

Lake Superior State
Forest Sustainable
Forest Management
Pilot Project

REPORT

3



The Lake Superior State Forest: A Description

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1. Introduction

The Lake Superior State Forest (LSSF) covers more than a million acres of land in the Eastern Upper Peninsula of Michigan. This report will describe the lands that make up the LSSF, on the basis of operations inventory data provided by the Michigan Department of Natural Resources (MDNR).

This report has been produced to provide a perspective on the size and composition of the LSSF. It contains a set of typical summary tables that could be included in subsequent forest management plans for the LSSF.

The following description summarizes data for the LSSF on the basis of the information found in the operations inventory. The operations inventory contains three primary data tables:

1. Compartment records
2. Stand records
3. Stand-volume records

In this summary both the compartment records and stand records have been used. A description of each of these data tables is found in Appendix A.

Both the forest and land resources of the LSSF are described in this report. Area information is presented on the forest areas, stand cover types, area classes, influence zones, age classes, stocking classes, tree size classes, forest health, featured wildlife species and forest soil types. Forest growing-stock volume and mean annual increment (MAI) information are presented by forest cover type and age class.

The operations inventory is a robust inventory that captures a great deal of information. In this forest description all information taken from the operations inventory is considered at face value.

2. Forest Areas

The LSSF is divided into three forest areas: Shingleton, Newberry, and Naub-Sault (amalgamated Naubinway and Sault Ste Marie areas). The forest areas divide the LSSF approximately into thirds. Table 1 presents the area in each of the forest areas aggregated into "land types", on the basis of

similar stand cover types. This table also shows that 72% of the LSSF is considered forest, while 13% is wetlands, and 8% is in the brush type. Less than 1% of the area is water, with other land types making up the remainder.

Table 1. Land types by forest area for the LSSF.

(acres)

Land Type	Shingleton	Newberry	Naub-Sault	LSSF
Forest	260,896	244,294	252,633	757,823
Brush	31,463	27,584	25,414	84,461
Wetlands	47,174	67,519	21,540	136,233
Other	31,098	7,695	17,879	56,672
Water	2,994	4,941	4,081	12,016
Total	373,625	352,033	321,547	1,047,205

3. Compartments and Stands

Each forest area is divided into compartments that range in size from 1,500 to 3,000 acres. There are 494 individual compartments on the LSSF. Forest and wildlife management operations are currently planned at the compartment level.

Compartments are subdivided into stands, for which there are 26 stand cover types. “A stand is the smallest unit on which managerial action can take place. It can be distinguished by any one of a number of parameters including species composition, age, stocking density, diameter of trees, health, site index, management objectives, and treatments.” (MDNR 1995) The operations inventory for the LSSF includes 26,155 individual stands that range in size from 0 to 996 acres, with the average stand size being 40 acres.

In this report two varieties of cover types will be discussed: forest cover types and stand cover types. Forest cover types will be based on predominant tree species (e.g., white pine, northern hardwood, oak), which are a subset of the cover types. Stand cover types will be used inclusively and will include both forest and non-forest cover types (e.g., lowland brush, treed bog, rock).

Within the stand inventory portion of the operations inventory, individual forest stands are described in terms of 45 attributes. The inventory includes both descriptive (managerial and biological) and prescriptive information. The focus of this report is on the descriptive attributes found in the inventory. The prescriptive data on management activities and timing can be used to build a profile of forest operations, but that is beyond the scope of this report.

Table 2 presents the area in the various stand cover types for each of the administrative forest areas within the LSSF. Forty-two percent of the area of the LSSF is in softwood forest cover types, while 30% is in hardwood. The softwood/hardwood split for the forest itself is 60%/40%. Northern hardwood constitute the largest forest cover type, accounting for almost 13% of the area of the LSSF and 17.5% of its forest lands. Aspen is the second largest cover type present on the LSSF (11% of land and 15% of forest), while jack pine is the largest conifer type and third largest forest cover type (10% of land and 14% of forest).

4. Area Classes and Influence Zones

Forest stands are classified in one of five "area classes", which reflect both the biological productivity of the forest and land use:

Commercial forest land - Land capable of producing more than 20 cubic feet per acre per year (cu. ft./ac./yr.) and not removed from timber production.

Non-timber-producing forest land - Land supporting trees, but not capable of producing more than 20 cu. ft./ac./yr. of any species (e.g., treed bogs, stagnant swamps, most lowland brush).

Timber-producing forest land reserved - Land capable of producing more than 20 cu. ft./ac./yr. of timber, but removed from timber production by lease or land-use commitment (e.g., wildlife openings, wilderness or natural areas (no cut), utility lines).

Non-timbered forest land - Bogs, marshes, rock outcrops, improved roads, gravel and sand.

Water - Ponds, lakes, and large streams.

Table 2. Area by stand cover types and forest area for the LSSF.

(acres)

Stand Cover Type	Shingleton	Newberry	Naub-Sault	LSSF
White Pine	13,155	15,673	3,166	31,994
Red Pine	36,031	22,321	14,371	72,723
Jack Pine	45,525	60,135	3,025	108,685
Black Spruce	13,846	8,808	10,835	33,489
Upland Spruce-Fir	4,383	3,260	7,436	15,079
Tamarack	2,481	1,128	3,230	6,839
Cedar	21,279	13,996	49,630	84,905
Mixed Swamp Conifer	23,921	39,195	17,715	80,831
Hemlock	2,320	1,768	1,669	5,757
Softwoods	162,941	166,284	111,077	440,302
Aspen	31,428	23,258	61,070	115,756
Paper Birch	6,785	4,146	12,112	23,043
Lowland Aspen/Poplar	2,690	3,974	17,909	24,573
Northern Hardwood	49,798	39,054	44,297	133,149
Oak	1,569	1,584	964	4,117
Lowland Hardwood	5,685	5,994	5,204	16,883
Hardwoods	97,955	78,010	141,556	317,521
Lowland Brush	29,824	24,159	22,797	76,780
Upland Brush	1,639	3,425	2,617	7,681
Brush	31,463	27,584	25,414	84,461
Treed Bog	3,276	35,253	6,915	45,444
Bog/Muskeg	3,685	6,801	6,136	16,622
Marsh	40,213	25,465	8,489	74,167
Wetlands	47,174	67,519	21,540	136,233
Rock	18		76	94
Sand Dune	132	433	7	572
Grass	29,220	7,015	15,989	52,224
Local Use	229	139	84	452
Other	1,499	108	1,723	3,330
Other (Non-Forest)	31,098	7,695	17,879	56,672
Water	2,994	4,941	4,081	12,016
Total	373,625	352,033	321,547	1,047,205

When the forest operations inventory for the LSSF is summarized by area class, as in Table 3, it can be seen that 73% of the area is in productive forest (commercial + reserved, >20 cu. ft./ac./yr.), 19% is non-timber-producing forest, 7% is non-timbered (non-forested) and 1% is water. Of the productive forest, 711,390 acres (68% of the land and 93% of the forest) are commercially available while 55,068 acres (5% of land and 7% of forest) are reserved.

Table 3. Area by area class for the LSSF.

Area Class	Acres	
Commercial Forest	711,390	68%
Reserved Timber-producing Forest	55,068	5%
Productive Forest	766,458	73%
Non-timber-producing Forest	197,420	19%
Non-timbered Forest Land	71,281	7%
Water	12,029	1%
	1,047,188	

Table 4 presents the area classes further subdivided by stand cover type. It shows that 5% of the total area (55,068 acres) is reserved, and more than 80% of the area in reserves is classified as grasslands. Of the 757,809 acres of forest stands listed in Table 4, 92.6% (701,838 acres) is considered commercial forest, while 6.8% (51,757 acres) is non-producing forest, and 0.6% is reserved (4,214 acres).

There appear to be some classification anomalies within this attribute, as some of the non-forest cover types can be classified as either commercial forest, non-producing forest or non-timbered (non-forest). If land is classified as grass or marsh it would normally be expected to be non-timbered.

The stand attribute "influence zone" describes the primary land use for the stand. There are seven influence zones identified in the forest operations inventory:

General Forest - All state forest lands not included in the following classes. This zone contains most of the commercial forest land and provides the most opportunity for the management of timber, wildlife habitat and dispersed recreational opportunities.

Travel - Land area subject to frequent viewing by the public. Visual quality is the primary consideration.

Water - State forest frontage on lakes, certain ponds, main streams, and feeder streams where water quality or water-oriented recreation is the primary consideration. These zones are 100 to 330 feet in width; a wider zone may be necessary in certain cases.

Table 4. Area by stand type and area class for the LSSF.
(acres)

Stand Cover Type	Commercial Forest	Non-producing	Reserved	Non-timbered	Water	Total
White Pine	31,727	6	261			31,994
Red Pine	72,384	153	186			72,723
Jack Pine	108,040	111	534			108,685
Black Spruce	30,830	2,628	31			33,489
Upland Spruce-Fir	14,700	107	272			15,079
Tamarack	5,047	1,792				6,839
Cedar	61,518	23,220	167			84,905
Mixed Swamp Conifer	65,708	15,063	46			80,817
Hemlock	5,693		64			5,757
Aspen	111,375	3,131	1,250			115,756
Paper Birch	21,646	1,079	318			23,043
Lowland Aspen/Poplar	22,416	2,117	40			24,573
Lowland Hardwood	15,013	1,610	260			16,883
Northern Hardwood	132,397	117	635			133,149
Oak	3,344	623	150			4,117
Forest Stand Subtotals	701,838	51,757	4,214			757,809
Lowland Brush	902	68,210	256	7,412		76,780
Upland Brush	2,926	1,640	3,019	93		7,678
Treed Bog	48	42,258		3,138		45,444
Bog/Muskeg		4,155		12,467		16,622
Marsh	214	28,308		45,632	13	74,167
Rock		42		52		94
Sand Dune		22		550		572
Grass	4,926	804	46,381	113		52,224
Local Use	370		71	11		452
Other Non-stk, Non-for	166	224	1,127	1,813		3,330
Water					12,016	12,016
Totals	711,390	197,420	55,068	71,281	12,029	1,047,188

Deer yard - Forest areas where deer concentrate in winter. Usually, all stands within ¼ mile should be included.

Other Wildlife - Stands managed for particular wildlife species (e.g., Kirtland's warbler) or stands whose management is influenced by the presence of or potential for certain wildlife species (e.g., red-shouldered hawk).

Recreation Sites - Developed recreation facilities (e.g., campgrounds, trails, pathways) and the areas within the visual landscape of such facilities. Treatments will enhance or protect the recreation value of the site.

Wild or Natural Areas - Areas formally designated under the Wilderness Areas Act (Act 241 - 1972) or areas that contain qualities to be protected but not formally designated.

Undedicated - None of the above.

Lease - Stands under lease or long-term agreement for transmission lines, pipelines and military uses.

Table 5 displays the area in each of the influence zones, along with the proportion of the LSSF in that type. Using the influence zones only, one can see that almost 74% (773,768 acres) of the LSSF is general forest where (it is assumed) "normal" forest management is practised. Forestry practices are modified or restricted (it is assumed) on 26% of the LSFF landbase (273,420 acres). Deer yards make up the second largest influence zone, accounting for 11.3% of the LSSF (118,247 acres). Water zones and travel corridors make up the third and fourth largest zones at 5.9% and 4.1%, respectively. The remainder of the area is split between the remaining influence zones.

Table 5. Area by influence zone for the LSSF.

Influence Zone	Acres	
General Forest	773,768	73.89%
Travel	42,954	4.10%
Water	62,009	5.92%
Deer Yard	118,247	11.29%
Other Wildlife Habitat	22,493	2.15%
Recreation	7,355	0.70%
Wild or Natural Areas	10,262	0.98%
Undedicated	133	0.01%
Lease	9,967	0.95%
	1,047,188	

Each influence zone type should have a formal set of ground rules or guidelines to specify how management activities are modified to meet the goal of the influence zone (if such goals exist). For example, along travel corridors the goal may be “no visual impact”, while the guideline would describe how this might be achieved through best management practices (e.g., partial harvesting, land form cutting, no cutting within two chains, no cutting at all). For the watercourse zones the goals could be “no sedimentation” and “minimal visual impact”, while the guidelines could include no cutting zone within 30 feet of the water and slope-dependent modified cutting zones and skyline reserves beyond.

Combining the influence zone and area class attributes provides a more detailed view of forest productivity and land use (Table 6). A new type of forest emerges, the general commercial forest (GCF), which can be considered (it is assumed) the core forest area used for producing timber. In the remaining influence zones/area classes, forest management activities are assumed to be modified to suit the intent of the zone as specified in formal ground rules/guidelines.

Table 6. Area by influence zone and area class for the LSSF.

(acres)

Influence Zone	Area Class					Total
	Commercial Forest	Non-producing Forest	Reserved Forest	Non-timbered	Water	
General Forest	544,808	143,808	30,879	52,392	1,881	773,768
Travel	34,021	3,167	3,272	2,409	85	42,954
Water	24,144	20,060	1,166	8,587	8,052	62,009
Deer Yard	87,524	26,325	2,398	1,851	149	118,247
Other Wildlife Habitat	1,302	2,011	12,721	4,729	1,730	22,493
Recreation	6,051	128	692	422	62	7,355
Wild or Natural Areas	6,185	1,607	1,971	442	57	10,262
Undedicated	133					133
Lease	7,222	314	1,969	449	13	9,967
Total	711,390	197,420	55,068	71,281	12,029	1,047,188

The area of the LSSF is 1,047,188 acres, which in certification jargon is considered the “defined forest area” (DFA). This DFA becomes the basis for planning management and assessing resource sustainability. The DFA is normally the complete forest and can be further subdivided into land-use classifications on the basis of productivity and/or management intent. The influence zone and area-class variable perform this role in the operations inventory. These classifications must be recognized and accounted for when it comes to management planning for the forest. For each of these subdivisions (including forest cover type), management emphasis and normal management practices should be formalized into ground rules and/or guidelines for management.

5. Forest Age

A key descriptor of the forest is its age. The operations inventory describes stand age through the identification of the year of origin for each even-aged stand. Stand ages are derived and then grouped into 10-year age classes. All-aged stands are coded separately.

The age-class distribution of the forests of the LSSF is presented in Figure 1 and Table 7 by forest cover type. Table 8 presents the same data for the general commercial forest (GCF). Figure 1 illustrates that almost one quarter

of the LSSF is considered all-aged forest; most of this is in the northern hardwood cover type. The age-class distribution of the even-aged forest appears quite well balanced. Nearly 60% of the forest is over 50 years old, and almost one third of the forest is currently between the ages of 50 and 70. The average age of the even-aged portion of the LSSF is approximately 60 years.

Age-class structure varies among the various forest cover types: e.g., 80% of the aspen cover type is below the age of 80, while 94% of the cedar stands are more than 60 years of age. There are some anomalies within the age-class attributes, e.g., some uneven-aged stands of “normally” even-aged species such as jack pine, aspen, and red pine.

The inventory data also provide estimates of total merchantable stand volume, in cords. From these data, a profile of the forest growing stock (or timber inventory) has been compiled and is presented by age class in Table 9.

When volume and area data are combined, average yield data can be generated from the operations inventory and then used as the basis for growth and development curves in a forest management model.

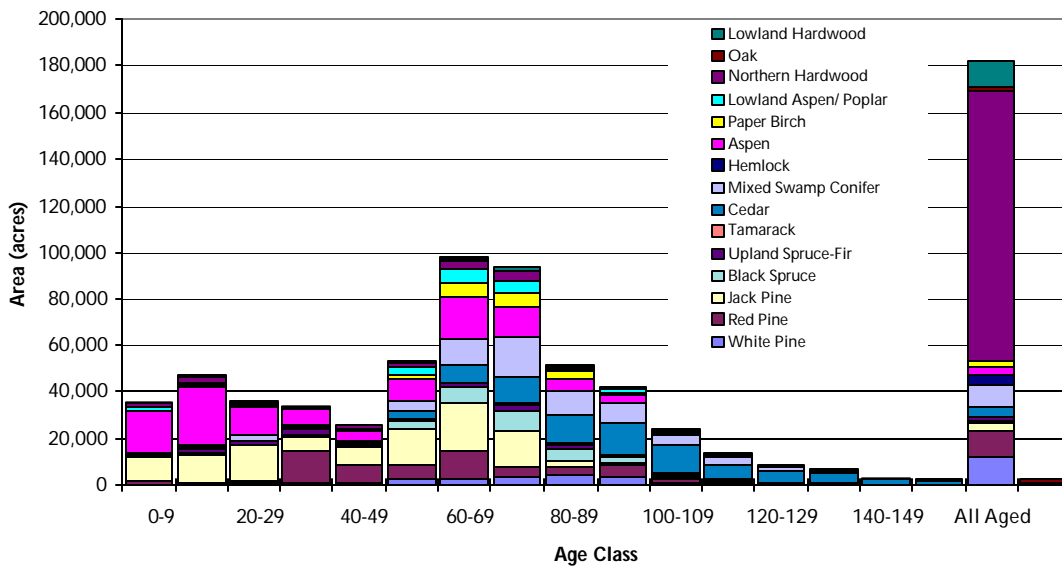


Figure 1. Age-class distribution of the Lake Superior State Forest by forest cover type.

Table 7. Age-class distribution of the LSSF by forest cover type.

(acres)

Age Class	White Pine	Red Pine	Jack Pine	Black Spruce	Upland Spruce-Fir	Tamarack	Cedar	Mixed Swamp Conifer	Hemlock	Aspen	Paper Birch	Lowland Aspen/Poplar	Northern Hardwood	Oak	Lowland Hardwood	Total
0-9	33	1,608	10,724	419	787	154	249	417		17,493	401	1,758	1,193	85	151	35,472
10-19	257	1,053	11,857	1,017	1,699	61	240	1,409	121	24,577	551	1,498	2,212	120	176	46,848
20-29	472	1,270	14,989	921	1,296	94	150	2,176		11,763	184	1,024	1,229	80	280	35,928
30-39	913	14,005	5,791	874	2,435	283	511	1,041		7,078	123	373	548	8	106	34,089
40-49	752	8,540	7,226	612	332	90	484	1,198		3,914	258	1,100	687	12	216	25,421
50-59	2,193	6,858	14,899	3,054	956	308	3,206	4,835	10	9,015	1,846	3,150	2,092	286	293	53,001
60-69	2,567	12,314	20,347	6,335	1,779	565	7,413	11,433	94	17,710	5,712	6,240	4,197	669	977	98,352
70-79	3,478	4,545	14,873	9,436	2,272	935	10,770	17,328	352	12,249	6,049	5,341	3,837	338	1,926	93,729
80-89	4,144	3,919	2,926	4,593	1,248	1,294	12,319	9,961	338	4,244	3,435	1,160	979	71	697	51,328
90-99	3,280	5,685	556	2,082	447	943	13,563	8,898	117	2,817	1,369	1,301	346		438	41,842
100-109	1,082	1,617	641	986	145	896	11,610	4,751	110	838	428	412	30		330	23,876
110-119	460	105	29	1,069	5	458	6,714	3,849	149	50	9	243	7		796	13,943
120-129	60	44		387	15	339	5,215	1,838	24	259	17	70				8,268
130-139	35			216	8	177	4,468	1,580	98	39			16		9	6,646
140-149				145			2,380	385			32				21	2,963
150+	195	65					1,578	244	125	24					49	2,280
All Aged	12,058	11,072	3,192	1,300	1,566	242	4,035	9,442	4,219	3,548	2,556	632	115,689	1,855	10,418	181,824
UNK	15	23	635	43	89			32		138	73	271	87	593		1,999
Total	31,994	72,723	108,685	33,489	15,079	6,839	84,905	80,817	5,757	115,756	23,043	24,573	133,149	4,117	16,883	757,809

Table 8. Age-class distribution of the GCF by forest cover type.

(acres)

Age Class	White Pine	Red Pine	Jack Pine	Black Spruce	Upland Spruce-Fir	Tamarack	Cedar	Mixed Swamp Conifer	Hemlock	Aspen	Paper Birch	Lowland Aspen/Poplar	Northern Hardwood	Oak	Lowland Hardwood	Total
0-9	27	1,284	9,336	407	449	154	139	335		15,315	259	1,468	1,013	10	49	30,245
10-19	197	848	11,051	862	1,025	61	40	530	121	19,516	383	682	1,567	120	162	37,165
20-29	423	1,181	12,731	839	889	9	105	480		9,681	5	794	797	80	222	28,236
30-39	877	12,604	5,322	796	1,976	129	449	505		5,251	97	240	418	8	34	28,706
40-49	693	7,574	6,415	500	196	82	78	688		2,861	198	506	395		12	20,198
50-59	2,029	5,924	12,615	1,857	590	223	1,115	2,409	10	7,107	1,192	1,761	1,671	228	216	38,947
60-69	1,842	9,513	17,256	5,044	1,186	322	3,652	7,664	87	14,133	4,008	3,463	2,650	404	813	72,037
70-79	2,890	3,606	12,379	7,929	1,135	563	4,452	9,329	170	8,965	3,232	3,247	3,205	324	1,484	62,910
80-89	3,613	3,295	2,479	3,813	372	1,191	5,683	5,291	276	2,874	1,909	655	570	39	603	32,663
90-99	1,922	4,684	456	1,561	184	686	4,829	4,682	71	2,351	649	1,210	318		200	23,803
100-109	768	1,407	573	513	145	198	2,892	2,683	4	424	124	246	30		55	10,062
110-119	419	105	29	647	5	250	2,028	1,508	149	34	9		7		763	5,953
120-129	45	11		112		57	2,538	482		259		16				3,520
130-139	22			102		41	1,308	808	59				16			2,356
140-149				114			232	114								460
150+	135	35					347	75	94	24					49	759
All Aged	9,414	9,096	2,870	1,024	1,208	140	2,060	5,970	3,127	2,612	1,566	381	90,734	1,464	5,496	137,162
UNK	15	23	635	9	89			10		138	60	51	80			1,110
Total	25,331	61,190	94,147	26,129	9,449	4,106	31,947	43,563	4,168	91,545	13,691	14,720	103,471	2,677	10,158	536,292

Table 9. Growing-stock volume by age class and cover type for the LSSF.

(cords)

Age Class	White Pine	Red Pine	Jack Pine	Black Spruce	Upland Spruce-Fir	Tamarack	Cedar	Mixed Swamp Conifer	Hemlock	Aspen	Paper Birch	Lowland Aspen/Poplar	Northern Hardwood	Oak	Lowland Hardwood	Total
0-9	107	5,427	43,381	3,700	2,830	-	1,197	1,533	-	23,759	5,827	1,818	2,142	144	-	91,865
10-19	675	809	81	208	293	-	184	1,200	868	2,892	228	224	536	261	-	8,459
20-29	1,354	11,710	10,027	192	862	-	-	1,229	-	9,853	228	384	1,737	428	815	38,819
30-39	4,284	140,632	20,661	2,209	10,907	82	914	911	-	63,665	120	2,326	2,889	-	284	249,884
40-49	4,416	148,593	73,966	1,234	2,692	632	909	4,351	-	44,376	2,387	9,813	4,142	154	2,056	299,721
50-59	21,934	143,233	219,338	11,733	10,749	3,038	8,889	28,058	163	116,745	22,021	40,445	23,036	2,898	1,437	653,717
60-69	24,938	262,889	338,435	59,659	24,770	4,521	56,492	111,320	2,038	265,278	86,912	77,650	65,859	5,416	11,832	1,398,009
70-79	38,834	61,507	273,005	110,699	37,696	11,121	122,405	156,222	6,214	210,536	99,066	79,147	63,167	4,524	18,178	1,292,321
80-89	60,907	57,184	59,100	51,192	22,915	16,106	161,677	133,749	6,050	71,233	64,261	16,267	17,066	578	10,967	749,252
90-99	49,693	100,801	12,587	28,236	6,249	12,845	230,090	107,633	2,735	57,851	24,115	24,831	6,503	-	6,603	670,772
100-109	19,010	30,455	11,674	9,959	2,098	6,192	185,153	62,305	1,883	19,517	9,169	9,669	798	-	4,626	372,508
110-119	6,518	1,225	603	12,277	140	2,392	111,922	45,567	2,042	820	162	666	137	-	5,449	189,920
120-129	1,592	1,108	-	1,763	285	3,450	72,131	18,207	880	7,491	270	1,146	-	-	-	108,323
130-139	676	-	-	3,364	181	1,128	61,164	15,808	2,152	654	-	-	255	-	57	85,439
140-149	-	-	-	1,128	-	-	33,001	5,341	-	-	954	-	-	-	160	40,584
150+	2,947	982	-	-	-	-	18,995	2,616	2,882	204	-	-	-	-	576	29,202
All Aged	197,827	173,723	51,588	16,467	19,631	2,533	73,733	129,166	89,493	43,888	38,274	8,117	2,014,819	23,613	117,898	3,000,770
UNK	330	380	64	-	21	-	-	494	-	-	624	1,690	1,639	-	-	5,242
Total	436,042	1,140,658	1,114,510	314,020	142,319	64,040	1,138,856	825,710	117,400	938,762	354,618	274,193	2,204,725	38,016	180,938	9,284,807

6. Forest Growing Stock

Forest growing stock can be defined as the total volume of timber growing in the forest. Depending on how volume is measured it can represent the total biomass or the merchantable volume of timber in the forest. In the operations inventory, merchantable stand volume is calculated for each stand. A biomass volume can be derived by calculating the volume of timber in the understory and the total tree volume in the overstory. Table 10 presents growing stock by forest cover type along with the average yield for the entire LSSF and GFC portion. It shows that the LSSF at present contains almost 9.3 million cords (cds) of merchantable timber, of which more than 70% (6.6 million cds) is found in the GFC, or operable forest.

Table 10. Forest growing stock and average yield by cover type.

Cover Type	LSSF		GFC		% GFC
	Growing Stock (cords)	Avg Yield (cords/ac.)	Growing Stock (cords)	Avg Yield (cords/ac.)	
White Pine	436,042	13.6	330,151	13.0	76%
Red Pine	1,140,658	15.7	944,570	15.4	83%
Jack Pine	1,114,510	10.3	941,348	10.0	84%
Black Spruce	314,020	9.4	260,747	10.0	83%
Upland Spruce-Fir	142,319	9.4	82,328	8.7	58%
Tamarack	64,040	9.4	47,846	11.7	75%
Cedar	1,138,856	13.4	474,525	14.9	42%
Mixed Swamp Conifer	825,710	10.2	500,151	11.5	61%
Hemlock	117,400	20.4	81,304	19.5	69%
Aspen	938,762	8.1	726,938	7.9	77%
Paper Birch	354,618	15.4	205,993	15.0	58%
Lowland Aspen/Poplar	274,193	11.2	172,063	11.7	63%
Northern Hardwood	2,204,725	16.6	1,718,070	16.6	78%
Oak	38,016	9.2	30,095	11.2	79%
Lowland Hardwood	180,938	10.7	107,583	10.6	59%
Total	9,284,807	12.3	6,623,712	12.4	71%

7. Stand Stocking and Size Class

The operations inventory classifies stands into stocking densities on the basis of basal area, and tree size classes on the basis of average diameter at breast height (DBH). The inventory captures stand basal area and average

DBH uniquely and then aggregates them into three classes of stand stocking density and three classes of tree size. For the seedling/sapling size class, stocking is based on trees per acre or percentage stocked.

Stocking Class		Size Class	
Poor	10-39 sq. ft.	Seedling/Sapling	
Medium	40-69 sq. ft.	Polewood	5 in.- 9.9 in. DBH
Well stocked	70+ sq. ft.	Sawtimber	10+ in. DBH

Table 11 summarizes stocking density and size class for the LSSF, while Table 12 presents the same data for the GCF portion of the LSSF. In general, the forest is quite well stocked, with the majority of the timber being classified as polewood.

When comparing Tables 11 and 12, one can see that, in general, stocking is higher and a larger proportion of the area is in sawtimber on the GCF than on the entire LSSF. This would confirm that the lands in the GCF are more productive and possibly better suited to timber production.

8. Stand Conditions

Forest stand conditions are classified in the inventory in one of ten classes on the basis of merchantability, stocking and vigor:

Non-stocked	
High Risk:	old and decrepit stands that are in decline and are not considered for old growth
Sparse:	stands with less than 40 sq. ft. of basal area per acre
Low Quality:	minimally stocked
Mature:	within 5 years of rotation
Immature:	more than 5 years from rotation
Uneven-aged	
Two-aged	
Old Growth:	real or potential
Regeneration:	stand has been established; stocking, density and composition have yet to be determined

Table 11. Area by cover type, stocking density and size class for the LSSF.
(acres)

Cover Type	Stocking Class			Size Class			Total
	Poor	Medium	Well stocked	Sapling	Polewood	Sawtimber	
White Pine	2,910	11,886	17,198	1,142	13,259	17,593	31,994
Red Pine	6,872	19,348	46,413	6,326	38,542	27,765	72,633
Jack Pine	5,204	30,453	66,688	34,126	68,127	92	102,345
Black Spruce	2,780	15,834	14,640	7,880	25,374	-	33,254
Upland Spruce-Fir	995	5,479	8,484	4,997	9,866	95	14,958
Tamarack	1,691	2,862	2,209	738	5,954	70	6,762
Cedar	4,961	16,088	63,739	9,838	73,320	1,630	84,788
Mixed Swamp Conifer	7,366	32,854	40,486	12,547	67,954	205	80,706
Hemlock	61	1,095	4,601	19	3,333	2,405	5,757
Aspen	6,504	33,465	74,552	54,007	57,120	3,394	114,521
Paper Birch	1,012	5,459	16,549	1,198	21,576	246	23,020
Lowland Aspen/Poplar	2,858	7,442	14,140	5,045	18,698	697	24,440
Northern Hardwood	2,688	22,310	108,094	5,578	97,426	30,088	133,092
Oak	578	1,086	1,860	85	2,663	776	3,524
Lowland Hardwood	2,026	7,471	7,354	1,137	14,128	1,586	16,851
Total	48,506	213,132	487,007	144,663	517,340	86,642	748,645
	6.5%	28.5%	65.1%	19.3%	69.1%	11.6%	

Table 12. Area by cover type, stocking density and size class for the GCF.
(acres)

Cover Type	Stocking Class			Size Class			Total
	Poor	Medium	Well stocked	Sapling	Polewood	Sawtimber	
White Pine	2,397	9,841	13,093	1,044	10,995	13,292	25,331
Red Pine	5,463	16,993	38,644	5,595	33,240	22,265	61,100
Jack Pine	4,497	27,412	56,442	29,941	58,318	92	88,351
Black Spruce	1,751	12,705	11,638	4,989	21,105	-	26,094
Upland Spruce-Fir	618	3,676	5,034	3,277	5,984	67	9,328
Tamarack	388	1,726	1,915	320	3,639	70	4,029
Cedar	466	6,121	25,339	2,969	27,999	958	31,926
Mixed Swamp Conifer	3,440	14,772	25,243	5,154	38,131	170	43,455
Hemlock	61	979	3,128	19	2,485	1,664	4,168
Aspen	3,982	26,877	59,624	44,321	43,284	2,878	90,483
Paper Birch	627	3,183	9,858	664	12,779	225	13,668
Lowland Aspen/Poplar	1,650	3,758	9,239	2,879	11,241	527	14,647
Northern Hardwood	1,772	17,481	84,197	4,099	75,782	23,569	103,450
Oak	404	851	1,422	34	1,994	649	2,677
Lowland Hardwood	1,662	4,079	4,417	532	9,005	621	10,158
Total	29,178	150,454	349,233	105,837	355,981	67,047	528,865
	5.5%	28.4%	66.0%	20.0%	67.3%	12.7%	

Tables 13 and 14 present the area in each stand condition class by forest cover type for the entire LSSF and the GCF portion. Immature stands account for nearly half of the forest, with mature and uneven-aged stands both accounting for approximately 20% of the forest. These proportions are similar for both the LSSF and the GCF. The remaining 10% of the forest is split amongst the remaining seven stand conditions. Old growth makes up a minor part of the LSSF, accounting for just 0.3% (2,055 acres) of the forest area.

9. Special Management Areas

A further classification of the LSSF landbase is available in the operations inventory, which delineates a variety of special management area types. There are nine special management areas identified in the operations inventory: free-flowing streams, beaver dams, unusual scenic values, unusual botanical, historical, unusual geological, immediacy of development in adjacent area, endangered and threatened species, and other. Tables 15 and 16 present the area in special management areas for both the LSSF and the GCF portion by stand cover type.

More than 45,000 acres have been designated special management areas in the LSSF. This represents 4.3% of the entire forest area (Table 15). More than 60% of the special management areas are classified as "other" (28,380 acres), an indication that the classification scheme used may not be comprehensive enough. The nature of the special management areas classified as "other" is recorded in more detail in a comments file that was not provided with the data used for this report. The variety of classes in this parameter is not clearly documented.

Table 13. Area by forest cover type and stand condition for the LSSF.

Cover type	Stand Condition Class										Total
	Non-stocked	High Risk	Sparse	Low Quality	Mature	Immature	Uneven-aged	Two-aged	Old Growth	Regenerating	
White Pine	38	75	1,342	990	2,056	15,794	10,004	1,661	12	22	31,994
Red Pine	137	172	3,019	1,035	6,942	50,558	8,013	2,420	197	230	72,723
Jack Pine	1,439	431	1,181	517	33,390	61,627	1,534	2,290		6,276	108,685
Black Spruce	1,074	79	1,246	956	4,564	24,728	533	74	15	220	33,489
Upland Spruce-Fir	167	239	530	241	4,228	8,051	1,178	72	52	321	15,079
Tamarack	37	241	1,264	549	997	3,469	76	44		162	6,839
Cedar	344	79	3,239	7,247	19,042	51,741	1,800	374	932	107	84,905
Mixed Swamp Conifer	830	194	3,877	4,420	13,646	51,738	5,073	514	316	209	80,817
Hemlock	54	28		11	825	1,407	3,126	165	122	19	5,757
Aspen	2,742	1,728	4,172	2,041	36,134	65,068	1,196	1,287	30	1,358	115,756
Paper Birch	384	443	751	757	12,549	7,193	754	118	28	66	23,043
Lowland Aspen/Poplar	404	347	2,066	1,493	11,132	8,455	371	173	44	88	24,573
Northern Hardwood	917	276	1,520	1,037	3,634	20,121	103,673	1,514	307	150	133,149
Oak	593		223	69	322	1,353	1,385	172			4,117
Lowland Hardwood	182	81	708	1,831	1,265	5,747	6,996	41		32	16,883
Total	9,342	4,413	25,138	23,194	150,726	377,050	145,712	10,919	2,055	9,260	757,809
Percentage	1.2%	0.6%	3.3%	3.1%	19.9%	49.8%	19.2%	1.4%	0.3%	1.2%	

Table 14. Area by forest cover type and stand condition for the GCF.

Cover type	Stand Condition Class										Total
	Non-stocked	High Risk	Sparse	Low Quality	Mature	Immature	Uneven-aged	Two-aged	Old Growth	Regenerating	
White Pine	8	56	1,155	828	1,715	12,407	7,573	1,577		12	25,331
Red Pine	65	144	2,639	699	5,719	42,948	6,506	2,110	179	181	61,190
Jack Pine	1,420	351	1,053	461	27,552	54,614	1,418	1,808		5,470	94,147
Black Spruce	195	79	851	357	3,512	20,438	412	74	3	208	26,129
Upland Spruce-Fir	62	44	323	142	2,308	5,577	737	62	20	174	9,449
Tamarack	22	5	186	457	722	2,555	76	6		77	4,106
Cedar	83	72	410	1,372	5,994	22,356	1,199	260	167	34	31,947
Mixed Swamp Conifer	418	104	1,980	1,747	6,329	29,285	3,336	206	23	135	43,563
Hemlock	54			11	624	998	2,237	135	90	19	4,168
Aspen	2,017	1534	2503	1,301	27,817	53,353	864	1,213		943	91,545
Paper Birch	376	187	439	376	7,343	4,355	472	49	28	66	13,691
Lowland Aspen/Poplar	270	322	1,174	704	6,704	5,112	216	173	28	17	14,720
Northern Hardwood	751	75	1,171	875	2,772	15,216	81,142	1,262	112	95	103,471
Oak			49	55	245	1,007	1,149	172			2,677
Lowland Hardwood		23	462	1,626	737	3,708	3,568	34			10,158
Total	5,741	2,996	14,395	11,011	100,093	273,929	110,905	9,141	650	7,431	536,292
Percentage	1.1%	0.6%	2.7%	2.1%	18.7%	51.1%	20.7%	1.7%	0.1%	1.4%	

Table 15. Special management potential by stand cover type for the LSSF.

Cover type	Special Management Potential											
	None	Free-flowing stream	Beaver	Scenic	Botanical	Historical	Geological	Imm. dev. adjacent lands	End. species	Other	Total	Special
White Pine	30,641	94		913	36		185			125	31,994	4%
Red Pine	67,580	184		17	4	49			126	4,763	72,723	7%
Jack Pine	107,595	5		72	114	5	131			763	108,685	1%
Black Spruce	33,342	13		56	4					74	33,489	0%
Upland Spruce-Fir	14,641	251		7	52				90	38	15,079	3%
Tamarack	6,828			11							6,839	0%
Cedar	81,472	1,277	24	7	131	11	62		16	1,905	84,905	4%
Mixed Swamp Conifer	79,300	1,124		30	161					202	80,817	2%
Hemlock	5,575	8	15		9			13		137	5,757	3%
Aspen	113,494	315	120	226	335				676	590	115,756	2%
Paper Birch	22,322	170		313			61			177	23,043	3%
Lowland Aspen/Poplar	24,032	238	110						15	178	24,573	2%
Northern Hardwood	116,378	191		603			89	19	161	15,708	133,149	13%
Oak	3,994	34								89	4,117	3%
Lowland Hardwood	16,689	49								145	16,883	1%
Lowland Brush	72,592	2,160	1,348		3				40	637	76,780	5%
Upland Brush	7,511	55								112	7,678	2%
Treed Bog	44,692	13	307	6	132					294	45,444	2%
Bog/Muskeg	15,593	27	387	14	75					526	16,622	6%
Marsh	72,231	190	485	14	25		27		112	1,083	74,167	3%
Rock	94										94	0%
Sand Dune	537			35							572	6%
Grass	50,256	156		105	529	2			600	576	52,224	4%
Local Use	427									25	452	6%
Other Non-stk, Non-for	3,170	7			40	2				111	3,330	5%
Water	10,836	92	569	13	18			8	358	122	12,016	10%
Total	1,001,822	6,653	3,365	2,442	1,668	69	555	40	2,194	28,380	1,047,188	4%
Percentage	95.7%	0.6%	0.3%	0.2%	0.2%	0.0%	0.1%	0.0%	0.2%	2.7%	100%	

Table 16. Special management potential by stand cover type for the GCF.

(acres) Cover type	Special Management Potential											
	None	Free-flowing stream	Beaver	Scenic	Botanical	Historical	Geological	Imm. dev. adjacent lands	End. species	Other	Total Special	
White Pine	25,296				29					6	25,331	0%
Red Pine	56,930	108		17	4	49			86	3,996	61,190	7%
Jack Pine	93,234				114		129			670	94,147	1%
Black Spruce	26,124	5									26,129	0%
Upland Spruce-Fir	9,352			7	52					38	9,449	1%
Tamarack	4,106										4,106	0%
Cedar	31,374	188	14		103	11	62			195	31,947	2%
Mixed Swamp Conifer	43,492	28								43	43,563	0%
Hemlock	4,157									11	4,168	0%
Aspen	90,934	29	24	7					343	208	91,545	1%
Paper Birch	13,606			22						63	13,691	1%
Lowland Aspen/Poplar	14,465	102	42							111	14,720	2%
Northern Hardwood	91,782	7						19	134	11,529	103,471	11%
Oak	2,609	34								34	2,677	3%
Lowland Hardwood	10,158										10,158	0%
Lowland Brush	646										646	0%
Upland Brush	2,489									112	2,601	4%
Treed Bog	3										3	0%
Marsh	207										207	0%
Grass	4,610									66	4,676	1%
Local Use	289									25	314	8%
Other Non-stk, Non-for	69										69	0%
Total	525,932	501	80	53	302	60	191	19	563	17,107	544,808	3%
Percentage	96.5%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	3.1%	100%	

10. Soil Types

The LSSF contains a wide range of soil types. The operations inventory currently identifies 117 individual soil types. Table 17 presents the soils data aggregated in 10 classes on the basis of soil drainage and soil texture. Well drained soils account for more than 30% of the area, with organic soils accounting for just under 15% of the area. The remainder of the area is made up of poorly drained soils and bedrock. There is no listed soil type on more than 34% of the area.

Table 17. Soil types on the LSSF.

Soil Types	Acres	
Organic	239,561	14.7%
Well drained sands	297,051	28.4%
Well drained loamy sands	16,654	1.6%
Well drained sand loams	7,415	0.7%
Well drained loams	17,058	1.6%
Well drained clay loams	3,910	0.4%
Somewhat poorly drained fines	11,799	1.1%
Somewhat poorly drained sands	303	0.0%
Poorly drained	86,582	8.3%
Bedrock	7,589	0.7%
Unknown	359,351	34.3%
	1,047,313	

11. Forest Health

On the basis of the data in the operations inventory, the LSSF can be considered a generally healthy forest. Table 18 presents a summary of the “insect, disease and other damage” attribute (a proxy for forest health) by forest cover type. This parameter identifies the presence of certain types of tree damage (e.g., conks, dead trees, etc.). There is no acknowledgment of either the agent of damage (e.g., budworm, flooding) or the severity of the damage. Ninety-three percent of the LSSF can be considered healthy on the basis of this parameter.

Table 18. Forest health conditions by cover type for the LSSF.

(acres)

Stand cover type	Healthy	Conks	Dead or flagged branches, needles, tips	Defoliation	Deformed trees	Other animal pests	Pockets of stunted, dead or missing trees	Stem cankers	Unknown	Weather-related damage	Total	Percent Healthy
White Pine	28,671	14	838	88	1,904		360	36	15	68	31,994	89.6%
Red Pine	70,175		174	156	257	629	937	46	150	199	72,723	96.5%
Jack Pine	104,629		779	700	436	55	1,702	35	193	156	108,685	96.3%
Black Spruce	30,772	40	811	487	583	271	219	5	260	41	33,489	91.9%
Upland Spruce-Fir	11,668	282	1,056	533	606	50	450	277	99	58	15,079	77.4%
Tamarack	5,290	457	339			181	281	243	48		6,839	77.4%
Cedar	72,144	241	1,881	1,124	4,185	15	1,974	238	3,079	24	84,905	85.0%
Mixed Swamp Conifer	72,461	228	1,546	840	2,296	35	2,086	286	985	68	80,831	89.6%
Hemlock	5,001	27	237	38	151		89	124		90	5,757	86.9%
Aspen	103,294	1,609	2,203	1,015	1,521	114	768	4,796	99	337	115,756	89.2%
Paper Birch	19,874	70	679	159	529		472	1,252	8		23,043	86.2%
Lowland Aspen/Poplar	18,997	386	1,685	197	598	14	703	1,712	45	236	24,573	77.3%
Northern Hardwood	125,768	313	1,237	159	2,227	1,220	252	1,641	209	123	133,149	94.5%
Oak	4,059		20				24		14		4,117	98.6%
Lowland Hardwood	14,638	48	145	102	443		270	69	1,100	68	16,883	86.7%
Lowland Brush	76,244			77				153	241	65	76,780	99.3%
Upland Brush	7,529		95		3		35	19			7,681	98.0%
Treed Bog	44,593		17	180	50		597			7	45,444	98.1%
Bog/Muskeg	16,590			32							16,622	99.8%
Marsh	74,149				5				13		74,167	100.0%
Rock	86								8		94	91.5%
Sand Dune	572										572	100.0%
Grass	52,005		206		10		3				52,224	99.6%
Local Use	427						25				452	94.5%
Other Non-stk, Non-for Water	3,253		52		7				18		3,330	97.7%
	12,016										12,016	100.0%
Total	974,905	3,715	14,000	5,887	15,811	2,584	11,247	10,932	6,584	1,540	1,047,205	93.1%
	93.1%	0.4%	1.3%	0.6%	1.5%	0.2%	1.1%	1.0%	0.6%	0.1%		

12. Forest Diversity

Forest diversity, or landscape diversity, is a complex subject. It is a higher-order component of biodiversity, at the ecosystem level rather than the species or genetic levels. Ecosystem diversity has several components as well: structural, functional, temporal, and spatial. In this description of the LSSF, three measures of structural forest diversity have been calculated, as follows:

Shannon-Weiner Heterogeneity Index : This index is based on information theory and measures the degree of order or predictability in a system (or attribute or parameter). The value generated usually falls between 1.5 and 4.5; the larger the number, the greater the heterogeneity of the system and the larger the diversity.

Simpson's Heterogeneity Index: This index is based on the probability that two elements selected at random will belong to the same class; the higher the probability, the less the heterogeneity. Index values fall between 0 and 1. This index is most sensitive to changes in relatively abundant elements in the class. The higher the value, the larger the diversity.

Shannon Evenness Index: This index is based on a comparison of the heterogeneity of an attribute with its theoretical maximum heterogeneity. It is the ratio between the heterogeneity found in an attribute and the heterogeneity attained when all attribute elements (e.g., cover types, age classes, habitat type) are represented equally (evenly). The value of the index will be between 0 and 1, with higher values representing greater evenness.

From the operations inventory, three measures of structural forest (landscape) diversity have been calculated for the stand cover type and age-class attributes.

Table 19 presents the three diversity indices calculated for the entire LSSF and the GCF portion on the basis of the abundance of forest cover types (in terms of area). A comparison of the indices for both landbases reveals that the GCF is less diverse than the entire LSSF.

Table 19. Forest cover type diversity indices.

	LSSF	GCF
Shannon-Weiner Index	3.77	3.34
Simpson's Index	0.92	0.88
Shannon Evenness Index	0.85	0.76

Table 20 presents the diversity indices for the LSSF and the GCF, as calculated on the age-class attribute. Age-class diversity was measured with all-aged forests included (all forest) and excluded (even-aged). This was done to show the weight the all-aged forest (at 25% of the forest base) gives in homogenizing age diversity. It may be more appropriate to utilize the basal-area attribute for computing structural diversity within all-aged stands. Like forest cover diversity, age diversity is greatest over the entire LSSF rather than on the operable portion or GCF. This disparity is not unexpected, as the lands that are not considered "general commercial forest" contain the majority of the unique values (elements) being protected or managed.

Table 20. Forest age diversity indices.

Index	LSSF		GCF	
	Even-aged	All forest	Even-aged	All forest
Shannon Weiner	3.47	3.44	2.92	2.92
Simpson's	0.90	0.88	0.95	0.94
Shannon Evenness	0.89	0.84	0.69	0.66

13. Featured Wildlife Species

Feature wildlife species (FWS) are identified on a compartment basis within the operations inventory. There are nine classes for featured species describing the wildlife species or group of species for which the compartment is being managed. The classification system allows for the

identification of primary and secondary classes. Table 21 presents the area, percentage of area, number of compartments and percentage of compartments falling within the nine classes. ("None" is not considered a class as it is an absence of data.) As one might expect in upper Michigan, deer are managed on 75% of the landbase (alone and in combination). This table shows that more than half of the LSSF is being managed for a combination of wildlife species (deer and ruffed grouse, with and without rabbits). Twenty-seven percent of the LSSF is being managed for a single featured species; deer is the dominant single species. Less than 3% of the LSSF is being managed for species other than those listed. More than 12% of the compartments on the LSSF do not have an identified featured species.

Table 21. Primary featured wildlife species for the LSSF.

Featured Wildlife Species	Area % of Area (acres)		Compartments	
			No.	%
Deer	181,839	17.4%	91	18.4%
Ruffed Grouse	36,097	3.5%	18	3.6%
Rabbits	20,509	2.0%	8	1.6%
Sharptail Grouse	48,157	4.6%	22	4.5%
Turkeys		0.0%		0.0%
Kirtlands Warbler		0.0%		0.0%
Deer & Ruffed Grouse	101,624	9.7%	48	9.7%
Deer, Ruffed Grouse & Rabbits	507,570	48.5%	234	47.4%
Other	28,949	2.8%	12	2.4%
None	121,177	11.6%	61	12.3%
	1,045,922		494	

14. Conclusions

The LSSF is described by its operations inventory. The operations inventory is a detailed compartment and stand inventory that describes the LSSF in terms of forest structure, composition, and productivity. It also describes a hierarchy of administrative and land-use classifications.

The LSSF is more than 1 million acres in size and contains more than 750,000 acres of forests covering a broad range of forest cover types native to Michigan's Upper Peninsula. From the variety of influence zones, special management areas and area classes, it is estimated that the LSSF has more than half a million acres of forested land available for industrial timber production.

The operations inventory is a robust inventory system that can assist forest planners in describing the forest and its various components. It contains a large variety of attributes that describe the disposition of lands on the LSSF. The attributes of area class, influence zone, and special management areas describe divisions of the land that imply differences in land use or management emphasis. A set of guidelines describing permissible management practices will permit the proper use of such classifications in planning. Similarly, for each of the forest cover types a set of silvicultural guidelines should identify which silvicultural systems and techniques are used to manage them. The complex web of classification in the operations inventory should be backed up by management guidelines and differences in management practice on the ground.

Many of the data presented in this report are included in the proposed forest management plan for the LSSF (Callaghan *et al.* 1999). Such data are required for Canadian Standards Association (CSA) or Forest Stewardship Council (FSC) certification of a sustainable forest management system.

For CSA certification, tables are required that present the area, growing stock volume, and MAI by forest type and age class for the defined forest area (LSSF) and the operable forest (assumed to be GCF). Tables 7 through 11 meet this requirement. Using the operations inventory we have also documented the area reserved from timber production, forest health conditions, and the administrative and land-use disposition of the DFA.

For FSC certification, the international standards are fairly broad and require a description of the forest and an active program to monitor forest conditions. The operations inventory would appear to meet those requirements.

Regardless of the certification agency, all sustainable forest management systems must include a plan and a monitoring system. If the planning system provides a uniform set of tables for the forest that is revised along with the plan on a set schedule, the planning tables themselves can be

useful to those monitoring the forest condition by identifying compositional and structural changes over time.

The operations inventory contains all the necessary data elements needed to undertake forest-level planning. The information in the inventory could be used to derive an ecosystem-type classification by combining forest cover, soils and ground vegetation data. As well, the data from this inventory could be used to drive a habitat-suitability matrix similar to those used in Ontario and New York state. In terms of forest-level modeling, such models could be created from the operations inventory.

References Cited

Callaghan, B., T. Clark, C. Howard, and A. Hayes. 1999. A Forest Management Planning Guide for the Lake Superior State Forest. Report #13 from the Lake Superior State Forest Sustainable Forest Management Pilot Project. 76 p.

MDNR, 1995. Operation Inventory Field Manual

MDNR, 1997. Lake Superior State Forest Operations Inventory Data, Access database files

Appendix A. Table Structures for Operations Inventory Data

Table: Stands97

Properties

Date Created:	3/9/98 10:52:26 AM	Def. Updatable:	True
Last Updated:	4/3/98 10:27:47 AM	OrderByOn:	False
RecordCount:	26155		

Columns

Name	Type	Size	Description
fc	Text	5	forest area + compartment
fcs	Text	8	forest area + compartment + stand
fa	Text	2	forest area
co	Number (Integer)	2	county
cmp	Number (Integer)	2	compartment
std	Number (Integer)	2	stand number
std_acres	Number (Integer)	2	stand area acres
ac	Number (Byte)	1	area class (0 to 5)
iz	Number (Byte)	1	Influence zone (1 to 9)
dat_yr	Number (Integer)	2	data year
dat_sou	Number (Byte)	1	source (1 to 5)
ct	Text	1	cover type (A to Z)
sd	Number (Byte)	1	size density - stocking (0 to 9)
sc	Number (Byte)	1	stand condition (0 to 9)
moc	Number (Byte)	1	method of cut (0 to 9)
merch	Number (Byte)	1	merchantability (0 to 7)
tp	Number (Byte)	1	treatment period (0 to 9)
rs	Number (Byte)	1	reproduction status (0 to 4)
mo	Text	1	management objective (cover type)
cn	Number (Byte)	1	cultural need (0 to 9)
cm	Number (Double)	8	cultural method SIP (0 to 9)
cp	Number (Byte)	1	priority of cult. treatment (0 to 4)
tsi_ba	Number (Byte)	1	TSI basal area to be removed (1=10, 2=20)
hp	Number (Byte)	1	harvest priority
tot_ba	Number (Integer)	2	total basal area
dbh	Number (Byte)	1	average DBH
u_t	Text	1	understory type (cover type codes)
u_stk	Number (Byte)	1	understory stocking (0 to 4)
eh	Number (Byte)	1	erosion hazard (0 to 4)
w_t	Number (Byte)	1	watershed treatment (0 to 9)
sm_p	Number (Byte)	1	spec. man. area potential (0 to 9)
wp1	Number (Byte)	1	spec. wildlife practice (0 to 9)
wp2	Number (Byte)	1	spec. wildlife practice (0 to 9)
gc	Number (Byte)	1	ground cover (0 to 9)
soil	Number (Integer)	2	soil type (as per manual)
id	Number (Byte)	1	insects, disease, other probs
sp	Number (Integer)	2	species for site index
yoo	Number (Integer)	2	year of origin 3 digits (555 = uneven)
si	Number (Byte)	1	site index
cc	Number (Byte)	1	cut code (0 to 2)
t_vol	Number (Integer)	2	total volume
c_vol	Number (Integer)	2	cut volume
yoe	Number (Byte)	1	year of entry
age_cls	Text	1	age class
si_cls	Text	10	site class

Source Table: Compartment Header**Properties**

Date Created:	3/9/98 10:53:49 AM	Def. Updatable:	True
Last Updated:	3/11/98 2:49:05 PM	OrderByOn:	False
RecordCount:	494		

Columns

Name	Type	Size	Description
fc	Text	255	
fa	Text	8	forest area
co	Number (Byte)	1	county code
cmp	Number (Integer)	2	compartment number
town	Text	5	2-digit grid number & N or S
range	Text	5	2-digit grid number & E or W
sec1	Number (Byte)	1	Section 1 640-acre section
sec2	Number (Byte)	1	Section 2
sec3	Number (Byte)	1	Section 3
sec4	Text	2	Section 4
sec5	Text	2	Section 5
sec6	Text	2	Section 6
yoe	Text	1	Year of Entry
entry_int	Text	1	Entry Interval (0,1,2,5)
plan_unit	Text	3	management unit number not used
mi_surv_need	Number (Single)	4	miles of cadastral survey line needed
mi_rd_need	Number (Single)	4	miles of road system needed
mi_rd_c1	Number (Integer)	2	miles road class 1
mi_rd_c2	Number (Integer)	2	miles road class 2
mi_rd_c3	Number (Integer)	2	miles road class 3
mi_rd_c4	Number (Integer)	2	miles road class 4
mi_rd_c5	Number (Integer)	2	miles road class 5
mi_rd_c6	Number (Integer)	2	miles road class 6
mi_rd_c7	Number (Integer)	2	miles road class 7
wlf_sp	Text	255	featured wildlife species (1 to 9)
wlf_sp_pr	Text	255	priority rating - feature wildlife species (1 to 3)
wlf_hab_cond	Text	255	
ac_open_need	Text	3	wildlife openings needed - additional acreage desired
food_sp	Text	255	food planting species (0 to 9)
food_sp_need	Text	255	food planting stock needed
cvr_sp	Text	255	cover planting species
ac_cvr_sp_need	Text	255	cover planting acres needed
watershed	Text	255	watershed number
recr_comp	Text	255	recreation composite - not used
cmp_acre	Number (Double)	8	compartment acreage

Source Table: 45TVL97

Properties

Date Created:	3/9/98 10:55:38 AM	Def. Updatable:	True
Last Updated:	3/11/98 2:52:47 PM	OrderByOn:	False
RecordCount:	4975		

Columns

Name	Type	Size	Description
FCS	Text	255	Forest-Compartment-Stand Index Number
Forest	Text	255	Forest Area Code
Comp	Text	255	Compartment Number
Stand	Text	255	Stand Number
Field_Code	Text	255	Sequential Number Of Each Species-Product Field In A Stand
Species	Text	255	Tree Species Code
Product	Text	255	Commercial Product (Sawlog or Pulpwood)
Height	Number (Double)	8	Average Height Of Trees In Stand (In 8 Foot Lengths)
BA	Number (Double)	8	Average Basal Area Of Stand
Pulp_Vol_cd	Number (Double)	8	Volume Of Pulpwood In Stand (In Cords)
Saw_Vol_Mbf	Number (Double)	8	Volume Of Sawlogs In Stand (In Thousand Board Feet)
Tot_Vol_cd	Number (Double)	8	Total Product Volume In Stand (In Cords)

This report was completed as part of the requirements for a project funded by the Great Lakes Environmental Protection Fund. The objective of the project was to develop a new forest management planning system for the Lake Superior State Forest that meets sustainable forest management standards, specifically those of the Canadian Standards Association and the Forest Stewardship Council.

Project Partners:

Michigan Department of Natural Resources

Mater Engineering, Ltd.

Smartwood

BioForest Technologies Inc.

Craig Howard

Anne Hayes

Brian Callaghan (Callaghan & Associates Inc.)

Tom Clark (CMC Consulting)

Reports generated by this project include:

Project Summary: The Lake Superior State Forest Sustainable Forest Management Pilot Project

An Assessment of the Michigan Department of Natural Resources' Commitment to Sustainable Forest Management

The Lake Superior State Forest: A Description

Michigan Department of Natural Resources Operations Inventory: Survey Results

Roles and Responsibilities for Forest Management Planning in the Lake Superior State Forest

Public Participation in Forest Management Planning in the Lake Superior State Forest: Finding the Right Pathway

Establishing Criteria and Indicators for the Lake Superior State Forest

Workshop I Summary: Values and Indicators of the Lake Superior State Forest

Workshop II Summary: Establishing Targets, Practices and Responsibilities for the Indicators of the Lake Superior State Forest

Modeling Forest Management on the Lake Superior State Forest

Wildlife Habitat Projections for 15 Species in the Lake Superior State Forest

Risk Assessment of Forest Management for the Lake Superior State Forest

A Forest Management Planning Guide for the Lake Superior State Forest

Further information on this report or any of the reports listed may be obtained from:



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