3,403	2,775	2,770	3,872	3,863	3,519	718
1992	3,812	1,914	2,722	2,917	2,764	3,170	2,115	5,094	3,812	1,914
1993	4,628	1,275	3,171	3,087	3,381	5,792	3,550	3,031	4,628	1,275
1994	3,571	1,697	2,132	3,869	4,088	5,955	3,814	2,139	3,571	1,697
1995	3,169	1,335	2,053	2,515	4,251	2,316	5,927	2,890	3,169	1,335
1996	4,742	800	2,396	4,341	3,419	3,154	4,397	4,457	4,742	800
1997	5,969	1,648	2,462	6,430	3,937	4,089	4,105	4,326	5,969	1,648
1998	4,800	883	2,438	4,663	3,757	4,593	3,893	3,800	4,800	883
1999	4,699	662	2,487	5,131	4,646	4,225	4,016	2,526	4,699	662
2000	4,237	1,032	2,555	5,358	5,402	4,631	5,740	2,866	4,237	1,032
2001	4,612	646	2,898	3,362	5,759	2,357	3,798	2,717	4,612	646
2002	4,848	724	2,407	4,872	5,030	4,980	5,789	2,450	4,848	724
2003	4,180	883	1,813	5,029	3,292	3,987	4,578	1,818	4,180	883
2004	3,498	693	3,343	4,891	3,225	3,125	5,985	3,394	3,498	693
average	4,129	1,179	2,627	3,918	3,581	3,771	4,433	3,247	4,129	1,179
05 Trend	4,687	673	2,405	5,330	4,869	4,096	4,887	2,799	4,687	673

Timber sales: 1986-2004 FMU Volume

Fiscal Year	BARAGA	CRYSTAL FALLS	GWINN	ESCANABA	SHINGLETON	NEWBERRY	S. STE MARIE	U.P. Sum
1986	9,169	47,297	53,037	44,365	58,266	7,585	31,181	250,900
1987	11,968	52,407	55,546	37,963	64,899	35,045	45,753	303,581
1988	12,686	98,867	116,403	54,266	55,356	45,287	51,731	434,596
1989	23,492	77,191	60,013	45,066	46,513	36,301	50,305	338,882
1990	28,152	67,152	83,415	43,520	44,618	42,508	47,441	356,806
1991	19,001	66,882	73,492	34,788	40,110	21,878	54,864	311,015
1992	35,756	77,415	67,857	38,004	72,688	33,477	71,676	396,872
1993	24,784	78,145	62,247	27,136	58,534	35,613	57,888	344,348
1994	16,476	62,249	67,022	37,880	63,782	20,968	55,357	323,735
1995	20,118	59,136	67,892	23,660	76,631	45,094	61,321	353,852
1996	26,863	61,018	53,273	39,810	68,295	38,859	53,329	341,447
1997	19,493	64,225	56,303	35,197	74,145	30,677	68,006	348,046
1998	15,276	52,961	84,954	21,139	102,773	50,491	80,936	408,529
1999	32,893	45,605	46,034	24,995	39,407	35,719	50,928	275,579
2000	21,296	46,968	44,798	28,054	55,320	42,451	66,023	304,910
2001	24,667	31,726	51,155	28,800	41,706	38,426	61,091	277,570
2002	46,545	63,448	54,616	30,899	28,528	39,376	96,862	360,274
2003	44,054	41,903	42,373	26,166	38,493	37,896	45,972	276,856
2004	22,541	51,160	39,181	18,107	50,899	61,200	48,811	291,898
average	23,960	60,303	62,085	33,674	56,893	36,782	57,867	331,563
05 Trend	34,148	45,242	44,663	20,676	51,322	47,148	69,520	312,719

Fiscal Year	GAYLORD	PIGEON RIVER	ATLANTA	TRAVERSE CITY	CADILLAC	ROSCOM-MON	GRAYLING	GLADWIN	N.L.P. Sum	State Sum:
1986	22,518	16,869	44,913	36,427	70,694	70,528	82,999	45,146	390,094	640,995
1987	31,238	34,213	50,684	37,778	41,483	48,115	75,677	48,135	367,323	670,905
1988	61,962	26,250	60,591	61,943	81,091	91,853	72,100	88,738	544,529	979,125
1989	41,414	17,889	57,656	43,456	48,902	60,579	65,472	65,902	401,270	740,151
1990	36,686	20,577	56,914	27,988	37,910	42,063	49,918	44,311	316,367	673,173
1991	53,745	11,357	38,247	45,026	50,371	42,329	53,523	65,440	360,038	671,053
1992	47,661	25,715	46,302	32,559	48,220	48,487	26,716	85,536	361,197	758,069
1993	62,139	17,664	60,436	38,908	57,507	94,504	46,834	50,707	428,700	773,048
1994	37,154	23,629	30,625	46,534	67,117	90,388	48,906	32,104	376,455	700,190
1995	35,668	16,244	29,678	27,682	70,430	35,032	72,876	50,170	337,780	691,632
1996	65,175	8,000	26,319	51,561	60,501	55,170	51,999	68,019	386,745	728,192
1997	65,023	19,016	19,511	78,044	65,975	56,462	50,884	59,435	414,351	762,397
1998	67,533	14,020	28,292	49,761	69,756	71,512	41,868	52,669	395,411	803,940
1999	62,806	8,658	34,998	40,299	66,784	75,163	49,577	36,791	375,077	650,656
2000	46,807	16,158	21,030	74,045	85,761	69,944	74,426	44,555	432,727	737,637
2001	55,998	11,721	32,679	42,196	83,179	41,726	42,218	43,033	352,750	630,320
2002	59,168	9,741	22,257	57,709	75,538	62,676	77,102	33,558	397,748	758,022
2003	46,663	13,301	21,370	59,737	49,533	70,934	71,386	27,403	360,326	637,181
2004	46,526	11,282	41,943	52,147	53,392	76,552	83,394	56,595	421,832	713,730
average	49,783	16,963	38,129	47,568	62,323	63,369	59,888	52,539	390,564	722,127
05 Trend	60,093	9,050	20,373	58,555	70,311	65,965	60,382	39,471	384,200	696,920

Appendix G: Timber Sales: 1994-2004 Major Cover Type Acres, WUP, EUP, NLP, SF

MI DNR Data on State Forest sales by cover type go back to 1994. Approximate[19] timber sales for major cover types are listed below; if a type is not listed, that indicates few if any sales occurred in several fiscal years for that type. The "05 trend" indicates what the level of sales would be in 2005 if it matched the trend from the previous eleven years. Thus, if 2005 total sales for the Western UP FMUs were exactly equal to their trend for the past eleven years, 10,051 acres would be sold, virtually equivalent to their average for the past eleven years. If the FMUs followed the sale trend for aspen over the past eleven years, sales would decline to 1899 acres. Contrasting the 05 trend to the average indicates if sales are trending up or down; however a few "outlier" years may make the trend misleading.

Western UP Timber Sales, 1994 – 2004 (Baraga, Crystal Falls, and Gwinn FMUs)

Fiscal Year	Sum	Aspen	Paper Birch	Spruce Fir	Jack Pine	Upland Hdwds	Oak	Red Pine	Black Spruce	White Pine
1994	9,342	3,090	476	427	618	3,615	206	216	13	141
1995	9,705	2,837	392	388	669	4,334	45	262	0	206
1996	10,407	2,577	897	330	783	4,526	149	512	13	257
1997	10,679	2,145	252	681	717	5,693	172	362	4	142
1998	10,081	2,533	607	59	615	5,327	161	337	6	0
1999	10,942	2,358	357	340	419	6,321	76	487	8	232
2000	8,746	1,633	287	381	576	5,085	0	664	48	2
2001	10,113	2,394	340	433	108	5,895	40	717	4	10
2002	10,835	2,340	441	435	798	5,996	105	219	10	150
2003	8,817	1,587	401	491	329	5,202	80	492	16	114
2004	10,439	2,583	221	316	637	6,227	165	185	15	10
Average:	10,010	2,370	425	389	570	5,293	109	405	12	115
05 Trend:	10,051	1,899	275	389	435	6,444	75	455	18	27

Eastern UP Timber Sales, 1994 - 2004 (Escanaba, Shingleton, Newberry, and Sault Ste. Marie FMUs)

Fiscal Year	Sum	Aspen	Paper Birch	Cedar	Swmp Hrdwds	Spruce Fir	Jack Pine	Upland Hdwds	Oak	Lowlnd Poplr	Mx Swmp Cnfr	Red Pine	Black Spruce	Tamarack	White Pine
1994	16,964	2,911	508	65	99	220	3,990	4,257	202	386	68	2,671	16,964	2,911	508
1995	14,860	2,927	836	240	56	136	2,007	4,108	1,029	339	326	1,982	14,860	2,927	836
1996	17,538	2,985	691	218	128	356	4,018	3,489	117	639	386	2,743	17,538	2,985	691
1997	17,929	2,045	486	97	70	242	3,457	6,387	212	772	252	2,617	17,929	2,045	486
1998	15,307	2,400	524	66	181	262	1,893	5,895	114	365	438	2,296	15,307	2,400	524
1999	18,729	2,948	424	33	139	287	1,709	6,995	59	409	293	3,720	18,729	2,948	424
2000	15,067	1,366	576	64	202	220	2,171	5,460	169	135	208	2,725	15,067	1,366	576
2001	14,912	2,207	357	195	153	615	1,836	3,513	120	1,968	378	1,655	14,912	2,207	357
2002	13,700	1,735	437	198	323	427	1,872	5,782	6	285	224	1,375	13,700	1,735	437
2003	13,615	1,836	214	47	148	129	2,082	4,643	168	255	417	2,394	13,615	1,836	214
2004	14,753	2,068	339	57	33	400	2,214	5,445	28	541	357	1,989	14,753	2,068	339
Average:	15,761	2,312	490	116	139	299	2,477	5,089	202	554	304	2,379	15,761	2,312	490
05 Trend:	13,916	1,600	255	79	183	397	1,496	5,567	-59	638	377	1,977	13,916	1,600	255

[19] A small percentage (approximately 2-3%) of sales each year do not have a cover type identified; therefore the numbers shown slightly underestimate the acres sold.

Michigan State Forest Timber Harvest Trends

No. Lower Timber Sales, 1994 - 2004

(Gaylord, Pigeon River, Atlanta, Traverse City, Cadillac, Roscommon, Grayling, and Gladwin FMUs)

Fiscal Year	Sum	Aspen	Paper Birch	Swamp Hrdwds	Spruce Fir	Jack Pine	Upland Hdwds	Oak	Lowlnd Poplr	Mx Swmp Cnfr	Red Pine	White Pine
1994	29,219	6,626	31	532	0	6,122	3,478	6,405	50	15	5,101	150
1995	27,784	6,835	129	427	0	4,852	3,228	7,133	327	60	4,108	166
1996	31,592	7,227	12	300	109	5,656	4,580	6,355	161	96	6,021	415
1997	31,329	7,166	54	471	10	5,791	3,021	5,348	120	25	8,005	405
1998	31,360	5,384	93	467	35	4,850	5,340	7,247	142	10	6,459	280
1999	31,960	5,933	76	425	72	6,421	5,910	6,250	152	31	4,768	223
2000	27,728	3,428	35	385	8	4,724	5,001	6,942	346	26	5,083	693
2001	32,013	4,348	7	841	81	7,073	4,586	6,848	113	5	6,529	639
2002	30,523	4,370	45	540	22	6,304	7,390	5,670	107	10	5,104	450
2003	26,218	4,968	42	300	41	5,450	4,297	5,778	76	33	4,326	439
2004	30,084	5,472	99	581	113	5,729	3,893	6,727	169	0	5,832	238
Average:	29,983	5,614	57	479	45	5,725	4,611	6,428	160	28	5,576	373
05 Trend:	29,579	4,011	53	540	76	5,987	5,570	6,255	139	3	5,437	510

Total State Forest, 1994 - 2004

Fiscal Year	Sum	Aspen	Paper Birch	Cedar	Swamp Hrdwds	Spruce Fir	Hem-lock	Jack Pine	Upland Hdwds	Oak	Lowlnd Poplr	Mxd Swmp Cnfr	Red Pine	Black Spruce	White Pine
1994	53,703	12,628	1,015	136	631	647	114	10,729	11,350	6,814	436	82	7,988	306	827
1995	51,064	12,600	1,357	314	550	524	77	7,529	11,670	8,207	686	398	6,352	109	692
1996	58,291	12,788	1,600	264	480	795	243	10,456	12,595	6,621	822	591	9,276	354	1,407
1997	58,387	11,356	793	117	544	933	136	9,964	15,101	5,732	932	288	10,984	288	1,219
1998	55,096	10,317	1,224	87	648	355	0	7,357	16,563	7,521	507	448	9,092	120	858
1999	59,054	11,239	857	47	564	699	20	8,549	19,225	6,385	624	354	8,975	158	1,360
2000	50,230	6,427	898	88	606	609	136	7,471	15,546	7,111	511	234	8,471	551	1,572
2001	54,917	8,948	704	201	994	1,128	127	9,017	13,994	7,008	2,083	419	8,900	191	1,203
2002	54,178	8,446	923	198	863	884	193	8,974	19,169	5,780	392	234	6,699	165	1,260
2003	48,650	8,391	657	47	448	661	106	7,861	14,142	6,025	335	520	7,211	312	956
2004	53,649	10,122	659	57	614	829	29	8,580	15,565	6,920	710	384	8,006	750	424
Average:	54,293	10,297	971	141	631	733	107	8,771	14,993	6,738	731	359	8,359	300	1,071
05 Trend:	52,434	7,510	584	60	713	862	89	7,918	17,581	6,271	784	412	7,869	448	1,031

Appendix H
Age Class Tables For Major Cover Types (BA for No. Hrdwd): 1988 vs. 2005
(see next page for absolute and percentage changes)

MI State Forest, 2005 Inventory

Cover Type	Total Acres	Not Coded	0-9 Yrs	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	Uneven Aged
Aspen	884,822	389	86,986	195,327	173,151	177,058	83,371	29,588	34,441	55,611	32,605	7,374	2,933	5,988
Black Spruce	68,636	45	1,505	471	1,194	1,107	1,794	2,821	7,869	16,097	16,838	6,717	9,571	2,607
Cedar	228,397	294	223	631	476	355	719	1,108	6,661	19,423	39,590	38,813	109,749	10,355
Grass	125,288	123,344	163	472	366	240	29	45	26	186	14	27	7	369
Jack Pine	367,034	991	57,244	69,834	44,226	37,526	29,499	32,942	39,301	34,873	14,008	1,809	564	4,217
Lowlnd Brush	197,448	185,078	13	454	493	628	562	537	1,961	1,300	2,439	1,189	1,969	825
Lowlnd Poplr	71,655	31	4,652	11,803	9,030	6,604	3,993	3,188	7,349	11,384	9,384	2,407	865	965
Mx Swmp Cnfr	261,183	1,133	1,204	2,193	2,743	3,346	3,243	4,480	18,912	51,771	65,449	35,398	53,542	17,769
Oak	243,691	580	13,707	13,143	10,454	7,060	3,505	2,517	13,260	54,765	76,248	27,419	9,708	11,325
Paper Birch	35,462	176	1,530	774	398	602	892	893	4,436	9,556	9,863	3,217	1,832	1,293
Red Pine	279,973	566	9,876	11,550	8,443	8,392	64,777	37,180	40,181	40,597	19,093	10,995	8,547	19,776
Spruce Fir	51,504	31	3,398	5,164	3,917	2,834	6,329	2,900	4,476	7,527	7,899	2,609	994	3,426
Swamp Hrdwds	135,912	385	1,888	3,781	2,677	5,107	2,979	6,105	13,012	25,366	24,943	9,124	6,720	33,825
Tamarack	22,256	76	203	270	706	1,197	1,183	1,205	2,747	3,151	2,777	2,455	5,730	556
Upland Hdwds	508,302	355	2,274	6,116	5,169	3,910	3,900	5,293	10,910	21,193	21,590	6,748	1,528	419,316
White Pine	93,568	106	1,545	2,014	2,481	3,444	13,390	6,306	6,499	8,552	10,696	7,427	8,783	22,325
MI State Forest 1988 Inventory														
Aspen	893,279	467	137,084	200,046	103,416	28,642	61,369	163,463	136,946	31,358	6,287	2,102	2,903	19,196
Black Spruce	69,082	173	511	1,160	2,898	1,345	5,161	9,455	17,994	10,940	7,773	3,593	4,808	3,271
Cedar	187,115	136	365	453	510	1,083	4,234	16,388	25,162	32,107	33,404	25,720	36,826	10,727
Grass	177,114	156,912	3,126	1,621	1,389	827	1,011	4,012	3,132	790	402	9	1,234	2,649
Jack Pine	401,705	3,137	42,112	47,438	36,627	28,970	54,831	89,246	66,902	15,469	2,111	498	471	13,893
Lowlnd Brush	201,154	171,774	461	148	320	1,215	2,032	2,362	2,877	2,856	2,294	1,286	11,950	1,579
Lowlnd Poplr	52,536	278	4,675	3,204	1,480	2,003	4,659	12,236	16,111	4,184	1,329	703	660	1,014
Mx Swmp Cnfr	260,426	538	1,743	3,112	2,288	3,399	17,340	37,011	64,778	37,430	31,854	12,346	23,934	24,653
Oak	243,010	10	11,350	9,985	3,380	2,736	10,741	44,802	88,866	38,542	9,667	3,062	417	19,452
Paper Birch	55,246	0	528	356	371	438	3,592	13,340	18,860	8,344	3,349	729	258	5,081
Red Pine	235,249	470	6,098	7,983	61,052	35,861	25,681	38,786	14,077	10,591	11,247	3,176	2,528	17,699
Spruce Fir	65,281	90	3,055	2,411	4,590	1,096	4,617	14,307	18,446	9,162	2,846	527	208	3,926
Swamp Hrdwds	107,890	214	2,431	3,136	1,561	1,953	6,388	18,065	27,053	10,768	4,285	2,265	2,473	27,298
Tamarack	16,540	205	218	124	312	543	1,503	1,904	2,824	2,520	2,400	1,526	1,948	513
Upland Hdwds	499,262	179	3,870	3,888	4,355	3,731	12,267	30,880	38,258	13,373	2,140	771	187	385,363
White Pine	55,703	0	419	1,142	8,477	2,291	2,960	3,486	6,012	7,528	6,754	3,076	1,752	11,806

Age Class Tables For Major Cover Types (BA for No. Hrdwd): 1988 vs. 2005 (cont'd.)

(See previous page for actual 1988 and 2005 inventory estimates)

Change in MI State Forest Acres, 1988 - 2005

Cover Type	Total Acres	Not Coded	0-9 Yrs	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100+	Uneven Aged
Aspen	-8,457	-78	-50,098	-4,719	69,735	148,416	22,002	-133,875	-102,505	24,253	26,318	5,272	30	-13,208
Black Spruce	-446	-128	994	-689	-1,704	-238	-3,367	-6,634	-10,125	5,157	9,065	3,124	4,763	-664
Cedar	41,282	158	-142	178	-34	-728	-3,515	-15,280	-18,501	-12,684	6,186	13,093	72,923	-372
Grass	-51,826	-33,568	-2,963	-1,149	-1,023	-587	-982	-3,967	-3,106	-604	-388	18	-1,227	-2,280
Jack Pine	-34,671	-2,146	15,132	22,396	7,599	8,556	-25,332	-56,304	-27,601	19,404	11,897	1,311	93	-9,676
Lowlnd Brush	-3,706	13,304	-448	306	173	-587	-1,470	-1,825	-916	-1,556	145	-97	-9,981	-754
Lowlnd Poplr	19,119	-247	-23	8,599	7,550	4,601	-666	-9,048	-8,762	7,200	8,055	1,704	205	-49
Mx Swmp Cnfr	757	595	-539	-919	455	-53	-14,097	-32,531	-45,866	14,341	33,595	23,052	29,608	-6,884
Oak	681	570	2,357	3,158	7,074	4,324	-7,236	-42,285	-75,606	16,223	66,581	24,357	9,291	-8,127
Paper Birch	-19,784	176	1,002	418	27	164	-2,700	-12,447	-14,424	1,212	6,514	2,488	1,574	-3,788
Red Pine	44,724	96	3,778	3,567	-52,609	-27,469	39,096	-1,606	26,104	30,006	7,846	7,819	6,019	2,077
Spruce Fir	-13,777	-59	343	2,753	-673	1,738	1,712	-11,407	-13,970	-1,635	5,053	2,082	786	-500
Swamp Hrdwds	28,022	171	-543	645	1,116	3,154	-3,409	-11,960	-14,041	14,598	20,658	6,859	4,247	6,527
Tamarack	5,716	-129	-15	146	394	654	-320	-699	-77	631	377	929	3,782	43
Upland Hdwds	9,040	176	-1,596	2,228	814	179	-8,367	-25,587	-27,348	7,820	19,450	5,977	1,341	33,953
White Pine	37,865	106	1,126	872	-5,996	1,153	10,430	2,820	487	1,024	3,942	4,351	7,031	10,519

% Change in MI State Forest Acres, 1988 - 2005

Aspen	-1%	-17%	-37%	-2%	67%	518%	36%	-82%	-75%	77%	419%	251%	1%	-69%
Black Spruce	-1%	-74%	195%	-59%	-59%	-18%	-65%	-70%	-56%	47%	117%	87%	99%	-20%
Cedar	22%	116%	-39%	39%	-7%	-67%	-83%	-93%	-74%	-40%	19%	51%	198%	-3%
Grass	-29%	-21%	-95%	-71%	-74%	-71%	-97%	-99%	-99%	-76%	-97%	200%	-99%	-86%
Jack Pine	-9%	-68%	36%	47%	21%	30%	-46%	-63%	-41%	125%	564%	263%	20%	-70%
Lowlnd Brush	-2%	8%	-97%	207%	54%	-48%	-72%	-77%	-32%	-54%	6%	-8%	-84%	-48%
Lowlnd Poplr	36%	-89%	0%	268%	510%	230%	-14%	-74%	-54%	172%	606%	242%	31%	-5%
Mx Swmp Cnfr	0%	111%	-31%	-30%	20%	-2%	-81%	-88%	-71%	38%	105%	187%	124%	-28%
Oak	0%	5,700%	21%	32%	209%	158%	-67%	-94%	-85%	42%	689%	795%	2228%	-42%
Paper Birch	-36%		190%	117%	7%	37%	-75%	-93%	-76%	15%	195%	341%	610%	-75%
Red Pine	19%	20%	62%	45%	-86%	-77%	152%	-4%	185%	283%	70%	246%	238%	12%
Spruce Fir	-21%	-66%	11%	114%	-15%	159%	37%	-80%	-76%	-18%	178%	395%	378%	-13%
Swamp Hrdwds	26%	80%	-22%	21%	71%	161%	-53%	-66%	-52%	136%	482%	303%	172%	24%
Tamarack	35%	-63%	-7%	118%	126%	120%	-21%	-37%	-3%	25%	16%	61%	194%	8%
Upland Hdwds	2%	98%	-41%	57%	19%	5%	-68%	-83%	-71%	58%	909%	775%	717%	9%
White Pine	68%		269%	76%	-71%	50%	352%	81%	8%	14%	58%	141%	401%	89%

Appendix I: Treatment Period Data: 1988 – 2006, WUP, EUP, NLP, SF *

WUP:

	When Acres Are Expected to be Next Treated							% of Total Acres Expected to Be Treated					
1979 – 1988 period	Sum	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive
Aspen	200,767	68,043	41,668	13,418	21,756	31,945	6,325	34%	21%	7%	11%	16%	3%
Black Spruce	19,611	1,877	3,861	4,428	1,668	1,268	4,948	10%	20%	23%	9%	6%	25%
Bog or Marsh	8,055						8,055						100%
Cedar	22,722	2,275	5,701	3,570	1,445	1,742	6,163	10%	25%	16%	6%	8%	27%
Grass	25,900	12,899	3,329	315	42	6	9,309	50%	13%	1%	0%	0%	36%
Hemlock	4,453	1,352	1,975	592	5	32	497	30%	44%	13%	0%	1%	11%
Jack Pine	30,623	9,141	8,867	5,161	2,387	1,860	852	30%	29%	17%	8%	6%	3%
Lowlnd Brush	40,006	337				10	39,659	1%				0%	99%
Lowlnd Poplr	4,057	1,504	1,049	319	220	27	695	37%	26%	8%	5%	1%	17%
Marsh	5,126	38					5,088	1%					99%
Mx Swmp Cnfr	85,384	7,724	21,214	23,802	13,134	3,801	13,667	9%	25%	28%	15%	4%	16%
Non Stocked	3,628	741	2				2,885	20%	0%				80%
Oak	4,467	611	2,321	854	84	23	416	14%	52%	19%	2%	1%	9%
Paper Birch	19,414	6,143	7,336	3,767	432	67	1,623	32%	38%	19%	2%	0%	8%
Red Pine	14,301	4,425	5,172	1,819	287	205	1,815	31%	36%	13%	2%	1%	13%
Spruce Fir	33,820	18,892	8,277	1,928	748	798	2,334	56%	24%	6%	2%	2%	7%
Swamp Hrdwds	12,008	1,809	2,272	1,824	926	758	3,643	15%	19%	15%	8%	6%	30%
Tamarack	3,561	1,045	272	300	667	514	479	29%	8%	8%	19%	14%	13%
Treed Bog	10,301		67	180			10,043		1%	2%			97%
Upland Hdwds	150,607	53,697	75,583	12,849	3,009	717	4,574	36%	50%	9%	2%	0%	3%
Water	5,877	6					5,871	0%					100%
White Pine	6,700	2,156	2,876	755	276	316	319	32%	43%	11%	4%	5%	5%
Totals	714,911	**195,248**	192,090	75,930	47,086	44,148	131,894	27%	27%	11%	7%	6%	18%

1997-2006 period	sum	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive
Aspen	209,614	14,730	33,613	25,042	35,689	52,179	8,492	7%	16%	12%	17%	25%	4%
Black Spruce	19,914	239	4,304	3,229	1,295	602	8,812	1%	22%	16%	7%	3%	44%
Bog or Marsh	5,997	21	0	0	0	0	5,976	0%	0%	0%	0%	0%	100%
Cedar	31,679	78	4,522	1,798	1,646	215	21,518	0%	14%	6%	5%	1%	68%
Grass	20,943	6,946	2,486	14	0	0	11,485	33%	12%	0%	0%	0%	55%
Hemlock	6,151	202	2,641	263	4	17	2,864	3%	43%	4%	0%	0%	47%
Jack Pine	28,012	4,001	4,852	1,964	2,998	6,558	998	14%	17%	7%	11%	23%	4%
Lowlnd Brush	37,358	4	10	0	0	9	37,246	0%	0%	0%	0%	0%	100%
Lowlnd Poplr	4,038	68	1,130	454	296	231	1,231	2%	28%	11%	7%	6%	30%
Marsh	5,070	291	21	0	0	0	4,758	6%	0%	0%	0%	0%	94%
Mx Swmp Cnfr	88,671	281	28,566	12,084	5,841	2,836	35,896	0%	32%	14%	7%	3%	40%
Non Stocked	2,081	16	0	0	0	0	2,056	1%	0%	0%	0%	0%	99%
Oak	6,342	750	3,033	1,020	142	186	751	12%	48%	16%	2%	3%	12%
Paper Birch	11,797	2,663	3,934	428	105	140	3,554	23%	33%	4%	1%	1%	30%
Red Pine	17,228	2,403	7,401	3,330	1,183	771	1,860	14%	43%	19%	7%	4%	11%
Spruce Fir	23,901	2,973	5,369	2,680	1,423	2,107	6,048	12%	22%	11%	6%	9%	25%
Swamp Hrdwds	13,948	54	3,057	1,487	674	385	7,213	0%	22%	11%	5%	3%	52%
Tamarack	3,101	33	66	124	113	100	2,179	1%	2%	4%	4%	3%	70%
Treed Bog	10,309	0	0	171	0	0	10,128	0%	0%	2%	0%	0%	98%
Upland Hdwds	153,903	34,623	75,132	26,041	4,289	388	12,810	22%	49%	17%	3%	0%	8%
Water	9,043	11	2	1	0	3	9,026	0%	0%	0%	0%	0%	100%
White Pine	9,099	566	3,542	1,538	734	349	1,951	6%	39%	17%	8%	4%	21%
Totals	720,541	**71,065**	183,779	81,668	56,443	67,081	198,960	10%	26%	11%	8%	9%	28%

* only the first five of 9 treatment periods are shown

EUP:

	When Acres Are Expected to be Next Treated								% of Total Acres Expected to Be Treated					
1979 – 1988 period	Sum	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive		This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive
Aspen	135,770	60,986	21,207	8,864	15,241	19,545	4,908		45%	16%	7%	11%	14%	4%
Black Spruce	40,813	4,908	7,893	8,707	7,819	3,584	4,971		12%	19%	21%	19%	9%	12%
Bog or Marsh	24,548	1,923	8	21	0	9	22,587		8%	0%	0%	0%	0%	92%
Cedar	101,894	11,328	25,196	15,506	10,094	7,091	25,874		11%	25%	15%	10%	7%	25%
Grass	62,730	30,766	8,290	2,721	704	269	19,977		49%	13%	4%	1%	0%	32%
Hemlock	7,335	3,662	1,471	1,092	217	70	585		50%	20%	15%	3%	1%	8%
Jack Pine	117,812	31,676	40,415	11,150	5,793	8,296	3,719		27%	34%	9%	5%	7%	3%
Lowlnd Brush	95,586	2,328	167	24	0	175	92,756		2%	0%	0%	0%	0%	97%
Lowhd Poplr	27,939	13,756	5,236	1,660	1,761	1,703	3,445		49%	19%	6%	6%	6%	12%
Marsh	62,613	1,363	0	0	0	0	61,250		2%	0%	0%	0%	0%	98%
Mx Swmp Cnfr	92,205	12,429	17,225	14,759	10,135	8,242	21,733		13%	19%	16%	11%	9%	24%
Oak	4,962	1,429	2,202	631	147	133	287		29%	44%	13%	3%	3%	6%
Paper Birch	27,615	10,505	11,045	2,559	1,310	376	1,547		38%	40%	9%	5%	1%	6%
Red Pine	68,689	27,118	21,600	9,892	5,072	1,372	2,393		39%	31%	14%	7%	2%	3%
Spruce Fir	22,013	11,413	3,357	1,442	1,787	1,828	1,017		52%	15%	7%	8%	8%	5%
Swamp Hrdwds	24,485	6,358	5,250	3,944	2,826	965	4,420		26%	21%	16%	12%	4%	18%
Tamarack	7,669	2,273	1,078	1,733	753	231	1,219		30%	14%	23%	10%	3%	16%
Treed Bog	45,348	265	0	25	580	0	44,092		1%	0%	0%	1%	0%	97%
Upland Brush	8,276	4,193	2,035	241	6	90	1,642		51%	25%	3%	0%	1%	20%
Upland Hdwds	143,809	59,655	55,823	19,485	4,019	711	2,474		41%	39%	14%	3%	0%	2%
Water	12,457	10	0	0	0	0	12,447		0%	0%	0%	0%	0%	100%
White Pine	24,464	7,937	7,463	4,495	1,879	923	1,281		32%	31%	18%	8%	4%	5%
SUM	1,163,974	306,432	237,025	108,951	70,170	55,747	339,060		26%	20%	9%	6%	5%	29%

1997-2006 period	sum	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive		This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive
Aspen	154,582	22,827	17,700	14,857	26,586	31,719	10,100		15%	11%	10%	17%	21%	7%
Black Spruce	41,055	4,352	10,960	8,939	3,596	1,172	8,566		11%	27%	22%	9%	3%	21%
Bog or Marsh	12,406	1,348	6	0	0	0	11,052		11%	0%	0%	0%	0%	89%
Cedar	129,170	1,545	25,379	21,872	11,788	7,688	55,169		1%	20%	17%	9%	6%	43%
Grass	44,198	13,722	7,055	947	675	774	20,607		31%	16%	2%	2%	2%	47%
Hemlock	9,741	1,063	3,347	1,320	698	129	2,705		11%	34%	14%	7%	1%	28%
Jack Pine	105,135	23,479	19,312	7,588	10,496	15,440	6,668		22%	18%	7%	10%	15%	6%
Lowlnd Brush	82,943	603	53	247	0	43	81,836		1%	0%	0%	0%	0%	99%
Lowlnd Poplr	26,328	6,353	4,026	2,366	1,950	4,055	2,949		24%	15%	9%	7%	15%	11%
Marsh	72,395	1,108	24	2	0	0	71,261		2%	0%	0%	0%	0%	98%
Mx Swmp Cnfr	78,560	3,718	14,869	11,002	6,213	3,382	32,908		5%	19%	14%	8%	4%	42%
Oak	7,667	710	2,660	1,209	310	317	2,153		9%	35%	16%	4%	4%	28%
Paper Birch	17,923	5,144	5,456	1,018	625	397	4,278		29%	30%	6%	3%	2%	24%
Red Pine	81,300	20,758	30,865	13,407	4,909	2,061	7,152		26%	38%	16%	6%	3%	9%
Spruce Fir	19,146	3,823	2,928	2,263	2,138	2,454	2,834		20%	15%	12%	11%	13%	15%
Swamp Hrdwds	29,022	1,858	6,679	5,184	1,477	768	11,707		6%	23%	18%	5%	3%	40%
Tamarack	11,809	1,428	2,799	768	437	811	4,521		12%	24%	7%	4%	7%	38%
Treed Bog	47,722	0	0	0	39	0	47,683		0%	0%	0%	0%	0%	100%
Upland Brush	6,802	1,840	1,234	255	74	136	3,163		27%	18%	4%	1%	2%	47%
Upland Hdwds	147,100	37,117	57,041	32,605	5,024	3,547	8,880		25%	39%	22%	3%	2%	6%
Water	16,091	413	11	0	0	0	15,667		3%	0%	0%	0%	0%	97%
White Pine	39,240	5,544	10,679	9,580	3,712	2,271	6,306		14%	27%	24%	9%	6%	16%
SUM	1,185,894	159,114	223,135	135,429	80,747	77,261	423,188		13%	19%	11%	7%	7%	36%

* only the first five of 9 treatment periods are shown

NLP:

	When Acres Are Expected to be Next Treated								% of Total Acres Expected to Be Treated					
1979 – 1988 period	Sum	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive		This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive
Aspen	556,742	117,474	91,417	48,661	85,350	126,353	51,099		21%	16%	9%	15%	23%	9%
Black Spruce	8,658	697	909	1,992	598	717	3,371		8%	10%	23%	7%	8%	39%
Bog or Marsh	16,442	159	94	0	0	6	16,177		1%	1%	0%	0%	0%	98%
Cedar	62,499	7,179	11,703	8,678	3,968	2,565	26,926		11%	19%	14%	6%	4%	43%
Grass	88,484	20,276	4,264	1,257	164	287	62,071		23%	5%	1%	0%	0%	70%
Hemlock	792	112	158	92	47	65	315		14%	20%	12%	6%	8%	40%
Jack Pine	253,270	69,710	64,534	29,501	22,750	26,744	23,464		28%	25%	12%	9%	11%	9%
Lowlnd Brush	65,562	912	482	139	252	143	63,163		1%	1%	0%	0%	0%	96%
Lowlnd Poplr	20,540	9,794	2,832	967	1,580	2,656	2,113		48%	14%	5%	8%	13%	10%
Marsh	25,546	270	78	6	8	145	25,033		1%	0%	0%	0%	1%	98%
Mx Swmp Cnfr	82,837	9,707	12,105	10,676	3,595	1,620	43,507		12%	15%	13%	4%	2%	53%
Non Stocked	23,172	634	79	68	0	0	22,386		3%	0%	0%	0%	0%	97%
Oak	233,581	31,750	88,006	42,866	16,787	12,539	32,892		14%	38%	18%	7%	5%	14%
Paper Birch	8,217	3,142	2,805	845	251	121	1,023		38%	34%	10%	3%	1%	12%
Red Pine	152,259	52,043	36,764	20,982	11,419	6,001	20,645		34%	24%	14%	7%	4%	14%
Spruce Fir	9,448	2,789	2,266	1,155	1,229	536	1,146		30%	24%	12%	13%	6%	12%
Swamp Hrdwds	71,397	13,709	20,702	10,630	5,225	3,784	13,681		19%	29%	15%	7%	5%	19%
Tamarack	5,310	173	395	1,732	444	734	1,569		3%	7%	33%	8%	14%	30%
Treed Bog	4,945	12	32	0	7	0	4,886		0%	1%	0%	0%	0%	99%
Upland Brush	33,834	5,382	1,688	1,162	731	169	24,363		16%	5%	3%	2%	0%	72%
Upland Hdwds	204,846	72,373	50,103	28,315	9,068	4,689	38,575		35%	24%	14%	4%	2%	19%
Water	17,839	75	289	0	0	0	17,475		0%	2%	0%	0%	0%	98%
White Pine	24,539	5,971	6,538	4,200	1,744	935	4,024		24%	27%	17%	7%	4%	16%
Sum	1,976,640	**424,493**	398,451	213,926	165,217	190,809	505,425		21%	20%	11%	8%	10%	26%

1997-2006 period	Sum	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive
Aspen	520,626	40,214	61,853	93,191	123,035	99,638	25,478	8%	12%	18%	24%	19%	5%
Black Spruce	7,667	150	821	1,167	606	382	4,221	2%	11%	15%	8%	5%	55%
Bog or Marsh	16,760	484	44	0	0	0	16,225	3%	0%	0%	0%	0%	97%
Cedar	67,548	635	7,973	9,451	3,085	1,259	44,050	1%	12%	14%	5%	2%	65%
Grass	60,147	15,067	2,321	1,709	300	33	40,621	25%	4%	3%	0%	0%	68%
Hemlock	1,587	55	238	130	8	118	1,008	3%	15%	8%	1%	7%	64%
Jack Pine	233,887	48,541	44,140	24,123	27,514	39,623	10,879	21%	19%	10%	12%	17%	5%
Lowlnd Brush	77,147	461	568	649	139	202	74,881	1%	1%	1%	0%	0%	97%
Lowlnd Poplr	41,289	4,065	4,688	4,515	5,676	5,381	10,857	10%	11%	11%	14%	13%	26%
Marsh	35,890	681	162	0	2	5	34,919	2%	0%	0%	0%	0%	97%
Mx Swmp Cnfr	93,952	1,293	11,358	10,424	2,388	2,021	64,212	1%	12%	11%	3%	2%	68%
Non Stocked	16,792	528	28	24	0	15	16,197	3%	0%	0%	0%	0%	96%
Oak	229,682	51,190	78,896	30,093	12,630	12,873	21,781	22%	34%	13%	5%	6%	9%
Paper Birch	5,742	1,087	1,540	613	506	65	1,646	19%	27%	11%	9%	1%	29%
Red Pine	181,445	44,761	73,908	30,373	11,641	6,381	10,504	25%	41%	17%	6%	4%	6%
Spruce Fir	8,457	722	1,991	1,719	560	479	2,464	9%	24%	20%	7%	6%	29%
Swamp Hrdwds	92,942	6,907	21,192	9,083	5,636	2,728	42,323	7%	23%	10%	6%	3%	46%
Tamarack	7,346	32	385	745	364	618	5,091	0%	5%	10%	5%	8%	69%
Treed Bog	4,661	72	0	59	15	12	4,503	2%	0%	1%	0%	0%	97%
Upland Brush	45,298	11,098	2,099	4,248	1,434	484	25,545	24%	5%	9%	3%	1%	56%
Upland Hdwds	207,299	48,418	79,917	44,602	7,710	3,447	19,783	23%	39%	22%	4%	2%	10%
Water	22,617	604	3	0	0	12	21,998	3%	0%	0%	0%	0%	97%
White Pine	45,229	3,982	14,157	9,298	3,747	1,953	8,346	9%	31%	21%	8%	4%	18%
Sum	2,029,650	**281,281**	408,434	276,257	207,000	177,729	512,735	14%	20%	14%	10%	9%	25%

* only the first five of 9 treatment periods are shown

Michigan State Forest Timber Harvest Trends
Treatment Period Data: 1988 – 2006 WUP, EUP, NLP, SF * (cont'd.): Total State Forest

		When Acres Are Expected to be Next Treated						% of Total Acres Expected to Be Treated					
1979 – 1988 period	Totals	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not prdctv
Aspen	893,279	246,503	154,292	70,943	122,347	177,843	62,332	28%	17%	8%	14%	20%	7%
Black Spruce	69,082	7,482	12,663	15,127	10,085	5,569	13,290	11%	18%	22%	15%	8%	19%
Bog or Marsh	49,045	2,082	102	21		15	46,819	4%	0%	0%	0%	0%	95%
Cedar	187,115	20,782	42,600	27,754	15,507	11,398	58,963	11%	23%	15%	8%	6%	32%
Grass	177,114	63,941	15,883	4,293	910	562	91,357	36%	9%	2%	1%	0%	52%
Hemlock	12,580	5,126	3,604	1,776	269	167	1,397	41%	29%	14%	2%	1%	11%
Jack Pine	401,705	110,527	113,816	45,812	30,930	36,900	28,035	28%	28%	11%	8%	9%	7%
Lowlnd Brush	201,154	3,577	649	163	252	328	195,578	2%	0%	0%	0%	0%	97%
Lowlnd Poplr	52,536	25,054	9,117	2,946	3,561	4,386	6,253	48%	17%	6%	7%	8%	12%
Marsh	93,285	1,671	78	6	8	145	91,371	2%	0%	0%	0%	0%	98%
Mx Swmp Cnfr	260,426	29,860	50,544	49,237	26,864	13,663	78,907	11%	19%	19%	10%	5%	30%
Non Stocked	30,499	1,484	81	68		37	28,808	5%	0%	0%	0%	0%	94%
Oak	243,010	33,790	92,529	44,351	17,018	12,695	33,595	14%	38%	18%	7%	5%	14%
Paper Birch	55,246	19,790	21,186	7,171	1,993	564	4,193	36%	38%	13%	4%	1%	8%
Red Pine	235,249	83,586	63,536	32,693	16,778	7,578	24,853	36%	27%	14%	7%	3%	11%
Spruce Fir	65,281	33,094	13,900	4,525	3,764	3,162	4,497	51%	21%	7%	6%	5%	7%
Swamp Hrdwds	107,890	21,876	28,224	16,398	8,977	5,507	21,744	20%	26%	15%	8%	5%	20%
Tamarack	16,540	3,491	1,745	3,765	1,864	1,479	3,267	21%	11%	23%	11%	9%	20%
Treed Bog	60,594	277	99	205	587		59,021	0%	0%	0%	1%	0%	97%
Upland Brush	43,351	10,042	3,971	1,452	737	259	26,482	23%	9%	3%	2%	1%	61%
Upland Hdwds	499,262	185,725	181,509	60,649	16,096	6,117	45,623	37%	36%	12%	3%	1%	9%
Water	36,173	91	289				35,793	0%	1%	0%	0%	0%	99%
White Pine	55,703	16,064	16,877	9,450	3,899	2,174	5,624	29%	30%	17%	7%	4%	10%
totals	3,855,525	**926,173**	827,566	398,807	282,473	290,704	976,379	24%	21%	10%	7%	8%	25%

		When Acres Are Expected to be Next Treated						% of Total Acres Expected to Be Treated					
1997-2006 period	Totals	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not productive	This decade	In 10-19 Yrs	In 20-29 Yrs	In 30-39 Yrs	In 40-49 Yrs	not schld or not prdctv
Aspen	884,822	77,771	113,166	133,090	185,310	183,536	44,070	9%	13%	15%	21%	21%	5%
Black Spruce	68,636	4,741	16,085	13,335	5,497	2,156	21,599	7%	23%	19%	8%	3%	31%
Bog or Marsh	35,163	1,853	50	0	0	0	33,253	5%	0%	0%	0%	0%	95%
Cedar	228,397	2,258	37,874	33,121	16,519	9,162	120,737	1%	17%	15%	7%	4%	53%
Grass	125,288	35,735	11,862	2,670	975	807	72,713	29%	9%	2%	1%	1%	58%
Hemlock	17,479	1,320	6,226	1,713	710	264	6,577	8%	36%	10%	4%	2%	38%
Jack Pine	367,034	76,021	68,304	33,675	41,008	61,621	18,545	21%	19%	9%	11%	17%	5%
Lowlnd Brush	197,448	1,068	631	896	139	254	193,963	1%	0%	0%	0%	0%	98%
Lowlnd Poplr	71,655	10,486	9,844	7,335	7,922	9,667	15,037	15%	14%	10%	11%	13%	21%
Marsh	113,355	2,080	207	2	2	5	110,938	2%	0%	0%	0%	0%	98%
Mx Swmp Cnfr	261,183	5,292	54,793	33,510	14,442	8,239	133,016	2%	21%	13%	6%	3%	51%
Non Stocked	22,791	590	38	24	0	19	22,111	3%	0%	0%	0%	0%	97%
Oak	243,691	52,650	84,589	32,322	13,082	13,376	24,685	22%	35%	13%	5%	5%	10%
Paper Birch	35,462	8,894	10,930	2,059	1,236	602	9,478	25%	31%	6%	3%	2%	27%
Red Pine	279,973	67,922	112,174	47,110	17,733	9,213	19,516	24%	40%	17%	6%	3%	7%
Spruce Fir	51,504	7,518	10,288	6,662	4,121	5,040	11,346	15%	20%	13%	8%	10%	22%
Swamp Hrdwds	135,912	8,819	30,928	15,754	7,787	3,881	61,243	6%	23%	12%	6%	3%	45%
Tamarack	22,256	1,493	3,250	1,637	914	1,529	11,791	7%	15%	7%	4%	7%	53%
Treed Bog	62,692	72	0	230	54	12	62,314	0%	0%	0%	0%	0%	99%
Upland Brush	53,008	13,050	3,373	4,503	1,519	625	29,440	25%	6%	8%	3%	1%	56%
Upland Hdwds	508,302	120,158	212,090	103,248	17,023	7,382	41,473	24%	42%	20%	3%	1%	8%
Water	47,751	1,028	16	1	0	15	46,691	2%	0%	0%	0%	0%	98%
White Pine	93,568	10,092	28,378	20,416	8,193	4,573	16,603	11%	30%	22%	9%	5%	18%
totals	3,936,085	**511,460**	815,348	493,354	344,190	322,071	1,134,883	13%	21%	13%	9%	8%	29%

* only the first five of 9 treatment periods are shown

Appendix J: Limiting Factor Data, 2002-06

The table below shows the number of acres coded with the top twenty-seven limiting factors for entry years 2002 through 2006. There are a total of 40 limiting factors. To arrive at approximate annual averages, divide by five. Multiply by 2 to extrapolate a decade total based upon the 2002 to 2006 period. Percentages shown are the proportion the acres coded with a limiting factor comprise of the total acres meeting silvicultural criteria. For example, fifteen percent of the acres which met silvicultural criteria had a limiting factor of "too wet" in the 2002 entry year; this number was fourteen percent in 2006. It should be noted that limiting factors largely are placed only on those acres meeting the silvicultural criteria (rotation ages and/or basal area) as defined in operations inventory. The silvicultural criteria are listed on the following page.

The first five years of limiting factor data is fairly consistent from one year to the next. This is noteworthy in light of the variability of data from one year of entry to the next. In the two most recent years this has changed slightly as coding of "Delayed treatment for age/size class diversity" and "Potential or Designated Old Growth" have decreased while "Inadequate volume due to low stocking/diameter" and "Deer Yards" have increased. Expectations with respect to the direction of these limiting factors are explained in detail in the body of the report under Evaluation of Limiting Factors.

Limiting Factors in Order of Prominence	2002		2003		2004		2005		2006		5-Year Sum
Too Wet	12,396	15%	12,098	14%	12,143	12%	12,452	15%	11,587	14%	60,676
Delayed treatment for age/size class diversity	11,576	14%	10,831	12%	12,985	13%	9,859	11%	7,552	9%	52,803
Potential or Designated Old Growth	5,847	7%	8,370	9%	13,038	13%	7,513	9%	5,817	7%	40,585
Inadequate volume due to low stocking/diameter	2,104	2%	1,602	2%	3,223	3%	1,761	2%	3,326	4%	12,016
Retention of stand for regeneration purposes	1,565	2%	2,148	2%	2,737	3%	2,245	3%	2,638	3%	11,333
Deer Yards	1,232	1%	3,017	3%	928	1%	1,348	2%	3,485	4%	10,010
Inferior quality	1,058	1%	2,058	2%	2,009	2%	1,476	2%	1,075	1%	7,676
Influence Zones	1,340	2%	1,572	2%	1,563	2%	1,295	2%	1,357	2%	7,127
Cedar/Hemlock Restraints	1,427	2%	1,142	1%	2,088	2%	1,667	2%	740	1%	7,064
Too Steep	1,403	2%	1,433	2%	1,264	1%	1,538	2%	1,031	1%	6,669
Blocked by Obstacle	1,628	2%	673	1%	1,292	1%	1,085	1%	766	1%	5,444
Scenic/Visual Values	812	1%	803	1%	1,104	1%	1,277	1%	1,170	1%	5,166
Water Quality/ BMPs	1,049	1%	939	1%	1,022	1%	717	1%	1,181	1%	4,908
Road Needed	2,032	2%	472	1%	997	1%	552	1%	592	1%	4,645
Other Special Wildlife Habitat	747	1%	260	0%	317	0%	2,065	2%	576	1%	3,965
Denied Access	885	1%	613	1%	1,075	1%	667	1%	508	1%	3,748
T&E Species Concerns	867	1%	1,502	2%	604	1%	262	0%	83	0%	3,318
Delayed - exceptional site quality or growth	171	0%	1,111	1%	521	1%	829	1%	604	1%	3,236
Regeneration technology inadequate	1,251	1%	485	1%	633	1%	306	0%	395	0%	3,070
Land Survey Needed	1,082	1%	742	1%	858	1%	26	0%	32	0%	2,740
Inadequate volume due to small acreage	533	1%	402	0%	504	0%	504	1%	710	1%	2,653
No market for species or product	294	0%	623	1%	787	1%	282	0%	322	0%	2,308
Military lease/easement/ long term agreement	290	0%	860	1%	74	0%	140	0%	469	1%	1,833
Recreational Site	310	0%	105	0%	671	1%	98	0%	506	1%	1,690
Bridge Needed	465	1%	401	0%	182	0%	137	0%	340	0%	1,525
Other Dep/Div Policy/Procedure	470	1%	527	1%	253	0%	82	0%	168	0%	1,500
Quiet Area/Natural Area/ Wilderness	180	0%	145	0%	8	0%	1,017	1%	134	0%	1,484

Michigan State Forest Timber Harvest Trends

Silvicultural Criteria

Cover Type	Description	Short Description	Rotational Age Criteria	Basal Area Criteria
A	ASPEN (UPLAND)	Aspen	50	
B	PAPER BIRCH	Paper Birch	50	
C	CEDAR	Cedar	150	
D	TREED BOG	Treed Bog		
E	SWAMP HARDWOODS	Swamp Hrdwds	80	
F	SPRUCE-FIR (UPLANDS-INCLUDING UPLAND BLACK SPRUCE)	Spruce Fir	54	
G	GRASS	Grass		
H	HEMLOCK	Hemlock	150	
I	LOCAL USE	Local Name	50	
J	JACK PINE	Jack Pine	60	
K	ROCK	Rock		
L	LOWLAND BRUSH	Lowlnd Brush		
M	NORTHERN HARDWOOD	Upland Hdwds		120
N	MARSH	Marsh		
O	OAK	Oak	80	
P	BALSAM POPLAR & SWAMP ASPEN and SWAMP WHITE BIRCH	Lowlnd Poplr	50	
Q	MIXED SWAMP CONIFER	Mx Swmp Cnfr	80	
R	RED PINE	Red Pine	80	180
S	BLACK SPRUCE-SWAMP	Black Spruce	80	
T	TAMARACK	Tamarack	60	
U	UPLAND BRUSH	Upland Brush		
V	BOG OR MUSKEG	Bog or Marsh		
W	WHITE PINE	White Pine	100	180
X	OTHER NON-STOCKED OR NON-FOREST OR NON-PRODUCTIVE	Non Stocked		
Y	SAND DUNES	Sand Dune		
Z	WATER	Water		

Appendix K: Potential Old Growth Designations by FMU

State Forest Potential Old Growth Acres, *through frozen '06 OI-8/05*

Acres Designated in OI db by Entry Year:

Forest Management Unit	Total Acres	2000	2001	2002	2003	2004	2005	2006	'06 POG % of Total Acres	Total Acres
BARAGA	140,496	1,829	4,229	5,454	6,209	6,730	6,645	6,511	4.6%	143,052
CRYSTAL FALLS	297,374	726	1,680	2,183	2,452	2,480	2,551	2,505	0.9%	294,284
GWINN	285,571	56,044	55,771	56,265	58,302	60,940	62,203	64,877	22.9%	283,213
ESCANABA	141,883	29,233	29,503	28,207	27,500	26,006	24,863	25,221	17.7%	142,178
SHINGLETON	375,767	7,139	12,384	13,331	16,934	22,858	28,431	36,458	9.7%	376,435
NEWBERRY	351,928	982	2,428	10,521	24,043	33,343	44,108	46,914	13.5%	346,446
SAULT STE. MARIE	323,754	10,909	13,791	13,749	13,773	14,278	14,203	14,689	4.6%	320,835
Upper Peninsula	1,916,773	106,862	119,786	129,710	149,213	166,635	183,004	197,175	10.3%	1,906,443
GAYLORD	310,756	9,367	10,192	11,237	11,516	13,689	13,779	13,977	4.4%	316,784
PIGEON RIVER	105,055	1,846	1,886	1,886	1,901	2,340	2,345	2,028	1.9%	105,049
ATLANTA	290,738	9,020	12,661	13,384	16,686	18,427	17,986	18,323	6.6%	279,638
TRAVERSE CITY	320,471	1,546	2,447	3,507	4,909	7,901	9,981	10,013	3.2%	312,144
CADILLAC	228,694	114	280	1,195	1,966	2,411	2,375	3,033	1.3%	235,783
ROSCOMMON	275,473	3,199	5,900	6,683	8,157	8,460	11,213	12,468	4.5%	276,911
GRAYLING	285,425	488	459	459	455	462	453	495	0.2%	284,429
GLADWIN	220,018	4,010	4,252	4,868	4,648	5,111	5,290	5,040	2.3%	218,913
No. Lower Peninsula	2,036,630	29,590	38,077	43,219	50,238	58,801	63,422	65,377	3.2%	2,029,651
Total State Forest	3,953,403	136452	157,863	172,929	199,451	225,436	246426	262,552	6.7%	3,936,094

Appendix L: Michigan DNR Inventory and Timber Program Summaries

Inventory

Compartment Review process

Each year approximately 10% of the roughly 3.9 million acres of state forest land is inventoried. The State Forest system is comprised of 15 Forest Management Units (FMU's) that conduct this inventory. State lands are divided into compartments at the FMU level, and assigned an entry year (YOE). Inventory occurs two field seasons prior to the YOE. Following completion of inventory, analyses are conducted, and FMFM and WLD staff propose treatments for the next decade that will further the goals and objectives of the State Forest system. These recommendations are reached as a consensus between WLD and FMFM, incorporating input from Fisheries Division when treatments have the potential to impact watersheds. Inventory findings and treatment recommendations are presented to the public for comments at the annual Forest Management Unit Open Houses. Comments are considered. Proposed treatments are then presented at the formal Compartment Review, where approval is sought by assigned representatives from the DNR Forest, Mineral, & Fire Management (FMFM), Wildlife, and Fisheries Divisions.

Operations Inventory (O.I.)

This is the inventory system that has been used to inventory State Forest lands since 1979. O.I. classifies stands based upon Covertype (species or mixture thereof; eg- jack pine or northern hardwoods, mixed swamp conifer), size density, age, as well as management objective. Data is gathered at the stand layer based upon expected treatment period (estimating the next time a stand will be entered for treatment) as well as any factors that may constrain management of stands that meet Silvicultural Criteria. Overstory, understory, and management objective are classified based upon one of 26 species/species group identifiers; and in the case of overstory and understory to a size density of poor, medium, and well-stocked, saplings or poles. O.I. is currently being phased out by a more advanced and detailed inventory system IFMAP.

IFMAP (Integrated Forest Monitoring, Assessment, and Prescription)

IFMAP is a canopy-based inventory that classifies stands based upon homogeneous areas of canopy, containing like species composition and textures. Stands are delineated from aerial and satellite imagery, then field inventoried. Detailed species level data is taken on the canopy and subcanopy structural layers including average diameter, size class, and the opportunity to record age by species. Stand level details include upland/lowland classifications, plantation/natural, and range of canopy closure.

This inventory system utilizes an enterprise GIS, with a custom suite of tools housed within the ArcGIS platform. It allows for the inventory to be more easily analyzed spatially, incorporating the multitude of GIS layers currently available and under development. Another important aspect of this inventory is it's departure from inventorying based upon management objective. Proposed treatments, treatment history, management objective and management constraint information are stored as attributes of

separate GIS layers, allowing for an inventory of the landscape unbiased by management objectives*.

**Management objective and constraint layers are currently underdevelopment.*

Geographic Decision Support Environment (GDSE)

This is an enterprise GIS environment that houses the IFMAP inventory tools, as well as the related information needed to conduct analysis and document treatment activities before, during and after the compartment review process. Tools are integrated that allow for the analysis of forest data across ownerships (utilizing remote sensing and FIA). Growth and yield modeling, as well as specialized documentation and business practice tools are also housed within the GDSE.

Forest Inventory and Analysis (FIA) in Michigan

FIA is a nationwide effort of the research arm of the USDA Forest Service to visit and re-measure fixed plots distributed systematically across the country. In Michigan it is conducted by crews from the North-Central Research Station in St. Paul, MN. A consortium of interests, including industry and the MDNR, have provided additional funding to FIA for the purpose of tripling the intensity of it's plot sampling in the Upper Peninsula of Michigan, and doubling it in the Northern Lower Peninsula. Previous inventories were completed in 1935, 1955, 1966, and 1980. Under new protocols, 20% of plots are re-inventoried annually. Upon the completion of each full re-inventory, analyses are conducted and reported upon. These analyses report on many trends. These trends include species composition of the forest and growth and removal across different ownerships (federal, state, private, etc.), and political boundaries (counties, states, regions, etc.). Although exact plot locations are kept confidential, this inventory data is available in various formats for the public, in both summary and raw-plot-level formats.

TSale & VMS

TSale

TSale is computer program that is used for the development of timber sales, timber sale contracts, and the receipt of monies. There are three versions of TSale, each used for a different phase of the timber sale process. The Proposal Only (POTSale) is used by the field foresters and technicians to create the pre-timber sale contract paperwork, i.e. the Proposal. The data from the POTSale is then transferred to the Master version of TSale (TSale Master) which is primarily used by the secretaries to create, amend and close the contract, in addition to receipting timber sales monies and most other monies collected by FMFM. The data from the Masters is uploaded weekly to the Access version of TSale which is used by the Lansing staff to create the sale Prospectus, i.e. advertisement, to view the statewide database, and to run reports. The TSale programs were developed in 1991 – 1992 and rolled out in January of 1993. They are currently being phased out by a more advanced web-based computer application (VMS).

Vegetation Management System (VMS)

VMS is a web-based application that will replace TSale (above). It is an information system to assist the Department in its planning, performing, monitoring, and analyzing commercial forest treatments. The system will make major improvement in quality control and data analysis. The Vegetative Management System, in combination with the Treatment Tracking Module of the IFMAP system, will track vegetative changes in land cover brought about by timber sales. It will be used to manage the 700 sales treating 55,000 acres (annual averages) of the 3.9 million acre State Forest each year. These sales bring in approximately $35 million dollars of revenues to the State annually. In addition, this system can be used by the other land management divisions of the Department.

The Vegetative Management System is being implemented to provide end-to-end automation of the commercial timber sales business area. Sales must be awarded fairly, timber harvesting must be bound by consistent administrative and methods constraints, revenue must be accounted for and allocated back to state funding sources, and sales, as actually cut, must feed back data into the overall forest resource inventory system (IFMAP). It is expected that automation and standardization of the embedded business processes will make this business practice much more efficient. In time, VMS will integrate with IFMAP and the GDSE, allowing the development of timber sale maps, as well as the ability to spatially track and record species and forest products sold from a specific geographic area.