



Landtype Associations of The Arenac Subsection: Subsection VII.1



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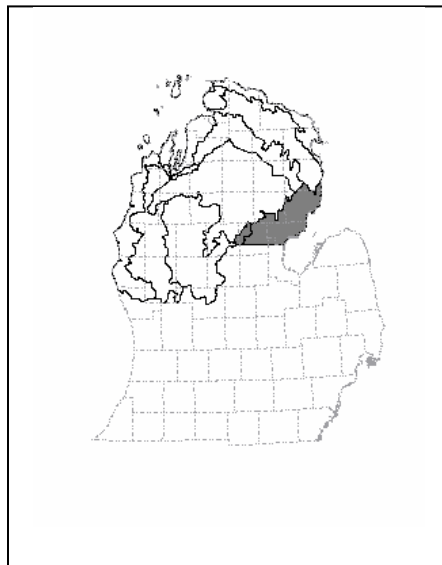
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P.O. Box 30444
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Northern Lower Michigan Ecosystem Management Project
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NORTHERN LOWER MICHIGAN ECOSYSTEM MANAGEMENT PROJECT



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Preface

Concept of Ecological Classification

The management of natural resources in Michigan is focusing increasingly on multi-resource management of ecosystems. The goal of landscape ecosystem classification (ecological classification) and mapping is to subdivide large areas of land into distinct landscape ecosystems. Landscape ecosystems must be mapped at several scales because ecosystems occur in a nested hierarchy (Bailey 1998, Barnes *et al.* 1998). Ecological classification allows natural resource managers to understand where and why ecosystems occur and provides a framework for: 1) integrated resource management and planning; 2) biological conservation; and 3) comparisons of species composition and productivity among ecosystems (Albert 1995, Albert *et al.* 1986). The current national ecological classification framework was developed by the U.S. Forest Service. The system is based on a hierarchy of landscape ecosystems including (from largest to smallest): Domain, Division, Province, Section, Subsection, Landtype Association, Ecological Land Type, and Ecological Land Type Phase (Table III-1 from Cleland 1993, Bailey 1995). In addition, we use the sub-subsection, between the subsection and the landtype association. The Section, Subsection, Sub-subsection, and Landtype Association (LTA) levels are addressed in this document.

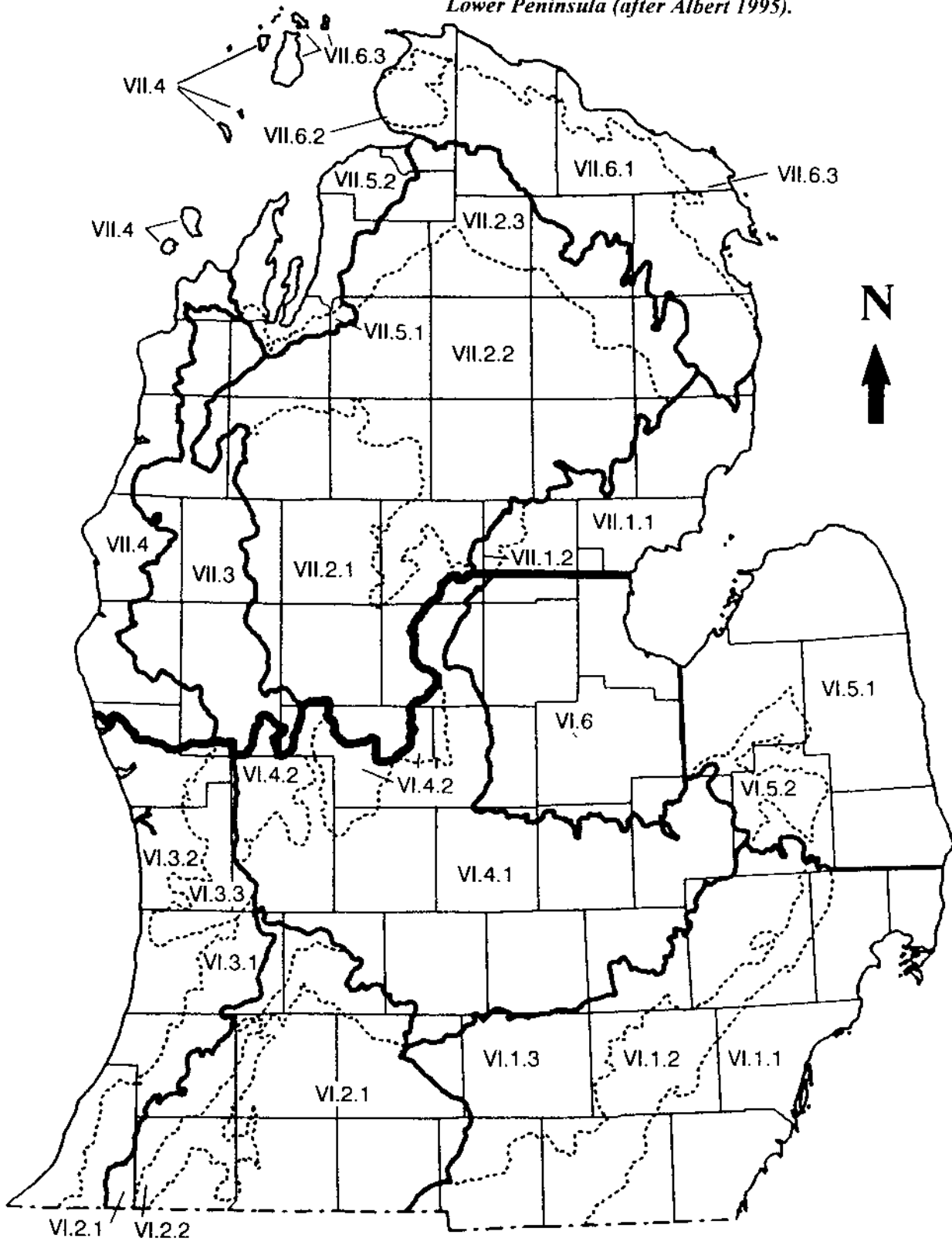
In this publication we map and describe landtype associations (LTAs) of northern Lower Michigan utilizing the landscape ecosystems approach (Albert *et al.* 1986), with minor modification by Albert (1995). These large map units are nested in even larger landscape ecosystems, or ecoregions, based largely on climate and major physiographic provinces (Bailey 1995).

This LTA classification was developed for Section VII (Northern Lacustrine-Influenced Lower Michigan). Six **subsections** occur within Section VII; these subsections are further divided into **sub-subsections** (Figure 1, after Albert 1995). The focus of the present series of reports was to delineate and describe **landtype associations** within the context of these **subsections** and **sub-subsections**.

Description of Approach

Several data layers were incorporated in the delineation of landtype associations (LTAs). Data layers were mapped to the scale of 1:63,360 (1 inch = 1 mile) to allow their comparison on a light table. As a first step, USDA soil surveys and the glacial landform map of Michigan (Farrand and Bell 1982) were interpreted to identify landform features, typically differentiated on the basis of combinations of slope class, soil texture, and drainage class characteristics, as defined by the USDA Natural Resource Conservation Service (formerly the Soil Conservation Service). These landform features were considered first approximation landtype associations (LTAs) and were compared to maps of presettlement vegetation (Comer *et al.* 1995). The assumption was that abiotic (physical) differences between adjacent LTAs should result in corresponding differences in the dominant vegetation, or at least different patterns in the mosaic of the dominant forest communities. Typically there was good agreement between presettlement vegetation and LTA boundaries, and following boundary verification, descriptions for the proposed LTA units were written.

Figure 1. Landscape Ecosystems of Michigan's Lower Peninsula (after Albert 1995).



scale in miles



Scale 1 : 2,000,000

Figure 1. *Landscape Ecosystems of Michigan's Lower Peninsula (after Albert 1995).*

SECTION VI. SOUTHERN LOWER MICHIGAN

SUBSECTION VI.1. Washtenaw

SUB-SUBSECTION VI.1.1. Maumee Lake Plain

SUB-SUBSECTION VI.1.2. Ann Arbor Moraines

SUB-SUBSECTION VI.1.3. Jackson Interlobate

SUBSECTION VI.2. Kalamazoo Interlobate

SUB-SUBSECTION VI.2.1. Battle Creek Outwash Plain

SUB-SUBSECTION VI.2.2. Cassopolis Ice-Contact Ridges

SUBSECTION VI.3. Allegan

SUB-SUBSECTION VI.3.1. Berrien Springs

SUB-SUBSECTION VI.3.2. Southern Lake Michigan Lake Plain

SUB-SUBSECTION VI.3.3. Jamestown

SUBSECTION VI.4. Ionia

SUB-SUBSECTION VI.4.1. Lansing

SUB-SUBSECTION VI.4.2. Greenville

SUBSECTION VI.5. Huron

SUB-SUBSECTION VI.5.1. Sandusky Lake Plain

SUB-SUBSECTION VI.5.2. Lum Interlobate

SUBSECTION VI.6. Saginaw Bay Lake Plain

SECTION VII. NORTHERN LACUSTRINE-INFLUENCED LOWER MICHIGAN

SUBSECTION VII.1. Arenac

SUB-SUBSECTION VII.1.1. Standish

SUB-SUBSECTION VII.1.2. Wiggins Lake

SUBSECTION VII.2. Highplains

SUB-SUBSECTION VII.2.1. Cadillac

SUB-SUBSECTION VII.2.2. Grayling Outwash Plain

SUB-SUBSECTION VII.2.3. Vanderbilt Moraines

SUBSECTION VII.3. Newaygo Outwash Plain

SUBSECTION VII.4. Manistee

SUBSECTION VII.5. Leelanau and Grand Traverse Peninsula

SUB-SUBSECTION VII.5.1. Williamsburg

SUB-SUBSECTION VII.5.2. Traverse City

SUBSECTION VII.6. Presque Isle

SUB-SUBSECTION VII.6.1. Onaway

SUB-SUBSECTION VII.6.2. Stutsmanville

SUB-SUBSECTION VII.6.3. Cheboygan

In those cases where there was not good agreement between presettlement vegetation and first approximation LTA boundaries, additional information was used to refine boundaries. First, photo-based soils maps from recent county soil surveys were studied to identify more appropriate boundary locations. The photo-based maps often allowed important differences in land use, slope class, and drainage class to be identified. Then, 1:24,000 topographic maps, with an overlay of the presettlement vegetation data, were studied to locate ecologically significant topographic boundaries. Following this refinement of boundaries, LTAs were described. The **Project References** section of this document details the sources of information used to delineate LTA boundaries.

LTAs are relatively local landscape ecosystem units based largely on glacial landforms and associated soil and climatic conditions. Glacial landforms can be viewed as large, broadly defined units, called **physiographic systems** or **major landforms**, such as outwash plains or moraines (Barnes *et al.* 1998, page 38). These large landforms can be further divided into **minor landforms**. For outwash, examples of minor landforms might be pitted outwash, broad outwash plain, or narrow outwash channel. We chose to include both major and minor landforms within our concept of LTAs by utilizing a four-digit code for LTAs. By lumping the second, third, and fourth digits, LTAs become the equivalent of the major landform (physiographic system), while differentiating LTAs with the second, third, and fourth digits is equivalent to minor landform. Different management and information needs will likely justify different scales of LTA description. We do not yet know the appropriate level of delineation for many management needs and are therefore maintaining as much information in our map codes as possible until we have adequately tested our LTAs.

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 Map 4: Arenac County

 Map 5: Bay County

 Map 6: Clare Traverse County

 Map 7: Gladwin County

 Map 8: Iosco County

 Map 9: Ogemaw County

USING THIS DOCUMENT

Landtype Associations:

Landtype associations (LTAs) are an intermediate level in the national hierarchy of ecoregional land classification. LTAs are delineated based upon similarities in glacial landform, gross soil texture and drainage classes, and natural overstory vegetation types (Cleland *et al.* 1993). The landtype associations of this subsection have been mapped and described within the context of Albert's 1995 regional landscape ecosystem classification of Michigan (Albert 1995).

Organization:

This document is organized by sub-subsection. Each sub-subsection has an introduction that provides a brief overview including general information, comparison of presettlement vegetation and current land cover by glacial landform, and hydrology. In addition, a very brief list of special plants, animals, and natural communities found within the sub-subsection is given. Following this overview, detailed descriptions of landtype associations found within the sub-subsection are given (see Format of Landtype Association Description below).

Landtype Association (LTA) maps and map codes:

Three types of LTA maps are included in Appendix C of this document: 1) a generalized LTA map showing all of Section VII; 2) a generalized LTA map of Subsection VII.1 that shows both Sub-subsection VII.1.1 and Sub-subsection VII.1.2; and 3) detailed LTA maps of each individual county that occurs within Subsection VII.1. The generalized LTA maps of Section VII and Subsection VII.1 provide a large-scale perspective of the landtype associations occurring in northern Lower Michigan and in this subsection. These maps can be interpreted from their legend. The individual county maps provide more detailed information and are appropriate for obtaining information about a specific location. On the county Landtype Association maps for this subsection, each LTA polygon is labeled with a four-digit code, which is described in Table 1. The first digit of the code identifies the major landform, the second digit identifies a landform modifier, the third digit identifies soil drainage class of the polygon, and the fourth digit identifies general soil texture (Table 1). Detailed descriptions of each LTA type are provided in the text of this document. Although they are left off for the sake of simplicity, the higher levels of mapping hierarchy should be considered part of each LTA's code. For example, an outwash plain coded 5111 located in Sub-subsection 1 in Subsection 5 of Section VII, would actually have a full name designation of VII.5.1.5111; *i.e.*, Section VII, Subsection 5, Sub-subsection 1, LTA 5111. (See Albert 1995 for discussion of Sections, Subsections, and Sub-subsection in Michigan.)

Format of Landtype Association (LTA) description:

Descriptions of each LTA are organized in the following format:

General description

Glacial and bedrock geology

Topography and soils

Presettlement vegetation

Present vegetation

Natural disturbance

Lakes and streams

Threatened and Endangered Species

The components of each heading listed above are briefly described below.

General description is a brief overview of the Landtype Association that provides information about the location of the LTA and/or some of its generalized characteristics.

Glacial and bedrock geology emphasizes bedrock types, glacial landforms, and/or glacial drift characterizing the LTA.

Topography and soils discusses detailed topographic information including slope class and presence of small landforms. Soil texture and drainage class are discussed, generally according to modern soil taxonomic terms.

Presettlement vegetation is based on an interpretation of original vegetation notes collected during the General Land Office survey of 1816-1856 (Comer et al. 1995). A table of codes used in classification and mapping of presettlement vegetation is provided (Table 2).

The total acres of each presettlement community within each LTA were obtained by performing a cross-tabulation of the two layers in a Geographic Information System (GIS) environment. A table giving acres and percent of presettlement communities is given for each LTA within each subsection or sub-subsection. However, only communities that had a cover of at least 5% are given in this table. Data for the rest of the presettlement communities within LTAs are combined and presented under the heading OTHER. A more detailed table, giving acres and percent of all presettlement communities with at least 1% cover, is given in Appendix 7.5.1.A and Appendix 7.5.2.A.

Present vegetation is based on MIRIS (Michigan Resource Information System) current land cover types. Current land cover types are state-wide and based on interpretation of 1978 color infrared photography. MIRIS maps at the scale 1:48,000 were examined for general information on areal extent of current land cover conditions. Table 3 summarizes the MIRIS current land cover types and codes.

The total acres of each MIRIS cover type within each LTA were obtained by performing a cross-tabulation of the two layers in a Geological Information System (GIS) environment. A table giving acres

and percent of MIRIS cover types is given for each LTA within each sub or sub-subsection. Only cover types that had a cover of at least 5% are given in this table. Data for the rest of the cover types are combined and presented under the heading OTHER. A more detailed table, giving acres and percent of all MIRIS cover types with at least 1% cover, is given in Appendix 7.5.1.B and Appendix 7.5.2.B.

Natural disturbance is based on comments in the General Land Office survey notes; disturbances were mapped along with the presettlement vegetation. Landform and soils play a large part in determining the type of disturbance that is found. The most common disturbances noted by the surveyors were windthrows (trees blown down by storms), fires, and beaver dams or ponds. There were also some references to human land management, generally Native American trails, fields, or settlements, but there were some early European settlements as well, typically along the coasts of the Great Lakes or along major rivers.

Lakes and streams are discussed in general terms. Stream classification is being developed by Dr. Paul Seelbach, Institute for Fisheries Research, Ann Arbor, and Dr. Mike Wiley, School of Natural Resources and Environment, University of Michigan. Likewise, general descriptions of the number and size of lakes are provided in general terms.

Threatened and Endangered Species and Exemplary Natural Communities occurring in each LTA within subsections or sub-subsections are presented in tabular form. This information was provided to alert resource professionals that special plants, animals, or natural communities may occur within a particular LTA. Relationships among elements of diversity and LTAs are not well understood in all cases. Other sources should be consulted if specific information is required.

Table 1. LTA Four digit code descriptions.

LTA's are classified using a four digit code:

- 1--- = major landform
- 1-- = landform modifier
- 1- = soil drainage class
- 1 = soil textural class

Major landform

1--- MORAINE RIDGES - STEEP OR IRREGULARLY SLOPED

landform modifiers (minor landforms):

- 11-- steep, broken topography, few kettle lakes
- 12-- steep, broken topography; many kettle lakes
- 13-- small, irregular ridges, few kettle lakes
- 14-- small, irregular ridges, many kettle lakes
- 15-- small knobs with many bedrock exposures

Major landform

2--- MORAINES OR TILL PLAINS - FLAT OR BROAD RIDGES

landform modifiers (minor landforms):

- 21-- flat plain
- 22-- large, broad ridges, few or no lakes
- 23-- large, broad ridges, many lakes
(typically linear basins eroded by glacial ice)
- 24-- drumlin field, primarily upland
- 25-- drumlin field, roughly 1/2 upland, 1/2 wetland
- 26-- drumlin field, primarily wetland surrounding small drumlins

Major landform

3--- ICE CONTACT

landform modifiers (minor landforms):

- 31-- large, steep, irregular ridges; few kettle lakes
- 32-- large, steep, irregular ridges; many kettle lakes
- 33-- small, steep, irregular ridges; few kettle lakes
- 34-- small, steep, irregular ridges; many kettle lakes
- 35-- broad ridges (not irregular or steep)

Major landform

4--- BEDROCK

landform modifiers (minor landforms):

- 41-- limestone or dolomite; bedrock pavement
- 42-- limestone or dolomite; cliffs or irregular ridges
- 43-- sandstone; flat pavement
- 44-- sandstone; cliffs
- 45-- sandstone; ridges or knobs
- 46-- basalt or volcanic ridges
- 47-- basalt or volcanic cliffs
- 48-- granitic ridges
- 49-- granitic cliffs

Major landform

5--- OUTWASH PLAIN

landform modifiers (minor landforms):

- 51-- broad, flat plain; no or few kettle lakes or wetlands
- 52-- pitted outwash
(many kettle depressions, lakes, or wetlands)
- 53-- terraced outwash features
- 54-- deltaic deposit (generally near present or historic Great Lake shoreline)
- 55-- narrow channel - floodplain
- 56-- dunes or dune field on outwash

Major landform

6--- LAKE PLAIN

landform modifiers (minor landforms):

- 61-- flat plain
- 62-- steeply eroded by stream (historic glacial or present)
- 63-- dune and swale complex (coastal)
- 64-- large, open dunes
- 65-- series of small transverse dunes in embayment

Major landform

7--- LARGE LAKES

landform modifiers (minor landforms):

- 71-- kettle lake
- 72-- solution lake (in limestone or dolomite)
- 73-- linear basin formed by glacial ice
- 74-- buried river mouth
- 75-- reservoir or man-made lake

soil drainage class modifiers:

- 1- excessively to somewhat excessively drain
- 2- well drained to moderately well drained
- 3- somewhat poorly to poorly drained
- 4- very poorly drained soils

soil texture class modifiers:

- 1 sand or loamy sand
- 2 sandy loam
- 3 loam
- 4 silt loam, clay loam, or clay
- 5 two storied soils: 12 inches or less of sand or loamy sand over silt loam, clay loam, or clay
- 6 two storied soils: 12 inches or less of sandy loam or loam over silt loam, clay loam, or clay
- 7 thin soil: 12 inches or less of sand or loamy sand over bedrock
- 8 thin soil: 12 inches or less of sandy loam or loam over bedrock
- 9 Peat or muck

Table 2. Codes used in the classification of presettlement vegetation.

WETLAND	UPLAND
NON-FORESTED WETLAND	NON-FORESTED
Emergent marsh / Meadow / Prairie	Grassland
6221 EMERGENT MARSH	31 HERBACEOUS - UPLAND GRASSLAND
6222 GREAT LAKES MARSH	Savanna
6223 INTERDUNAL WETLAND	331 LAKE PLAIN OAK OPENING
6224 WET MEADOW	332 OAK BARRENS
6225 INLAND SALT MARSH	333 PINE BARRENS
6226 LAKE PLAIN PRAIRIE	334 OAK-PINE BARRENS
6227 INLAND WET PRAIRIE	335 BUR OAK SAVANNA
6228 INTERMITTENT WETLAND	336 OAK OPENING
Mud Flats	FORESTED
6231 MARL FLATS	Northern hardwoods
Shrub-Dominated Wetland	4111 BEECH, SUGAR MAPLE, YELLOW BIRCH
6121 BOG	4115 SUGAR MAPLE, YELLOW BIRCH, FIR
6122 ALDER, WILLOW, BOG BIRCH THICKET	4117 SUGAR MAPLE, BASSWOOD
6123 BUTTONBUSH, WILLOW SWAMP	4119 BEECH, HEMLOCK
6124 PATTERNED PEATLAND	413 ASPEN, PAPER BIRCH
6125 MUSKEG	Central Hardwoods
Landscape Complex	4121 BEECH, SUGAR MAPLE, BASSWOOD
911 WOODED DUNE / SWALE COMPLEX	4122 WHITE OAK, BLACK OAK, HICKORY
FORESTED WETLAND	4123 BLACK OAK, WHITE OAK
41 Hardwood / Conifer - hardwood dominant	4124 PIN OAK, BLACK OAK
414 LOWLAND HARDWOOD	Pine
4141 ASH	4211 WHITE PINE
4142 ELM	4212 RED PINE
4143 SILVER MAPLE, RED MAPLE	4213 JACK PINE
4144 COTTONWOOD	4215 RED PINE, JACK PINE
4145 BALSAM POPLAR	4216 RED PINE, WHITE PINE
4146 ASPEN	4217 WHITE PINE, WHITE OAK
4147 WHITE BIRCH	4218 RED PINE, OAK
4148 BLACK WILLOW	4219 WHITE PINE, BEECH, RED MAPLE
42 Conifer / Hardwood - conifer dominant	Other Upland Conifer
423 LOWLAND CONIFER	4221 WHITE SPRUCE
4231 CEDAR	4222 HEMLOCK, CEDAR
4232 BLACK SPRUCE	4223 FIR, SPRUCE, CEDAR
4233 TAMARACK	4226 HEMLOCK
4234 BALSAM FIR, WHITE SPRUCE	4227 HEMLOCK, WHITE PINE
4235 BALSAM FIR	4228 HEMLOCK, SUGAR MAPLE
4236 JACK PINE	4229 HEMLOCK, YELLOW BIRCH
4237 HEMLOCK	SPARSELY VEGETATED
4238 WHITE PINE	72 BEACH, RIVERBANK
LAKES AND RIVERS	73 OPEN SAND DUNE
51 MAJOR RIVER	74 EXPOSED BEDROCK
52 LAKE OR POND	741 ALVAR
54 GREAT LAKES	742 BEDROCK GLADE
WETLAND GRADE	743 SINKHOLE
I = INTACT; well buffered, no altered hydrology	744 LIMESTONE LEDGE / OUTCROP
D = DEGRADED; lacking complete upland buffer	745 SANDSTONE LEDGE / OUTCROP
M = MANIPULATED; any activity altering hydrology	746 IGNEOUS-METAMORPHIC LEDGE / OUTCROP
E = ELIMINATED; all or most of area gone	NATURAL DISTURBANCES / CULTURAL FEATURES
	92 WILDFIRE
	93 WINDTHROW
	94 BEAVER FLOODING
	95 GREAT LAKES LEVEL CHANGE
	96 CULTURAL FEATURES
	97 JACK PINE THICKET

Table 3. Key to MIRIS land cover type codes.

1 Urban	3 Nonforested
11 Residential	31 Herbaceous
111 Multi-Family, High Rise	32 Shrub
112 Multi-Family, Low Rise	4 Forested
113 Residential	41 Deciduous
115 Mobile home park	411 Northern Hardwood
12 Commercial, Services, Institutional	412 Central Hardwood
121 Primary, Central Business District	413 Aspen/White Birch Association
	414 Lowland hardwood
122 Shopping Center, Mall	42 Coniferous
124 Secondary/neighborhood Services	421 Pine
126 Institutional	422 Other Upland Conifer
13 Industrial	423 Lowland conifer
138 Industrial park	429 Christmas Tree Plantation
14 Transportation, Communications, Utilities	5 Water
141 Air transportation	51 Stream
142 Rail Transportation	52 Lake
143 Water Transportation	53 Reservoir
144 Road Transportation	54 Great Lakes
145 Communications	6 Wetlands
146 Utilities	61 Forested
17 Extractive	611 Wooded
171 Open Pit	612 Shrub, Scrub
172 Quarry	62 Nonforested
173 Wells	621 Aquatic Bed
19 Open Land, Other	622 Emergent
193 Outdoor recreation	623 Flats
194 Cemeteries	7 Barren
2 Agricultural	72 Beach, riverbank
21 Cropland	73 Sand Dune
22 Orchards, bush fruit, vineyards, horticulture	74 Exposed Rock
23 Confined Feeding	999 Other
24 Permanent pasture	
29 General Agriculture	

SUB-SUBSECTION VII.1.1: STANDISH

Introduction

Discussion:

The 1,359 mi² (3520 km²) Standish Sub-subsection (VII.1.1) is intermediate in size compared to other sub-subsections in northern Michigan and 71% of the lands within are privately owned. Fifteen percent of land within the sub-subsection is owned by the state of Michigan and 14% is federally owned. The density of highways and county roads is intermediate compared to other sub-subsections; it ranks 5th and 6th out of 12, respectively.

The Standish Sub-subsection is separated from the southern portion of the Saginaw lake plain area on the basis of climatic differences that result in a shorter growing season. The sub-subsection is characterized by glacial lake plain occurring in a mosaic of large, poorly drained basins and extensive droughty plains. A difference of only a few feet of elevation often separates poorly drained areas from droughty areas. The northern portion of the sub-subsection is a large glacial delta with thick, droughty, sandy soils. As such, this delta is technically a lake plain. However, we have classified it as outwash plain because of its similarity in soils, pre-settlement vegetation, and current land use to other droughty outwash plains in the state. Down cutting of streams through the deltaic sands has resulted in droughty conditions. Finally, the central portion of this sub-subsection is characterized by low, level, ground moraine of fine-textured soil.

Changes in Land Use/ Land Cover by Major Landforms:

Lake plains (landtype associations beginning with the number 6) cover about 60% of the Standish Sub-subsection. The majority of the lake plain is poorly drained (80%) and the remainder is well to excessively well drained (20%). Conifer swamps dominated the poorly drained lake plains in presettlement Michigan (56%). A somewhat complicated mosaic of upland conifer forests, most often hemlock and white pine occurring together or in relatively pure stands, occurred on areas of intermediate drainage and covered another 36% of this landtype. Northern hardwoods of American beech and sugar maple occurred on localized inclusions of better drained soils and covered about 12% of the wet outwash.

Hardwood swamps have increased from only 2% of the wet lake plain in presettlement times to 24% today; replacing conifer swamps as the dominant cover type. Further, aspen/white birch forests, practically non-existent in presettlement times, now cover about 17% of this landform. Northern hardwood forests are slightly reduced in aerial extent compared to presettlement times and cover about 9% of the wet lakeplain. Following extensive drainage, the lakeplain has proven productive for agriculture and croplands (23%). Abandoned fields are, however, also relatively extensive (11%). The remaining poorly-drained lakeplain consists of a variety of cover types of minor extent.

Sixty-eight percent of well-drained lake plain was dominated by dry and dry-mesic conifer forests such as jack pine/red pine, red pine/white pine, and hemlock/white pine forests. Conifer swamps occurred on poorly-drained inclusions within the dry lakeplain and covered about 16% of the presettlement landtype. Northern hardwoods were common locally and covered about 9% of the land form. The remaining presettlement cover types were variable and of minor extent.

Today, the dry lake plain has become fragmented into a wide variety of cover types. Conifer forest, the dominant forest cover in presettlement Michigan, has been reduced from 68% to about 16% cover today. Conversely, upland deciduous forests have increased in cover from 9% in presettlement Michigan to about 37% today. Similarly, aspen/birch forests, which covered less than 1% of this landform, now cover about 9% and hardwood swamps have increased in cover from 2% to 13%. The increase in the latter two forest types largely resulted from conversion of conifer swamps in low-lying inclusions. Conifer swamps have decreased in cover from 16% presettlement to about 2% today. Further, urban development is more concentrated on the dry lakeplain, than any other landtype in the sub-subsection and covers about 14%.

Croplands cover about 1% of dry lakeplain whereas abandoned agricultural fields cover 5%. The remaining cover types are variable and of minor extent.

A significant portion (23%) of Sub-subsection VII.1.1 is characterized by till plains (landtype associations beginning with the number 2). Presettlement vegetation of the till plains was dominated by forests containing hemlock, either in association with American beech and sugar maple (35%) or mixed with white pine (39%). Mixed conifer swamps and mesic conifer forests covered about 23% of the till plain, occurring on poorly-drained inclusions.

The till plains of Sub-subsection VII.1.1 have proven well suited to agriculture and croplands now dominate the sub-subsection (38%). Another 20% of the sub-subsection is abandoned agricultural fields and pasture land. Aspen/white birch forests, which did not occur in presettlement times, now cover about 15% of the till plains. In contrast, northern hardwood forests dominated by American beech and sugar maple have decreased from 35% to 12%. Further, hemlock and white pine have been almost entirely eliminated from the remaining northern hardwood forests. Perhaps the most significant change in the till plain is the dramatic reduction of conifer-dominated forests. Forests of white pine and hemlock once occupied about 39% of the till plain but now occur on less than 1%. Further, while hardwood swamps have increased in cover from about 2% presettlement times to 9% today, conifer swamps have decreased from 23% to less than 1%.

Eight percent of Sub-subsection VII.1.1 has been mapped as dry glacial outwash plain and 5% as wet outwash plain (outwash plain landtype associations begin with the number 5). The wet outwash plain occurs entirely within the valley of the Au Sable river and, in presettlement times, supported mostly conifer swamps. Upland forests occasionally occurred on better-drained inclusions. Only about one fourth of the acreage of conifer swamps remains; the rest has been converted to a variety of cover types including (in decreasing acres): aspen/birch forests, hardwood swamp, old field, cropland, and a variety of others of minor extent.

In presettlement times, virtually all (95%) of the dry outwash plain was covered by dry conifer forests (mostly jack pine alone or with red pine) and open barrens. Although all of the open barrens have been lost, seventy percent of the area remains dominated by extensive jack pine forests. Most of the remaining area has been converted to deciduous forest and a variety of other cover types of minor extent.

Hydrology:

The hydrologic regimes of Michigan streams occur in a continuum between groundwater and surface-water dominated. Groundwater-dominated streams tend to occur in landscapes characterized by high elevation features, *e.g.* end moraines or ice contact ridges, with coarse-textured soils (sands and gravels). In contrast, surface-water dominated streams tend to occur in flat or low-gradient landscapes with finer-textured soils, *e.g.* lake plains, till plains, and low elevation, fine-textured moraines. At one extreme, groundwater-fed streams tend to have relatively constant, cool to cold temperatures, stable base flows, and low peak flows. Typical fishes supported by these streams are species of sculpin, trout, and dace. In contrast, surface water streams have fluctuating, warmer temperatures, very low base flows, and high peak flows. Such streams are commonly referred to as flashy. Examples of fishes common to surface water-streams include sunfishes, mud minnows, and bullheads.

The headwaters of most large streams in Sub-subsection VII.1.1, *e.g.* the Au Sable, Au Gres, Rifle, Tittabawassee, Pine, and Sugar Rivers, originate in the adjacent High Plains Subsection (Subsection VII.2). Because of the high elevations and coarse-textured soils of the High Plains, these large streams enter Sub-subsection VII.1.1 with groundwater-dominated characteristics, *i.e.* cool to cold temperatures and stable base flows. However, moving from their headwaters across the level, often heavy textured, lake plains of Sub-subsection VII.1.1, the streams become progressively more surface-water dominated (warmer and flashier). The streams also become larger and are often impounded, which also contributes significantly to increasing temperatures.

Streams that originate in Sub-subsection VII.1.1, *e.g.* the Kawkawlin, are among the warmest, flashiest, most surface-water controlled streams in northern Michigan. These streams form dense networks of small, tightly meandering, closely spaced channels. Further, natural drainage systems and wetlands of this sub-subsection have undergone intensive hydraulic manipulation of all kinds, including channelization/channel straightening, ditching, damming, and draining of wetlands. Most of the few natural lakes in the sub-subsection are concentrated within small areas of end moraine and ice contact topography. In addition, large impoundments occur on the Au Sable (*e.g.* Foote, Cooke, and Loud Dam Ponds), Tittibawassee, and Tobacco rivers, as well as on other smaller streams.

Special Plants, Animals, and Natural Communities:

The dominant original forest type of this sub-subsection, white pine/hemlock forest, has been virtually eliminated. Small areas of wet prairies may exist, although none are currently known. The Lake Huron shoreline provides important habitat for Pitcher's thistle (*Cirsium pitcheri*, state and federal threatened) and black terns (*Chilodrias niger*, state special concern).

Landtype Associations (LTAs)

Tables VII.1.1.A through VII.1.1.E provide summary statistics for each of the LTAs within the sub-subsection. The presettlement vegetation of each LTA is presented in Table VII.1.1.C. Current land cover types occurring within each LTA are given in Table VII.1.1.D. The occurrence of threatened or endangered plants and animals and exemplary plant communities from the Michigan Natural Features Inventory (MNFI) database are provided in Table VII.1.1.E. Following these tables, detailed descriptions of each LTA are given by major landform (see Table VII.1.1.A for page numbers of specific LTA descriptions).

Table VII.1.1.A: Brief description of the Landtype Associations (LTA) of Sub-subsection VII.1.1.

LTA	Description	Page
Broad moraines, till plains, or drumlin fields.		
		25
2123	Flat till plain; well drained loam.	25
2133	Level plain; poorly drained loam.	25
2134	Level plain; poorly drained fine-textured soil.	26
2143	Flat till plain; very poorly drained loam.	26
2333	Broad till plain ridges; many lakes; poorly drained loam.	27
Ice Contact.		
		28
3411	Small ice contact ridges; many kettle lakes; excessively drained sand.	28
Outwash plain.		
		28
5111	Broad, flat outwash plain; few kettle lakes; excessively drained sand.	28
5149	Broad, flat outwash plain; very poorly drained peat and muck.	29
5549	Narrow outwash channel; very poorly drained peat or muck.	29
Lake plain.		
		30
6111	Broad flat lake plain; excessively drained sand.	30
6121	Broad flat lake plain; well drained sand.	30
6124	Broad flat lake plain; well drained heavy textured soil.	31
6131	Broad flat lake plain; poorly drained sand.	32
6133	Broad flat lake plain; poorly drained loam.	32
6134	Broad, flat lake plain; poorly drained silt or clay.	33
6135	Broad flat lake plain; poorly drained two storied soil.	33
6141	Broad, flat lake plain; very poorly drained sand or loamy sand.	34
6144	Broad, flat lake plain; very poorly drained heavy textured soil.	34
6145	Broad, flat lake plain; very poorly drained two storied soil.	35
6149	Broad, flat lake plain; very poorly drained muck or peat.	35
6311	Dune and swale complex; excessively drained sand.	36
6421	Large open dunes; well drained sand.	36
6521	Series of small transverse dunes; very poorly drained sand.	37

Table VII.1.1.B. Area of Sub-subsection VII.1.1 LTAs.

Rank equals relative area for each LTA.

LTA	Rank	Acres	Miles²	Percent
2123	6	47308	74	5
2133	3	88715	139	10
2134	21	6711	10	1
2143	13	26183	41	3
2333	7	45200	71	5
3411	16	15842	25	2
5111	4	73163	114	8
5149	10	30409	48	3
5549	15	18570	29	2
6111	12	28592	45	3
6121	9	37377	58	4
6124	22	2718	4	<1
6131	2	124869	195	14
6133	17	15217	24	2
6134	14	21127	33	2
6135	19	7151	11	1
6141	8	39712	62	4
6144	5	50241	79	6
6145	18	9657	15	1
6149	1	166620	260	19
6311	11	28928	45	3
6421	23	801	1	<1
6521	20	6734	11	1

Table VII.1.1.C: Presettlement vegetation communities within each LTA in Sub-section VII.1.1. Communities with greater than or equal to 5% cover are reported individually. Communities with less than 5% cover are combined in the category **Other**; in this category, the codes for each presettlement community that has greater than 1% cover are listed in order of decreasing size. Codes for communities with less than 1% cover are not given. (See Table 2 for key to presettlement vegetation codes and Appendix 7.1.1.A for complete list of presettlement community data.)

LTA	Code	Description	Acres	Percent
2123		4226 Hemlock	21029	44
		4111 Beech/sugar maple	10410	22
		4119 Beech/hemlock	9610	20
		4227 Hemlock/white pine	3205	7
	Other	4211, 4231	3054	6
2133		4227 Hemlock/white pine	26040	29
		4119 Beech/hemlock	25093	28
		4111 Beech/sugar maple	16600	19
	Other	4233, 4231, 4226, 4141, 4216, 4215, 423	20982	24
2134		4227 Hemlock/white pine	5384	80
		4119 Beech/hemlock	791	12
	Other	4231, 4233, 4141	536	8
2143		4227 Hemlock/white pine	15029	57
		423 Lowland conifer	3884	15
		4111 Beech/sugar maple	3388	13
		52 Lake or pond	1638	6
	Other	4233, 4231, 4141	2244	9
2333		4227 Hemlock/white pine	28807	64
		4119 Beech/hemlock	7668	17
		423 Lowland conifer	3603	8
		52 Lake or pond	2273	5
	Other	4233, 4226	2849	6

Table VII.1.1.C continues on following page.

Table VII.1.1.C continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
3411	4216	Red pine/white pine	8654	55
	423	Lowland conifer	1505	9
	4227	Hemlock/white pine	1480	9
	4215	Red pine/jack pine	1030	7
	52	Lake or pond	815	5
	Other	4231, 4111, 4213	2357	15
5111	4213	Jack pine	31619	43
	333	Pine barrens	22926	31
	4215	Red pine/jack pine	13909	19
	Other	4226, 423	4707	6
5149	4231	Cedar swamp	10984	36
	4227	Hemlock/white pine	6657	22
	423	Lowland conifer	6057	20
	4111	Beech/sugar maple	5100	17
	Other	52	1611	5
5549	423	Lowland conifer	11041	59
	4231	Cedar swamp	4942	27
	Other	51, 4141, 4111, 4212, 4215	2587	14
6111	4215	Red pine/jack pine	8930	31
	4213	Jack pine	5454	19
	4211	White pine	3615	13
	333	Pine barrens	2550	9
	4226	Hemlock	2486	9
	4212	Red pine	1930	7
	Other	4231, 423, 4111	3627	12
	6121	4216	Red pine/white pine	16257
4119		Beech/hemlock	5861	16
4213		Jack pine	3252	9
4231		Cedar swamp	3173	8
4227		Hemlock/white pine	2535	7
4211		White pine	2177	6
Other		413, 4233, 414	4122	11
6124	4111	Beech/sugar maple	2609	96
	Other	54, 4141	109	4

Table VII.1.1.C continues on following page.

Table VII.1.1.C continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
6131	4227	Hemlock/white pine	70845	57
	4231	Cedar swamp	20989	17
	4226	Hemlock	16739	13
	Other	4119, 423, 4233, 4237, 413	16297	13
6133	4226	Hemlock	12209	80
	4233	Tamarack swamp	1001	7
	423	Lowland conifer	966	6
	Other	4231, 414, 4237, 4232	1040	7
6134	4226	Hemlock	8518	40
	4231	Cedar swamp	5654	27
	4227	Hemlock/white pine	2528	12
	4119	Beech/hemlock	1960	9
	423	Lowland conifer	1307	6
	Other	4111	1161	5
6135	4226	Hemlock	5728	80
	4227	Hemlock/white pine	670	9
	Other	414, 4233, 4213	754	11
6141	423	Lowland conifer	15259	38
	4231	Cedar swamp	7722	19
	4226	Hemlock	6341	16
	414	Lowland hardwoods	4235	11
	4119	Beech/hemlock	2768	7
	Other	4227, 6222, 4141	3388	9
6144	4231	Cedar swamp	15056	30
	4141	Black ash	12973	26
	4227	Hemlock/white pine	4836	10
	414	Lowland hardwoods	4228	8
	4233	Tamarack swamp	3094	6
	4111	Beech/sugar maple	3067	6
	Other	4226, 4238, 6222, 423, 6226	6988	14
6145	414	Lowland hardwoods	6966	72
	423	Lowland conifer	1769	18
	Other	4141, 4143, 4233, 54	922	10

Table VII.1.1.C continues on following page.

Table VII.1.1.C continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
6149		4233 Tamarack swamp	41019	25
		4231 Cedar swamp	29141	17
		423 Lowland conifer	23304	14
		4141 Black ash	22410	13
		4227 Hemlock/white pine	18083	11
		414 Lowland hardwoods	13512	8
	Other	6221, 4119, 6222	19151	11
6311		4231 Cedar swamp	7030	24
		4213 Jack pine	5545	19
		4212 Red pine	5011	17
		333 Pine barrens	3783	13
	Other	6221, 4219, 4211, 423, 4233, 54, 52, 4215, 414, 72	7559	26
6421		4226 Hemlock	568	71
		4227 Hemlock/white pine	217	27
	Other	4233	15	2
6521		4215 Red pine/jack pine	2810	42
		4211 White pine	1337	20
		4216 Red pine/white pine	1292	19
		4227 Hemlock/white pine	549	8
		4231 Cedar swamp	546	8
	Other	6221	200	3

Table VII.1.1.D: Current landcover types (MIRIS) for each LTA in Sub-subsection VII.1.1. Types with greater than or equal to 5% cover are reported individually. Types with less than 5% cover are combined in the category **Other**; in this category, the code for each cover type that has greater than 1% cover is listed in order of decreasing size. Codes for communities with less than 1% cover are not given. (See Table 3 for key to current cover codes and Appendix 7.1.1.B for complete list of presettlement community data).

LTA	Code	Description	Acres	Percent
2123	21	Cropland	25847	55
	414	Lowland hardwood forest	4379	9
	24	Permanent pasture	3754	8
	32	Shrub (upland)	3361	7
	412	Central hardwood forest	3121	7
	Other	31, 413	6677	14
2133	21	Cropland	38326	43
	413	Aspen/white birch association	12264	14
	31	Herbaceous (upland)	8231	9
	414	Lowland hardwood forest	6289	7
	411	Northern hardwood forest	5431	6
	32	Shrub (upland)	4920	6
	Other	24, 412, 612, 421	12931	15
2134	413	Aspen/white birch association	1250	19
	21	Cropland	1137	17
	31	Herbaceous (upland)	998	15
	412	Central hardwood forest	855	13
	411	Northern hardwood forest	833	13
	414	Lowland hardwood forest	647	10
	32	Shrub (upland)	519	8
	Other	144, 24	415	5
2143	411	Northern hardwood forest	6919	26
	21	Cropland	4347	17
	612	Shrub, scrub wetlands	2955	11
	413	Aspen/white birch association	2679	10
	414	Lowland hardwood forest	2021	8
	32	Shrub (upland)	1806	7
	31	Herbaceous (upland)	1747	7
	52	Lake	1680	6
	Other	113, 423	2029	8

Table VII.1.1.D continues on following page.

Table VII.1.1.D continued: Current landcover by LTA.

LTA	Code	Description	Acres	Percent
2333	413	Aspen/white birch association	11443	25
	21	Cropland	7455	17
	24	Permanent pasture	5016	11
	411	Northern hardwood forest	4287	9
	414	Lowland hardwood forest	4006	9
	31	Herbaceous (upland)	3484	8
	52	Lake	2308	5
Other	612, 113, 32		7164	16
3411	412	Central hardwood forest	4623	29
	413	Aspen/white birch association	3336	21
	421	Pine forest	1955	12
	423	Lowland conifer forest	1577	10
	113	Residential	996	6
	414	Lowland hardwood forest	899	6
	52	Lake	813	5
Other	32, 612, 31, 411, 622		1643	10
5111	421	Pine forest	50461	69
	412	Central hardwood forest	11883	16
	Other	413, 411, 113, 414, 423		10818
5149	411	Northern hardwood forest	7623	25
	414	Lowland hardwood forest	4440	15
	413	Aspen/white birch association	3934	13
	32	Shrub (upland)	2775	9
	21	Cropland	2770	9
	423	Lowland conifer forest	2721	9
	612	Shrub, scrub wetlands	2175	7
Other	31, 52, 113, 422, 24		3971	13
5549	423	Lowland conifer forest	5540	30
	53	Reservoir	3971	21
	413	Aspen/white birch association	3689	20
	414	Lowland hardwood forest	1530	8
	Other	421, 612, 412, 51, 411, 622, 621		3840

Table VII.1.1.D continues on following page.

Table VII.1.1.D continued: Current cover by LTA.

LTA	Code	Description	Acres	Percent
6111		412 Central hardwood forest	10544	37
		421 Pine forest	5891	21
		414 Lowland hardwood forest	3684	13
		141 Air transportation	1710	6
	Other	413, 113, 31, 126, 32, 411, 423, 21	6815	23
6121		411 Northern hardwood forest	12242	33
		412 Central hardwood forest	6580	18
		414 Lowland hardwood forest	3909	10
		113 Residential	3257	9
		413 Aspen/white birch association	2980	8
		422 Other upland conifer	2113	6
	Other	32, 421, 412, 52, 31, 21	6294	16
6124		414 Lowland hardwood forest	502	19
		21 Cropland	479	18
		171 Open pit mine	477	18
		31 Herbaceous (upland)	395	15
		113 Residential	326	12
		32 Shrub (upland)	262	10
	Other	412, 413, 411, 193	250	8
6131		413 Aspen/white birch association	40584	33
		414 Lowland hardwood forest	25355	20
		21 Cropland	12358	10
		411 Northern hardwood forest	10418	8
		32 Shrub (upland)	6884	6
	Other	612, 31, 412, 113, 421, 611, 53	29218	23
6133		21 Cropland	4856	32
		414 Lowland hardwood forest	2933	19
		413 Aspen/white birch association	1885	12
		31 Herbaceous (upland)	1475	10
		32 Shrub (upland)	1072	7
		411 Northern hardwood forest	811	5
	Other	412, 421, 113, 612, 24	2184	14

Table VII.1.1.D continues on following page.

Table VII.1.1.D continued: Current land cover by LTA.

LTA	Code	Description	Acre	Percent
6134	21	Cropland	13245	63
	31	Herbaceous (upland)	2160	10
	414	Lowland hardwood forest	1423	7
	32	Shrub (upland)	1058	5
	Other	24, 411, 413, 421	3240	15
6135	21	Cropland	3279	46
	414	Lowland hardwood forest	1594	22
	32	Shrub (upland)	754	10
	31	Herbaceous (upland)	546	8
	412	Central hardwood forest	497	7
Other	421, 113	516	7	
6141	414	Lowland hardwood forest	11747	30
	413	Aspen/white birch association	5804	15
	31	Herbaceous (upland)	5557	14
	21	Cropland	4332	11
	411	Northern hardwood forest	3069	8
	32	Shrub (upland)	2913	7
	Other	612, 421, 113, 53, 622, 611	6229	15
6144	21	Cropland	34009	68
	414	Lowland hardwood forest	6420	13
	Other	31, 32, 24, 412, 113	9627	19
6145	21	Cropland	5723	59
	414	Lowland hardwood forest	2229	23
	32	Shrub (upland)	581	6
	Other	31, 421, 412, 24, 113	1228	12
6149	414	Lowland hardwood forest	59698	36
	413	Aspen/white birch association	20045	12
	612	Shrub, scrub wetlands	19687	12
	21	Cropland	12397	7
	412	Central hardwood forest	10707	6
	Other	421, 622, 423, 31, 32, 611, 411, 113	43493	26

Table VII.1.1.D continues on following page.

Table VII.1.1.D continued: Current land cover by LTA.

LTA	Code	Description	Acres	Percent
6311	421	Pine forest	5454	19
	414	Lowland hardwood forest	4789	17
	113	Residential	4591	16
	411	Northern hardwood forest	2726	9
	413	Aspen/white birch association	2478	9
	412	Central hardwood forest	1851	6
	423	Lowland conifer forest	1552	5
Other	612, 622, 31, 32, 52, 193, 124		5572	19
6421	413	Aspen/white birch association	566	71
	31	Herbaceous (upland)	62	8
	411	Northern hardwood forest	62	8
	21	Cropland	47	6
	Other	414, 24	64	7
6521	412	Central hardwood forest	2674	40
	413	Aspen/white birch association	1680	25
	421	Pine forest	1371	20
	414	Lowland hardwood forest	623	9
	Other	612, 611	385	6

Table VII.1.1.E: Number of known sites for occurrences of special plants, animals, and exemplary natural communities by LTA, Sub-subsection VII.1.1 (Sb-Sbsec.), Subsection VII.1 (Sbsec.), Section VII, and for the State of Michigan. (Based on the Heritage Database provided by Michigan Natural Features Inventory).

LTA	Species or Community	Common Name	Observations within				State-Wide
			LTA	Sbsbsec	Sbsec	Section	
2123	<i>Clemmys insculpta</i>	Wood turtle	1	6	8	76	112
2124	<i>Cirsium hillii</i>	Hill's thistle	1	1	1	85	104
2133	<i>Dentaria maxima</i>	Large toothwort	1	1	1	1	5
	<i>Haliaeetus leucocephalus</i>	Bald eagle	1	14	14	113	396
	<i>Pandion haliaeetus</i>	Osprey	2	4	4	61	309
2143	<i>Gavia immer</i>	Common loon	2	9	9	129	395
	<i>Haliaeetus leucocephalus</i>	Bald eagle	1	14	14	113	396
	<i>Pandion haliaeetus</i>	Osprey	1	4	4	61	309
2333	<i>Gavia immer</i>	Common loon	4	9	9	129	395
	Great blue heron rookery	Great blue heron rookery	1	4	6	71	264
3411	<i>Clemmys insculpta</i>	Wood turtle	1	5	7	76	112
	Bog		1	1	1	44	75
5111	<i>Appalachia arcana</i>	Secretive locust	1	3	3	26	26
	<i>Dendroica kirtlandii</i>	Kirtland's warbler	3	4	4	45	46
	<i>Haliaeetus leucocephalus</i>	Bald eagle	2	14	14	113	396
	<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	4	10	10	55	213
5149	<i>Dalibarda repens</i>	False-violet	1	1	1	7	8
	<i>Gavia immer</i>	Common loon	2	9	9	129	395
	<i>Haliaeetus leucocephalus</i>	Bald eagle	1	14	14	113	396
	<i>Mesodon sayanus</i>	Spike-lip crater	1	1	1	11	12
5231	<i>Clemmys insculpta</i>	Wood turtle	1	6	8	76	112
	<i>Notropis anogenus</i>	Pugnose shiner	1	1	2	15	40
5411	<i>Accipiter cooperii</i>	Cooper's hawk	1	1	1	5	10
	<i>Dendroica kirtlandii</i>	Kirtland's warbler	1	4	4	45	46
	<i>Emydoidea blandingii</i>	Blanding's turtle	2	3	3	19	41
	<i>Rudbeckia fulgida</i> var <i>sullivantii</i>	Showy coneflower	1	1	1	1	50
	<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	1	10	10	55	213
	Northern fen		1	1	1	9	15

Table VII.1.1.C continues on following page.

Table VII.1.1.E continued: Special plants, animals, and natural communities by LTA.

LTA	Species or Community	Common Name	Observations within				State-Wide
			LTA	Sbsbsc	Sbsc	Section	
5549	<i>Acipenser fulvescens</i>	Lake sturgeon	1	1	1	8	32
	<i>Clemmys insculpta</i>	Wood turtle	1	6	8	76	112
	<i>Cypripedium arietinum</i>	Ram's head lady's-slipper	1	1	1	42	74
	<i>Haliaeetus leucocephalus</i>	Bald eagle	1	14	14	113	396
	<i>Moxostoma carinatum</i>	River redhorse	1	1	1	4	8
	<i>Moxostoma valenciennesi</i>	Greater redhorse	1	1	1	4	11
	<i>Percina copelandi</i>	Channel darter	2	7	7	16	22
	<i>Percina shumardi</i>	River darter	1	1	1	1	5
	<i>Pterospora andromedea</i>	Pine-drops	1	1	1	18	41
6111	<i>Haliaeetus leucocephalus</i>	Bald eagle	1	14	14	113	396
	<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	3	10	10	55	213
	<i>Zizania aquatica</i> var <i>aquatica</i>	Wild-rice	1	1	1	3	30
	Southern floodplain forest		1	1	1	6	22
6121	<i>Buteo lineatus</i>	Red-shouldered hawk	2	2	2	125	142
	<i>Gavia immer</i>	Common loon	1	9	9	129	395
	<i>Percina copelandi</i>	Channel darter	2	7	7	16	22
	Great blue heron rookery	Great blue heron rookery	1	4	6	71	264
6131	<i>Haliaeetus leucocephalus</i>	Bald eagle	2	14	14	113	396
	Great blue heron rookery	Great blue heron rookery	1	4	6	71	264
	Great lakes marsh		2	2	2	18	71
6145	<i>Percina copelandi</i>	Channel darter	1	7	7	16	22
6149	<i>Appalachia arcana</i>	Secretive locust	1	3	3	26	26
	<i>Clemmys insculpta</i>	Wood turtle	6	6	8	76	112
	<i>Emydoidea blandingii</i>	Blanding's turtle	1	3	3	19	41
	<i>Epilobium palustre</i>	Marsh willow-herb	1	1	1	4	27
	<i>Haliaeetus leucocephalus</i>	Bald eagle	5	14	14	113	396
	<i>Merolonche dolli</i>	Doll's merolonche	1	1	1	3	3
	<i>Percina copelandi</i>	Channel darter	1	7	7	16	22
	<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	2	10	10	55	213
	Great blue heron rookery	Great blue heron rookery	1	6	6	71	264
	6311	<i>Appalachia arcana</i>	Secretive locust	1	3	3	26
<i>Cirsium pitcheri</i>		Pitcher's thistle	3	3	3	103	141
<i>Percina copelandi</i>		Channel darter	1	7	7	16	22
<i>Trimerotropis huroniana</i>		Lake huron locust	1	2	2	13	21
Interdunal wetland			1	1	1	13	23
Wooded dune and swale			1	1	1	14	41

DESCRIPTIONS OF SUB-SUBSECTION VII.1.1 LANDTYPE ASSOCIATIONS (LTAs)

LTA 2—: Till plain.

2123: Flat till plain; well drained loam.

General description: The single unit of LTA 2123 covers about five percent of the sub-subsection's land area (Table VII.1.1.B). The unit occurs in south western Arenac and northern Bay Counties.

Glacial and bedrock geology: LTA 2123 occurs as level to gently rolling, medium-textured till plain.

Topography and soils: The most common soil type of LTA 2123, the Nester series, is characterized by shallow surface horizons of fine sandy loam, loam, or silty clay loam over clay loam. The soils are well to moderately well drained and slopes range from 0 to 7%.

Presettlement vegetation: The LTA supported extensive hemlock forests in presettlement Michigan. Forty-four percent of the LTA was covered by pure stands of hemlock (4226), whereas hemlock mixed with American beech (4119) and hemlock/white pine forests (4227) covered 20% and 7% of the LTA, respectively (Table VII.1.1.C and Appendix 7.1.1.A).

Present vegetation (MIRIS current land cover):

Over one half of the current land cover is cropland (55%), with the remaining acreage in upland and lowland deciduous forests, shrublands, and pastures (Table VII.1.1.D and Appendix VII.1.1.B). Virtually none of the original hemlock-dominated forests persist, and hemlock has also been largely eliminated where it co-occurred with hardwoods such as American beech.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: The Rifle and Pine Rivers cross this LTA and both streams have cut deep gorges into the ground moraine. In addition, many small, ephemeral, and relatively narrow streams occur and deeply dissect the till plain. Lakes are not a significant component of this LTA.

Threatened and endangered species and exemplary natural communities: Although a single observation of wood turtle is reported from this LTA, special plants and animals do not seem to show a strong relationship to the landtype.

LTA 2133: Level till plain; poorly drained loam.

General Description: The LTA occurs as a single unit and covers about 10% of the sub-subsection (Table VII.1.1.B). The landtype is located at the intersection of Ogemaw, Iosco, and Arenac Counties.

Glacial and Bedrock Geology: LTA 2133 occurs primarily on loamy till plain.

Topography and Soils: Topography is generally fairly level to strongly undulating, with low swells of well drained loamy soils surrounded by broad lowlands. Soils, predominately Selkirk silt loams, are characterized by two feet of loamy material overlying a relatively impervious clay layer. The soil has moderate to high fertility and is somewhat well drained, except in low areas where heavier-textured subsoils impede drainage. Additionally, poorly drained and saturated organic soils such as Rifle peat and Lupton muck occur locally.

Presettlement Vegetation: LTA 2123 was dominated by hemlock forests. Twenty-nine percent was hemlock/white pine forest (4227) and 28% was hemlock mixed with American beech (4119) (Table VII.1.1.C and Appendix 7.1.1.A). The remainder was covered by a wide variety of forest types of limited extent, including conifer and hardwood swamps and hemlock and red pine forests (Table VII.1.1.C and Appendix 7.1.1.A).

Present vegetation (MIRIS current land cover):

The original hemlock-dominated forests have been virtually eliminated and the species is no longer an important component of deciduous forests. Forty-three percent of the current land cover has been converted to cropland and 14% supports aspen/white birch forests (Table VII.1.1.D and Appendix VII.1.1.B). The remaining acreage consists of upland and lowland deciduous forests and shrublands.

Natural Disturbance: General land office surveyors reported small windthrows throughout this LTA.

Lakes and Streams: Streams are relatively small, have few meanders, and drain low, swampy areas between higher clayey swells. Some channelization has occurred. Many lakes occur within the LTA and these range in size from small, marshy lakes to the 300+ acre Ogemaw Lake. Other significant lakes include Hardwood Lake, Cranberry Lake, and Johnson Lake.

Threatened and Endangered Species and Exemplary Natural Communities: Along with two records for osprey and one for bald eagle, the only known record for large toothwort in Section VII occurs in this LTA (Table VII.1.1.E).

LTA 2134: Level till plain; poorly drained fine-textured soil.

General Description: The single unit of LTA 2134 in Sub-subsection VII.1.1 covers less than one percent of the sub-subsection's area (Table VII.1.1.B). The unit is located at the intersection of Gladwin, Arenac, and Ogemaw Counties.

Glacial and Bedrock Geology: LTA 2134 occurs as medium-textured till plain.

Topography and Soils: Topography is relatively level to locally undulating with wide spread shallow swales and depressions. Soils are dominated by fine-textured loam or sand over loam and are poorly drained to very poorly drained. The soils are slightly acid to neutral in reaction and usually have a high water table.

Presettlement Vegetation: Eighty percent of the LTA was covered by hemlock mixed with white pine (4227) and 12% was hemlock mixed with American beech (4119) (Table VII.1.1.C and Appendix 7.1.1.A).

The remaining surface area was covered by black ash (4141), cedar (4131), and tamarack (4233) swamps.

Present vegetation (MIRIS current land cover): LTA 2134 has been fragmented into a wide variety of cover types including aspen/white birch forests (19%), cropland (17%), and upland (26%) and lowland (10%) deciduous forests without hemlock (Table VII.1.1.D and Appendix VII.1.1.B). Virtually none of the original conifer-dominated forest persists.

Natural Disturbance: No natural disturbances were reported by GLO surveyors within the LTA.

Lakes and Streams: Lakes and streams are not a significant component of this LTA.

Threatened and Endangered Species and Exemplary Natural Communities: None reported to date

LTA 2143: Level till plain; very poorly drained fine-textured soil.

General Description: The single unit of LTA 2143 in Sub-subsection VII.1.1 covers about 3% of the sub-subsection's area (Table VII.1.1.B). The unit is located in eastern Ogemaw County.

Glacial and Bedrock Geology: LTA 2143 occurs as medium-textured till plain.

Topography and Soils: Topography is relatively level to slightly undulating, with hummocks and low sand ridges occurring locally. Soils are a complex mosaic of Ogemaw sandy loam, Rifle peat, Lupton muck, and Saugatauck sand. Ogemaw soils are somewhat poorly drained or poorly drained sand overlying loam, clay loam, silty clay loam, or light clay. Saugatauck sand is saturated much of the year and is sometimes covered by a thin organic horizon. Lupton muck and Rifle peat are deep, very poorly drained, organic soils.

Presettlement Vegetation: Fifty-seven percent of LTA 2143 supported hemlock/white pine (4227) forests and another 13% supported northern hardwood forests of American beech and sugar maple. Poorly drained areas within the LTA usually supported mixed conifer swamps (423) (Table VII.1.1.C and Appendix 7.1.1.A).

Present vegetation (MIRIS current land cover): Seventeen percent of the LTA is now in cropland with an additional 15% and 8% in herbaceous and shrub-dominated old fields, respectively (Table VII.1.1.D and Appendix VII.1.1.B). The original conifer-dominated forests have been eliminated, whereas Second-growth northern and central hardwood forests now collectively cover 26% of the LTA. Although the aspen/white birch cover type did not occur in presettlement Michigan, it now covers 19% of the landtype. Lowland hardwoods occur on 10% of the landform.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: Streams are small, low gradient, and generally have few meanders. There are many small, marshy lakes within the landform; larger lakes, *e.g.* Sage, Arrowhead, and Styles Lakes, are not uncommon.

Threatened and Endangered Species and Exemplary Natural Communities: Although single records for osprey and bald eagle are reported from this LTA, along with two records for common loon, these birds do not show strong fidelity to this landtype (Table VII.1.1.E)

LTA 2333: Broad till plain ridges; many lakes; poorly drained loam.

General description: LTA 2333 occurs as a single unit, located between Ogemaw and Iosco Counties, in Sub-subsection VII.1.1. The landtype is the seventh largest LTA in the sub-subsection (Table VII.1.1.B).

Glacial and bedrock geology: LTA 2333 occurs as moraines of fine- and course-textured materials.

Topography and soils: Topography is level but low knolls and ridges occur locally. Slopes are generally less than 6% and soils are dominated by Nester and Ogemaw loams. Nester soils are moderately well drained clay loams or silty clay loams, whereas Ogemaw soils are somewhat poorly to poorly drained sand overlying loamy or clayey subsoils. Additionally, Lupton muck and Rifle peat, both very poorly drained organic soils, occur on low areas throughout this LTA.

Presettlement Vegetation: Forests containing significant amounts of hemlock, usually mixed with white pine or American beech, covered much of this LTA (Table VII.1.1.C and Appendix 7.1.1.A). Relatively pure stands of hemlock (4226) and tamarack swamps (4233) were also locally extensive.

Present vegetation (MIRIS current land cover): LTA 2333 has been fragmented into a wide variety of cover types such as aspen/white birch forest (25%), cropland (17%), pasture (11%), and both upland and lowland deciduous forests (Table VII.1.1.D and Appendix VII.1.1.B). Virtually none of the original conifer-dominated forests persist and hemlock is no longer an important component of the hardwood forests.

Natural disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: Several large lakes, *e.g.* Loon, Long, and George Lakes, occur within the LTA as well as many small marshy lakes. Streams, which are generally narrow and only slightly meandering, tend to form steep-sloped, “v” shaped ravines; a 40 foot deep example of this occurs on Hale Creek.

Threatened and endangered species and exemplary natural communities: Although a great blue heron rookery and four records for common loon occur within this LTA, the birds do not show strong fidelity to this LTA (Table VII.1.1.E).

LTA 3—: Ice contact:

3411: Irregular ice contact ridges; many kettle lakes; excessively drained sand or loamy sand.

General description: Sub-subsection VII.1.1 contains a single unit of LTA 3411 which covers about two percent of its area (Table VII.1.1.B). The LTA occurs in Iosco County.

Glacial and bedrock geology: LTA 3411 occurs as ice contact ridges.

Topography and soil: Topography is undulating and steeply dissected by narrow ravines. Typically, soils are excessively drained, gravelly sands with low fertility. However, several broad, level wetlands with deep organic soils also occur within the LTA.

Presettlement vegetation: Over one half of this LTA supported fire-dependent red pine/white pine (4216) and red pine/jack pine (4223) forests (Table VII.1.1.C and Appendix 7.1.1.A). Less excessively drained inclusions within the landform supported hemlock/white pine forests (4227), whereas wetlands were characterized by mixed conifer swamps (423).

Present vegetation (MIRIS current land cover): Currently, LTA 3411 is dominated by American beech/sugar maple (29%) and aspen/white birch (21%) forests (Table VII.1.1.D and Appendix VII.1.1.B). Pine forests, mostly consisting of red and jack pine plantations, occur on 12% of the LTA. Ten percent of the unit still supports mixed conifer swamps.

Natural disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: Linear lakes and wetlands are common in old glacial outwash channels within the LTA. Streams usually form steep-sided ravines, *e.g.* Hope and Latter Creeks and the Au Gres River.

Threatened and endangered species and exemplary natural communities: Although the LTA contains a single occurrence of wood turtle and an exemplary bog, no strong relationships between special plants or animals and landtype was observed

LTA 5—: Outwash plain.

LTA 5111: Broad, flat outwash plain; few kettle lakes; excessively drained sand.

General Description: LTA 5111 covers about 8% of the sub-subsection (Table VII.1.1.B). The LTA is concentrated in the northern portion of the sub-subsection but a small unit occurs in Ogemaw County.

Glacial and Bedrock Geology: LTA 5111 occurs as deep sandy deposits of glacial outwash.

Topography and Soils: Topography is generally level but some dry kettle depressions occur locally. Soils are deep, excessively drained, and acidic, *e.g.* Grayling and Roselawn sands. The LTA is locally dissected by dry, steeply entrenched river channels.

Presettlement Vegetation: Presettlement vegetation was dominated by fire-dependent coniferous vegetation, *e.g.* red pine/jack pine (4215) and jack pine (4213) forests (Table VII.1.1.C and Appendix 7.1.1.A). Pine barrens were also extensive, covering 31% of the LTAs. Wetlands and poorly drained stream channels were dominated by cedar swamps (4231).

Present Vegetation (MIRIS current land cover): Conifer forests, mostly jack and red pine plantations, still dominate the LTAs, but hardwood forests of American beech and sugar maple now occur on about 16% of the landform (Table VII.1.1.D and Appendix VII.1.1.B). While the extensive pine barrens have been eliminated, localized areas of conifer-dominated wetland persist.

Natural Disturbance: GLO surveyors reported evidence of large wildfires within this LTA.

Lakes and Streams: Widely scattered kettle lakes and wetlands occur within this unit. Streams, which tend to form deep ravines within the landform, are few.

Threatened and Endangered Species and Exemplary Natural Communities: All records for the federally endangered Kirtland's warbler in Subsection VII.1 occur within these LTAs, along with single occurrences of several rare plants and animals and many records for eastern massasauga rattlesnake.

LTA 5149: Broad, flat outwash plain; very poorly drained muck or peat.

General Description: LTA 5149, which occurs as a single unit in Ogemaw County, covers about 3% of Sub-subsection VII.1.1 (Table VII.1.1.B).

Glacial geology: LTA 5149 occurs as deep peat and muck deposits in Low-lying areas of glacial outwash plain.

Topography and soils: Topography is generally very level to locally undulating. Soils are dominated by deep, very poorly drained organics such as Rifle peat and Lupton muck. However, soils become an intricate mix of poorly drained sands, loams, and clay loams in localized areas.

Presettlement vegetation: Cedar (4231) and mixed conifer swamps (423) covered about 86% of the LTA in presettlement times (Table VII.1.1.C and Appendix 7.1.1.A). Hemlock/white pine (4227) and American beech/sugar maple (4111) forests covered extensive areas on better drained inclusions within the wetlands.

Present vegetation (MIRIS current land cover): Conifer swamps now occur on only 9% of the LTA whereas hardwood (both upland and lowland), and aspen/birch forests have increased from less than 20% of the LTA in presettlement times to more than 50% today (Table VII.1.1.D and Appendix VII.1.1.B).

Natural disturbance: GLO surveyors reported the occurrence of a few small, scattered windthrows.

Lakes and streams: There are many lakes, ranging in size from 20 to 300 or more acres, within the LTA. The landtype also contains many narrow, low gradient creeks such as Vaughn, Gamble, and Houghton Creeks, as well as the Rifle River.

Threatened and endangered plants and animals and exemplary natural communities: Single occurrences for false violet and spike-lipped crater snail occur within this LTA, but there are no threatened or endangered species strongly associated with this LTA (Table VII.1.1.E).

5549: Narrow outwash channel; very poorly drained peat or muck.

General description: LTA 5549 covers about 2% of the sub-subsection's area and the single unit of the landtype occurs in Iosco County (Table VII.1.1.B).

Glacial and bedrock geology: The LTA occurs as poorly drained channels of glacial outwash and, in this case, contains the Au Sable River.

Topography and soils: The LTA occurs as a broad flat valley with steep walls. Topography is generally very level and soils are dominated by deep, very poorly drained organics, *e.g.* Rifle peat. There are also inclusions of deep, excessively drained sands, too small to map separately, within the LTA. Despite their small size, some of these inclusions supported fire-dependent coniferous vegetation.

Presettlement vegetation: Cedar (4231) and mixed conifer (423) swamps covered about 56% of the LTA in presettlement times (Table VII.1.1.C and Appendix 7.1.1.A). Red pine (4212) and red pine/jack pine (4215) forests occurred on inclusions of excessively drained sand, whereas hemlock/white pine forests occurred on areas of intermediate drainage.

Present Vegetation (MIRIS current land cover): Conifer swamps persist on 30% of the landform (Table VII.1.1.D and Appendix VII.1.1.B). Twenty-one percent of the LTA is now under reservoirs behind impoundments on the Au Sable River, while 20% is covered by aspen/white birch forests.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: There are several impoundments on the Au Sable River, *e.g.* Loud Dam, Cooke Dam, and Foot Dam Ponds.

Threatened and Endangered Species and Exemplary Natural Communities: Single occurrences of several rare fishes, *e.g.* lake sturgeon, river and greater redhorse, and channel and river darter, are reported from the Au Sable River within this LTA. In several cases, these are the only record for the species in Subsection VII (*see* Table VII.1.1.E). Additionally, a single occurrence of wood turtle occurs within this LTA.

LTA 6—: Lake plain.

LTA 6111: Broad flat lake plain; excessively drained sand.

General Description: LTA 6111 occurs in relatively small units scattered throughout the sub-subsection and covers about 3% of its surface area (Table VII.1.1.B).

Glacial and Bedrock Geology: LTA 6111 occurs as thick, sandy outwash deposits that have been reworked by glacial lakes.

Topography and Soils: Topography is generally very level but occasionally becomes undulating to hilly. Locally, the lake plain is deeply dissected by streams which form steep-sided ravines. Soils are characterized by deep, infertile, excessively drained sands, *e.g.* Grayling sand.

Presettlement Vegetation: Seventy-nine percent of the LTA supported conifer forests which occurred on a variety of soil drainage conditions and physiographic positions (Table VII.1.1.C and Appendix 7.1.1.A). Red pine/jack pine (4215), jack pine (4213), and red pine (4212) forests, along with oak/pine barrens (334), occupied the driest, most fire-prone portions of the land area, whereas relatively pure stands of hemlock (4226) occurred on imperfectly drained, sandy areas. Further, pure stands of white pine (4211) occurred on areas of intermediate drainage. (The exact ecological factors leading to establishment and perpetuation of pure hemlock and white pine stands are imperfectly understood at this time.)

Local areas of very poorly drained soils supported cedar (4231) or mixed conifer (423) swamps.

Present Vegetation (MIRIS current land cover): LTA 6111 has been fragmented into a wide variety of cover types (Table VII.1.1.D and Appendix VII.1.1.B). Hardwood forests have replaced conifer forests as the dominant cover type and occur on 37% of the landtype. Pine forests persist on about 21% of the landform, but much of this is red pine or jack pine plantation. The white pine and hemlock forests, as well pine barrens, of presettlement Michigan have been eliminated from the landtype.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: There are very few natural lakes within this LTA but several reservoirs occur. Streams, *e.g.* the Rifle River, deeply dissect the lake plain in Arenac County, forming steep-sided ravines with broad flat valley bottoms,.

Threatened and Endangered Species and Exemplary Natural Communities: The only known occurrence of wild rice in Subsection VII occurs in LTA 6111, along with three of the ten records for eastern massasauga rattlesnake (Table VII.1.1.E).

6121: Broad flat lake plain; well drained sand.

General Description: LTA 6121 occurs as a single, relatively large unit that covers about 4% of the sub-subsection's area (Table VII.1.1.B). The LTA occurs in both Ogemaw and Arenac Counties.

Glacial and Bedrock Geology: LTA 6121 occurs as thick, sandy outwash deposits that have been reworked by glacial lakes.

Topography and Soils: The topography is generally level to slightly undulating. The most extensive soil type, Ottawa sand, is moderately well drained with medium to low fertility. Deep, poorly drained organic soils, *e.g.* Rifle peat and Lupton muck, occur along streams.

Presettlement Vegetation: Much of the LTA supported forests with white pine, which occurred mixed with red pine (4216), hemlock (4226), or in relatively pure stands (4211) (Table VII.1.1.C and Appendix 7.1.1.A). In addition to its association with white pine, eastern hemlock also occurred as a co-dominant with American beech (4911); these forests covered about 16% of the LTA. The driest, most fire-prone portions of the landtype supported jack pine (4213) and red pine/jack pine (4215) forests, whereas the most poorly drained portions supported cedar swamps (4231).

Present Vegetation (MIRIS current land cover): The extensive pineries of presettlement Michigan have been

virtually eliminated from this landform and replaced by northern and central hardwood forests or the aspen/white birch association (Table VII.1.1.C and Appendix 7.1.1.A). Additionally, wetlands which were once dominated by cedar have largely been converted to hardwood swamps. Residential areas are now relatively widespread on the LTA and cover about 9% of its surface.

Natural Disturbance: GLO surveyors reported the occurrence of large wildfires and windfalls within this LTA.

Lakes and Streams: Many miles of the Rifle River, which is a relatively large, highly meandering stream with a broad, steep-sided valley, flow through this LTA. Its tributaries, *e.g.* Mansfield, Silver, and Eddy Creeks, are relatively narrow and steeply entrenched into loose sands.

Many lakes occur within the LTA, *e.g.* Skidway, Bush, Elbow, Norway, Cabin, and Silver Lake. These tend to be seepage lakes, ranging in size between 40 and 80 acres.

Threatened and Endangered Species and Exemplary Natural Communities: Both of the known occurrences for red-shouldered hawk in Subsection VII occur within this LTA, along with two records for the rare channel darter and single records for grate blue heron rookeries and loons (Table VII.1.1.E).

6124: Broad flat lake plain; well drained loamy soils.

General Description: LTA 6421 covers less than one percent of Sub-subsection VII.1.1 (Table VII.1.1B) and occurs as a single unit along the Lake Huron shore of Iosco County.

Glacial and Bedrock Geology: LTA 6124 occurs as glacial lake plain.

Topography and Soils: Topography is fairly level throughout the unit. Soils are characterized by loamy textures and moderately high fertility.

Presettlement Vegetation: Although poorly drained areas within the LTA supported mixed hardwood swamps, the landtype was almost entirely covered by northern hardwood forests of American beech and sugar maple (Table VII.1.1.C and Appendix 7.1.1.A).

Present Vegetation (MIRIS current land cover): Northern hardwood forests are no longer an important

cover type on this LTA and the upland portion has been fragmented into a wide variety of cover types including croplands (18%), open pit mines (18%), old fields (herbaceous and shrub-dominated, 15% and 10%, respectively) and residential areas (12%) (Table VII.1.1.D and Appendix VII.1.1.B). Poorly drained areas now support hardwood swamps, which cover 19% of the LTA.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: A few small, linear streams cut directly across this LTA and drain into Lake Huron. No lakes occur within the LTA.

Threatened and Endangered Species and Exemplary Natural Communities: None reported to date.

6131: Broad flat lake plain; poorly drained sand:

General Description: Landtype association 6131 is the second most extensive LTA in Sub-subsection VII.1.1 and covers about 14% of the land area (Table VII.1.1.B). The largest unit of this LTA occurs in Gladwin County, while small units occur in both Iosco and Arenac Counties.

Glacial and Bedrock Geology: LTA 6131 occurs as somewhat poorly drained sandy lake plain.

Topography and Soils: Topography is level to locally undulating. Soils are a complicated mosaic of Ogemaw gravelly sandy loam, Newton loamy sand, and Ottawa sand. In general, they are somewhat poorly drained, but conditions ranging from excessively well drained to very poorly drained occur within the LTA.

Presettlement Vegetation: Fifty-seven percent of the LTA was dominated by hemlock mixed with white pine (4227) but relatively pure stands of hemlock (4226) occurred on another 13% of the landtype (Table VII.1.1.C and Appendix 7.1.1.A). Cedar swamps (4231), which occurred on very poorly drained inclusions with deep organic soils, occurred on 17% of the LTA.

Present Vegetation (MIRIS current land cover): Aspen/white birch forests, which were of minor importance

in presettlement times, have replaced hemlock/white pine as the dominant cover type. Similarly, hardwood swamps, which were also very limited in pre-settlement times, have replaced cedar swamps on very poorly drained areas (Table VII.1.1.D and Appendix VII.1.1.B). Cropland now covers about 10% of the landtype. The remaining area supports various cover-types of minor extent.

Natural Disturbance: GLO survey notes indicate that both wildfires and windfalls occurred within this LTA.

Lakes and Streams: There are very few lakes within this LTA and these tend to be small, widely scattered, and marshy. In general, streams tend to be narrow and tightly meandering. However, the LTA contains the headwaters of the Tittabawassee River and its tributaries, which tend to be large and steeply entrenched.

Threatened and Endangered Species and Exemplary Natural Communities: The only reported occurrences of exemplary Great Lakes marshes within Subsection VII occur in LTA 6131, as do single records for heron rookeries and bald eagles (Table VII.1.1.E).

6133: Broad flat lake plain; poorly drained loam.

General Description: LTA 6133, which occurs in southern Arenac and Gladwin Counties in two relatively small units, covers about 4% of Sub-subsection VII.1.1 (Table VII.1.1.B).

Glacial and Bedrock Geology: LTA 6133 occurs as glacial lake plain.

Topography and Soils: Topography is level to slightly undulating. Soils are dominated by poorly drained and very poorly drained clay loams.

Presettlement Vegetation: Eighty percent of the LTA supported extensive, relatively pure stands of hemlock (4226) (Table VII.1.1.C and Appendix 7.1.1.A). Tamarack (4223) and mixed conifer swamps (423) occurred on the most poorly drained areas and were locally extensive.

Present Vegetation (MIRIS current land cover): Vast stands of hemlock have been virtually eliminated and thirty-two percent of the LTA now supports cropland (Table

VII.1.1.D and Appendix VII.1.1.B). Conifer-dominated swamps have also been eliminated, whereas deciduous swamps have increased from about 2% presettlement cover to 19% cover today. Likewise, aspen/white birch forests, which did not occur in presettlement times, now cover about 12% of the LTA. The remainder of the landform supports old fields of (herbaceous vegetation (10%) and shrubs (7%), northern hardwood forests (5%), and various cover types of minor extent.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: There are no lakes in this LTA and the majority of streams have been channelized.

Threatened and Endangered Species and Exemplary Natural Communities: No special plants, animals, or natural communities are reported to date

6134: Broad, flat lake plain; poorly drained silt or clay.

General Description: In Sub-subsection VII.1.1, LTA 6134 occurs only in Gladwin County and covers about 2% of the sub-subsection (Table VII.1.1.B).

Glacial and Bedrock Geology: LTA 6134 occurs as glacial lake plain.

Topography and Soils: Topography is generally level and soils are dominated by poorly drained to very poorly drained loams, silt loams, clay loams, or silty clay loams.

Presettlement Vegetation: Sixty-one percent of the LTA supported forests in which eastern hemlock was a major constituent, either growing in relatively pure stands (4226), or mixed with white pine (4227) or American beech (4119) (Table VII.1.1.C and Appendix 7.1.1.A). Cedar swamps (4223) and other conifer-dominated wetlands were also extensive, covering about 33% of the landtype.

Present Vegetation (MIRIS current land cover): Much of the LTA has been converted to agriculture (63%) or old fields of herbaceous vegetation (10%) or shrubs (5%) (Table VII.1.1.D and Appendix VII.1.1.B). Much of the original conifer-dominated wetland, has been drained or converted to hardwood swamp and virtually no hemlock-dominated forests remain.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: There are no lakes in this LTA and the majority of streams have been channelized.

Threatened and Endangered Species and Exemplary Natural Communities: No special plants, animals, or natural communities are reported to date.

6135: Broad, flat lake plain; poorly drained, two-storied soils.

General Description: Sub-subsection VII.1.1 contains a single unit of LTA 6135 which covers about 1% of the land area (Table VII.1.1.B). The LTA occurs in Iosco County.

Glacial and Bedrock Geology: LTA 6135 occurs as glacial lake plain.

Topography and Soils: Topography is generally level to slightly undulating. Soils, which are poorly drained to very poorly drained, are characterized by 18 to 42 inches of sand over loam, silt loam, clay loam, or silty clay loam.

Presettlement Vegetation: Extensive, relatively pure stands of hemlock (4226) and hemlock mixed with white pine (4227) covered 80% and 4% of this LTA respectively (Table VII.1.1.C and Appendix 7.1.1.A). The remaining area supported a variety of vegetation types including mixed hardwood and conifer swamps and also limited areas of jack pine (4213) forests.

Present Vegetation (MIRIS current land cover): The vast pineries of presettlement Michigan have been virtually eliminated and the LTA is now dominated by cropland (46%) and old fields of herbaceous vegetation (8%) or shrubs (10%) (Table VII.1.1.D and Appendix VII.1.1.B). Lowland hardwoods occur on about 22% of the LTA, whereas conifer-dominated wetlands have been eliminated.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: There are no lakes in this LTA and the majority of streams have been channelized.

Threatened and Endangered Species and Exemplary Natural Communities: No special plants, animals, or natural communities have been reported to date.

6141: Broad, flat lake plain; very poorly drained sand or loamy sand.

General description: LTA 6141 occurs in two distinct units and covers about 4% of Sub-subsection VII.1.1 (Table VII.1.1.B). The LTA occurs in Gladwin and Arenac Counties.

Glacial and bedrock geology: LTA 6141 occurs as poorly drained sands of lacustrine origin.

Topography and soils: Topography is level to very gently rolling and the sandy soils generally are saturated much of the year, *e. g.* Saugatuck and Newton sands.

Presettlement vegetation: Fifty-seven percent of the LTA supported mixed conifer swamps (423) and cedar swamps (4231), while lowland hardwoods (414) occurred on another 11% (Table VII.1.1.C and Appendix 7.1.1.A). In addition, extensive forests of hemlock (4226) and

hemlock mixed with American beech (4119) occurred on less poorly drained areas.

Present vegetation (MIRIS current land cover): Cropland now covers 11% of the LTA and old fields of herbaceous vegetation or shrubs cover 14% and 7%, respectively (Table VII.1.1.D and Appendix VII.1.1.B). Lowland hardwood forests have become extensive and now cover 30% of the landtype. In contrast, the conifer-dominated swamps of presettlement Michigan have been largely drained for agriculture or converted to lowland hardwoods. Aspen/white birch forests, which were unimportant in presettlement times, now occur on another 15% of the landform.

Natural disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: There are a few small marshy lakes in the LTA. Few streams occur in this unit, although it does contain portions of the Tittabawassee River along with several of its impoundments.

Threatened and endangered species and exemplary natural communities: No special plants, animals, or natural communities are known from this LTA to date.

6144: Broad, flat lake plain; very poorly drained silt or clay loam.

General description: The single unit of LTA 6144 in Sub-subsection VII.1.1 is quite large and covers about 6% of the land area. The unit occurs in Iosco and Arenac Counties (Table VII.1.1.B).

Glacial and bedrock geology: LTA 6144 occurs as poorly drained, heavy textured soils.

Topography and soils: Topography is level to very gently rolling. Soils are dominated by poorly drained to very poorly drained clay loams and silty clay loams. Locally, a thin veneer of sand overlies the finer textured soils.

Presettlement vegetation: The LTA supported a variety of wetlands which collectively covered more than three fourths of the landtype (Table VII.1.1.D and Appendix VII.1.1.B). Cedar swamps (4231) were the most common type but black ash (4141), mixed hardwoods (414), and tamarack (4233) swamps were also extensive. Hemlock/white pine forests (4227), which covered 10% of the LTA, were the most common upland type, while northern

hardwoods of American beech and sugar maple (4111) covered another 6%.

Present Vegetation (MIRIS current land cover): This LTA has proven extremely valuable for agriculture and almost 70% of the land area has been converted to cropland. Conifer swamps have been eliminated, whereas hardwood swamps now occur on about 13% of the surface area (Table VII.1.1.D and Appendix VII.1.1.B).

Natural disturbance: GLO surveyors reported scattered windfalls within this LTA; some of these were up to one half square mile in area.

Lakes and streams: This LTA has been extensively drained to facilitate agriculture and the drainage network is now characterized by a combination of channelized streams and drainage ditches.

Threatened and endangered species and exemplary natural communities: No special plants, animals, or natural communities are known from this LTA to date.

6145: Broad, flat lake plain; very poorly drained two storied soils.

General description: A single unit of LTA 6145 occurs in this sub-subsection and covers about 1% of the land surface. The unit occurs in central Arenac County (Table VII.1.1.B).

Glacial and bedrock geology: LTA 6145 occurs as poorly drained sands of lacustrine origin.

Topography and soils: Topography is level to very gently rolling. Soils are characterized by horizons of somewhat poorly drained to poorly drained sand over clay or silt loam.

Presettlement vegetation: Forested wetlands of mixed hardwoods (414) and mixed conifers (423) covered much

(72% and 18%, respectively) of this LTA in presettlement times (Table VII.1.1.C and Appendix 7.1.1.A).

Present Vegetation (MIRIS current land cover): This LTA has proven extremely valuable for agriculture and almost 60% of the land area has been converted to cropland, with another 6% in shrub-dominated old fields (Table VII.1.1.D and Appendix VII.1.1.B). Hardwood swamps are still fairly extensive, covering about 23% of the land area, whereas conifer-dominated wetlands have been virtually eliminated (Table VII.1.1.D and Appendix VII.1.1.B).

Natural disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: This LTA has been extensively drained to facilitate agriculture and the drainage network is characterized by channelized streams and drainage ditches.

Threatened and endangered species and exemplary natural communities: Apart from a single occurrence of channel darter, which was found in a channelized branch of Saverine Creek within this LTA, no special plants or animals are reported to date.

LTA 6149: Broad, flat lake plain; very poorly drained peat or muck.

General Description: LTA 6149 is the most extensive landtype in Sub-subsection VII.1.1 and covers about 19% of its surface are (Table VII.1.1.B). The LTA is concentrated near the Lake Huron shore in Iosco and Arenac Counties, but large units also occur in Ogemaw and Gladwin Counties.

Glacial and Bedrock Geology: LTA 6149 occurs as low, level lake plains with deep, very poorly drained, organic soils.

Topography and Soils: Topography is generally very level to locally undulating, with small sand spits and beach ridges occurring locally. The most common soil types, Lupton and Tawas mucks, are deep, poorly drained organics. Poorly drained sandy soils, such as Roscommon mucky sand, also occur locally. Small areas of excessively drained Rubicon sand, which occur on dunes and other beach features, are also mapped within this LTA.

Presettlement Vegetation: Forested wetlands dominated this LTA in presettlement Michigan (Table VII.1.1.C and Appendix 7.1.1.A). Tamarack swamp (4233), which covered 25% of the LTA, was the most extensive type, but vast areas of mixed conifer (423), cedar (4231), and black ash (4141) swamps, along with other hardwood dominated wetlands (414) also occurred. About 11% of the LTA

supported hemlock/white pine forests (4227), which appeared to occur on less poorly drained, sandier inclusions.

Present Vegetation (MIRIS current land cover): Conifer swamps have been largely eliminated from the LTA, whereas lowland hardwood forests now occur on about 36% of the area (Table VII.1.1.D and Appendix VII.1.1.B). Aspen/white birch forests, which did not occur in presettlement times, now cover about 12% of the LTA, with shrub-dominated wetlands on another 12%. Croplands are locally extensive and occur on about 7% of the unit. Hemlock/white pine forests have been eliminated, whereas Second-growth deciduous forests occur on about 6% of the LTA.

Natural Disturbance: GLO survey notes indicate that both fire and windfall occurred in this LTA.

Lakes and Streams: A few small and marshy lakes occur within this LTA. Natural drainage networks have undergone significant hydrologic manipulation and most streams have been channelized.

Threatened and Endangered Species and Exemplary Natural Communities: A variety of special plants and animals occur within this LTA, including the only records for mountain willow-herb and doll's merolonche in Sub-subsection VII.1.1 (Table VII.1.1.E).

6311 Large dune and swale complex; well drained sand.

General Description: LTA 6311 covers about 3% of Sub-subsection VII.1.1 (Table VII.1.1.B). The two units of the LTA occur along the Lake Huron shoreline in Iosco and Arenac Counties.

Glacial and Bedrock Geology: LTA 6331 occurs as a dune and swale complex dominated by excessively drained sands.

Topography and Soils: Topography is characterized by level plains with dune features oriented parallel to the Lake Huron shoreline. Small, parabolic dune features also occur locally. Soils are dominated by Eastport and Rubicon sands which are deep, somewhat acidic, excessively drained sands. Poorly drained, organic soils, e.g. Tawas and Lupton muck, occur in swales.

Presettlement Vegetation: Although a variety of cover-types occurred within this LTA, uplands were dominated by fire-dependent communities such as jack pine (4213) and red pine (4212) forests and oak/pine barrens (334) (Table VII.1.1.C and Appendix 7.1.1.A). Low-lying inclusions within the LTA were dominated by cedar swamps (4231).

Present Vegetation (MIRIS current land cover): LTA 6311 has become fragmented into a wide variety of cover types (Table VII.1.1.D and Appendix VII.1.1.B). Conifer forest now covers only 19% of the land area and pine barrens have been eliminated. In contrast, various types of hardwood forests have increased in extent. Finally, residential areas have become extensive and now cover about 16% of the land area.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: Lakes and streams are not a significant component of this LTA.

Threatened and Endangered Species and Exemplary Natural Communities: Most of the special

plants, animals, and natural communities within this LTA are strongly associated with the Great Lakes shoreline, *e.g.* Pitcher's thistle, and Lake Huron locust, as well as a record of a high quality dune and swale complex (Table VII.1.1.E).

6421 Large open dunes; well drained sand.

General Description: A single unit of LTA 6421 occurs in Sub-subsection VII.1.1 and covers less than one percent of the subsection's area (Table VII.1.1.B). The LTA occurs in southwestern Gladwin County.

Glacial and Bedrock Geology: LTA 6421 occurs as dunes of wind-deposited sand.

Topography and Soils: Soils of the LTA are dominated by deep, acidic, excessively drained Rubicon sands. Slopes are quite variable but generally range between 6 and 12%.

Presettlement Vegetation: Relatively pure stands of hemlock (4226) covered about 71% of the LTA in presettlement times, and forests of hemlock mixed with white pine (4227) covered another 27% (Table VII.1.1.C and Appendix 7.1.1.A). Tamarack swamps (4233) were the most common wetland type.

Present Vegetation (MIRIS current land cover): The hemlock forests of presettlement Michigan have been eliminated, whereas aspen/white birch forests now cover 71% of the LTA (Table VII.1.1.D and Appendix VII.1.1.B). Almost 6% of the LTA has been converted to cropland and another 8% to old fields of herbaceous vegetation. Second-growth northern hardwoods of American beech and sugar maple occur on 8% of the LTA.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: No lakes or streams occur within this LTA.

Threatened and Endangered Species and Exemplary Natural Communities: No special plants, animals, or natural communities have been reported to date.

6521 Series of small transverse dunes; very poorly drained sand.

General Description: A single unit of LTA 6521 occurs in southwestern Gladwin County and covers about one percent of the sub-subsection's total area (Table VII.1.1.B).

Glacial and Bedrock Geology: LTA 6421 is characterized by dunes of wind deposited sand.

Topography and Soils: Topography is level but relatively steep dune features are scattered throughout the unit. Soils, predominantly Crosswell and AuGres sands, are moderately well to somewhat poorly drained, rapidly permeable soils.

Presettlement Vegetation: Eighty-one percent of the LTA supported a variety of coniferous forest types (Table VII.1.1.C and Appendix 7.1.1.A) Forty-seven percent of these forests contained a significant component of white pine, either in pure stands (20%), or co-dominant with red pine (19%) or hemlock (8%). Red pine/jack pine (4215) forests were also extensive, covering 42% of the landtype. Cedar swamps (4231), covering 8% of the LTA, were the dominant wetland type.

Present Vegetation (MIRIS current land cover): Conifer forests currently occur on only about 20% of the land area, whereas hardwood forests of American beech and sugar maple, which did not occur in presettlement times, now occur on 40% (Table VII.1.1.D and Appendix VII.1.1.B). Aspen/white birch forests, an insignificant cover type in presettlement times, now cover about 25% of the area. Conifer swamps have been virtually eliminated, whereas hardwood swamps now cover about 9% of the LTA.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and Streams: There are a few small ponds within this LTA and streams are small, low gradient, and generally intermittent.

Threatened and Endangered Species and Exemplary Natural Communities: No special plants, animals, or exemplary natural communities are reported to date.

SUB-SUBSECTION VII.1.2: WIGGINS LAKE

Introduction

Discussion:

The 111 mi² (289 km²) Wiggins Lake Sub-subsection (VII.7.1.2) is the smallest sub-subsection in Northern Lower Michigan and it is almost entirely privately owned (98%). The state of Michigan owns two percent of the sub-subsection and there is no federal land. The density of highways is relatively low compared to other sub-subsections (it ranks 8th out, however, the density of county roads is very high and ranks 2nd of 12).

The Wiggins Lake Sub-subsection is almost entirely ground moraine and is a physiographic continuation of the Lansing till plain of southern lower Michigan. However, the growing season in this part of the till plain is shorter. End moraine and poorly drained outwash plains also occur very locally within this sub-subsection.

Changes in Land Use/ Land Cover by Major Landforms:

Eighty-one percent of Sub-subsection VII.1.2 is characterized by till plains (landtype associations beginning with the number 2). Presettlement vegetation of these plains was dominated (81%) by northern hardwood forests of American beech and sugar maple. In addition, the sub-subsection supported a limited amount (5%) of hemlock/white pine forest. Forested wetlands dominated by conifers occurred on eight percent of the sub-subsection and hardwood swamps occurred on 3%.

The till plains of Sub-subsection VII.1.2 were well suited to agriculture and croplands now dominate the landform, covering about 40%. Many efforts to cultivate these lands failed, however, and 24% of the till plain is in abandoned old fields. Another seven percent of the till plain supports second-growth northern hardwood forests and aspen/white birch forests occur on 13% of the till plain. Conifer-dominated wetlands have been reduced from 8% to 1% of the till plain, whereas hardwood swamps have increased from 3% to 9%.

Sixteen percent of sub-subsection VII.1.2 is poorly drained glacial outwash plain. This landform was dominated by conifer swamps and by northern hardwood forests on less poorly drained inclusions in presettlement times. Limited acreage of hardwood swamp and upland conifer forests also occurred.

The wet outwash plains have become fragmented into a wide variety of cover types. Aspen/white birch forests, which did not occur in presettlement Michigan, now cover 24% of the outwash. Hardwood swamps have become much more common than conifer swamps (25% vs. 4%). Croplands are also relatively extensive now, covering about 13% of the landform. Abandoned fields cover another 18% of the poorly drained outwash plains. The remainder of the wet outwash supports a variety of cover types of limited extent.

The end moraines of Sub-subsection VII.1.2 supported virtually all northern hardwood forests of American beech and sugar maple. Currently, the end moraines are dominated by agriculture (59%) and old fields (21%). The remaining cover types are variable and of limited extent but include: urban areas, deciduous forests, and hardwood swamps.

Hydrology:

The hydrologic regimes of Michigan streams occur in a continuum between groundwater and surface-water dominated. Groundwater-dominated streams tend to occur in landscapes characterized

by high elevation features, *e.g.* end moraines or ice contact ridges, with coarse-textured soils (sands and gravels). In contrast, surface-water dominated streams tend to occur in flat or low-gradient landscapes with finer-textured soils, *e.g.* lake plains, till plains, and low elevation, fine-textured moraines. At one extreme, groundwater-fed streams tend to have relatively constant, cool to cold temperatures, stable base flows, and low peak flows. Example fishes supported by these streams are species of sculpin, trout, and dace. In contrast, surface water streams have fluctuating, warmer temperatures, very low base flows, and high peak flows. Such streams are commonly referred to as flashy. Examples of fishes common to surface water-streams include sunfishes, mud minnows, and bullheads.

Most larger streams in Sub-subsection VII.1.2, *e.g.* the Sugar River, and tributaries of the Cedar and Tobacco Rivers, have headwaters originating in the adjacent High Plains Subsection (Subsection VII.2). Because of the high elevations and coarse-textured soils of the High Plains, these streams enter Sub-subsection VII.1.2 with groundwater-dominated characteristics, *i.e.* cool to cold temperatures and stable base flows. However, moving from their headwaters across the level to rolling, often heavy-textured, ground and end moraines of Sub-subsection VII.1.2, the streams become progressively more surface-water dominated (warmer and flashier).

Several small lakes and impoundments also occur within the sub-subsection.

Threatened and Endangered Species and Exemplary Natural Communities:

To date, no rare plant or animal species or exemplary natural communities have been identified within the Wiggins Lake Sub-subsection.

Landtype Associations (LTAs)

Tables VII.1.2.A through VII.1.2.E provide summary statistics for each of the LTAs within the sub-subsection. The presettlement vegetation of each LTA is presented in Table VII.1.2.C. Current land cover types occurring within each LTA are given in Table VII.1.2.D. The occurrence of threatened or endangered plants and animals and exemplary plant communities from the Michigan Natural Features Inventory (MNFI) database are provided in Table VII.1.2.E. Following these tables, detailed descriptions of each LTA are given by major landform (see Table VII.1.2.A for page numbers of specific LTA descriptions).

Table VII.1.2.A: Brief description of the Landtype Associations (LTA) of Sub-subsection VII.1.2.

LTA	Description	Page
	Steep or irregularly sloped moraines.	45
1123	Steep, broken moraine ridges; few kettle lakes; well drained loam.	45
	Broad moraines, till plains, or drumlin fields.	45
2123	Flat till plain; well drained loam.	45
2223	Large, broad ridges; few or no lakes; well drained loam.	46
	Outwash plain.	46
5231	Pitted outwash plain; poorly drained sand.	46
5549	Narrow outwash channel; very poorly drained peat or muck.	47

Table VII.1.2.B. Area of Sub-subsection VII.1.2 LTAs.

Rank equals relative area for each LTA.

LTA	Rank	Acres	Miles²	Percent
1123	5	2760	4	3
2123	1	70337	110	68
2223	2	14272	22	14
5231	3	10665	17	10
5549	4	5945	9	6

Table VII.1.2.C: Presettlement vegetation communities within each LTA in Sub-section VII.1.2. Communities with greater than or equal to 5% cover are reported individually. Communities with less than 5% cover are combined in the category **Other**; in this category, the codes for each presettlement community that has greater than 1% cover are listed in order of decreasing size. Codes for communities with less than 1% cover are not given. (See Table 2 for key to presettlement vegetation codes and Appendix 7.2.1.A for complete list of presettlement community data.)

LTA	Code	Description	Acres	Percent
1123	4119	Beech/hemlock	2679	97
	Other 423		82	3
2123	4119	Beech/hemlock	50502	72
	4231	Cedar swamp	4082	6
	4111	Beech/sugar maple	4062	6
	4227	Hemlock/white pine	3543	5
	Other 414, 4141, 4226, 423, 4233		8147	12
2223	4119	Beech/hemlock	13561	95
	Other 4141, 423, 4231		712	5
5231	4119	Beech/hemlock	7218	68
	423	Lowland conifer	1008	9
	4231	Cedar swamp	964	9
	4233	Tamarack swamp	638	6
	Other 4141, 52		838	8
5549	4231	Cedar swamp	3170	53
	4119	Beech/hemlock	1579	27
	4227	Hemlock/white pine	670	11
	Other 414, 4216, 4233		526	9

Table VII.1.2.D: Current landcover types (MIRIS) for each LTA in Sub-subsection VII.1.2. Types with greater than or equal to 5% cover are reported individually. Types with less than 5% cover are combined in the category **Other**; in this category, the code for each cover type that has greater than 1% cover is listed in order of decreasing size. Codes for communities with less than 1% cover are not given. (See Table 3 for key to current cover codes and Appendix 7.1.2.B for complete list of presettlement community data).

LTA	Code	Description	Acres	Percent
1123	21	Cropland	1581	57
	31	Herbaceous (upland)	415	15
	414	Lowland hardwood forest	180	7
	411	Northern hardwood forest	156	6
	32	Shrub (upland)	148	5
	Other	611, 413, 113, 421	279	10
2123	21	Cropland	23121	33
	31	Herbaceous (upland)	10937	16
	413	Aspen/white birch association	9538	14
	414	Lowland hardwood forest	6820	10
	32	Shrub (upland)	6444	9
	411	Northern hardwood forest	4043	6
Other	612, 24, 423, 611, 412, 421	9422	13	
2223	21	Cropland	8777	61
	31	Herbaceous (upland)	1203	8
	32	Shrub (upland)	838	6
	413	Aspen/white birch association	754	5
	Other	414, 113, 411, 412, 612, 193, 24, 611	2701	19
5231	414	Lowland hardwood forest	2333	22
	21	Cropland	1727	16
	32	Shrub (upland)	1077	10
	31	Herbaceous (upland)	986	9
	612	Shrub, scrub wetlands	850	8
	413	Aspen/white birch association	680	6
	113	Residential	586	5
	Other	411, 53, 611, 421, 423, 52, 24, 412	2436	23
5549	413	Aspen/white birch association	2790	47
	414	Lowland hardwood forest	1265	21
	423	Lowland conifer forest	353	6
	32	Shrub (upland)	316	5
	Other	31, 421, 412, 612, 21, 113, 52	1221	21

Table VII.1.2.E: Number of known sites for occurrences of special plants, animals, and exemplary natural communities by LTA, Sub-subsection VII.1.2 (Sb-Sbsec.), Subsection VII.1 (Sbsec.), Section VII, and for the State of Michigan. (Based on the Heritage Database provided by Michigan Natural Features Inventory).

LTA	<i>Species or Community</i>	Common Name	Observations within				State-Wide
			LTA	Sbsbsec	Sbsec	Section	
2123	<i>Clemmys insculpta</i>	Wood turtle	1	2	7	76	112
5231	<i>Clemmys insculpta</i>	Wood turtle	1	2	7	76	112
	<i>Notropis anogenus</i>	Pugnose shiner	1	1	1	15	40

DESCRIPTIONS OF SUB-SUBSECTION VII.1.2 LANDTYPE ASSOCIATIONS (LTAs)

LTA 1—: Steep, broken moraine ridges.

1123: Steep, broken moraine ridges; few kettle lakes; well drained loamy soils.

General description: A single unit of LTA 1123 occurs in Sub-subsection VII.1.2 and covers about 3% of the land area. The LTA occurs in Gladwin County.

Glacial and bedrock geology: LTA 1123 occurs as medium-textured end moraine.

Topography and soils: Topography is strongly undulating to locally steep and broken. Characteristic soils of this landtype are fine-textured and moderately well to somewhat poorly drained.

Presettlement vegetation: Presettlement vegetation was almost entirely forests of hemlock mixed with American beech (4119) (Table VII.1.2.C and Appendix 7.1.2.A).

Present vegetation (MIRIS current land cover): The original American beech/hemlock forests have been

eliminated from this LTA. Cropland now occurs on almost 60% of the landtype and other herbaceous uplands cover about 15% (Table VII.1.2.D and Appendix 7.1.2.B). Second-growth deciduous forests and lowland hardwoods occupy much of the remaining land area.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: There are a few small lakes scattered within this LTA. These are mostly less than 10 acres in size. Streams are generally small and often ephemeral.

Threatened and endangered species and exemplary natural communities: No special plants, animals, or natural communities have been reported from this LTA to date.

LTA 2—: Broad moraines and till plains.

2123: Flat till plain; well drained loam.

General description: LTA 2123 is the largest LTA in Sub-subsection VII.1.2 and covers 68% of the land area. The LTA occurs as a single unit covering parts of Clare, Gladwin, and Roscommon Counties.

Glacial and bedrock geology: LTA 2123 occurs as medium-textured till plain.

Topography and soils: Topography is level to slightly undulating. Soils of this landform are predominately Nester silt loam, which is fine-textured and moderately well to somewhat poorly drained. There are also significant inclusions of sandier soils, while deep, very poorly drained, organic soils occur in the lowest, wettest portions of the LTA.

Presettlement vegetation: Extensive forests of hemlock mixed with American beech (4119) covered much of the landform (72%) in presettlement times (Table VII.1.2.C and Appendix 7.1.2.A). Hemlock/white pine forests (4227) were locally extensive, but covered only 5% of the LTA, while American beech/sugar maple (4111) forests occurred on another 6% of the land area. Wetlands, which were locally extensive, were characterized by cedar swamps (4231).

Present vegetation (MIRIS current land cover): Hemlock-dominated forests have been eliminated from this landtype, whereas cropland now occurs on about 30% of the area and old fields of herbaceous vegetation or shrubs cover 16% and 10%, respectively (Table VII.1.2.D and Appendix 7.1.2.B). Aspen/white birch forests, which did not occur in presettlement times, now occupy about 14% of the land area, while deciduous forests occur on another 10%.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: Many lakes occur within this LTA. The largest of these, Round Lake, has a surface area of about 160 acres. Streams occupy small, narrow valleys and are often tightly meandering. The Tobacco River and its major tributaries occur within this LTA.

Threatened and endangered species and exemplary natural communities: Apart from a single record for wood turtles within this LTA, no special plants, animals, or natural communities have been reported to date.

2223: Flat till plain; well drained loam.

General description: LTA 2223 is the second largest LTA in Sub-subsection VII.1.2 and covers 68% of the land area. The LTA occurs in two large units, primarily in Gladwin County.

Glacial and bedrock geology: LTA 2223 occurs as medium-textured till plain characterized by large, broad ridges.

Topography and soils: Topography is strongly undulating to rolling or locally level. Soils of this landform are dominated by Nester silt loam, which is fine-textured and moderately well to somewhat poorly drained. Deep organic soils occur in wetlands.

Presettlement vegetation: Northern hardwood forest dominated by American beech and sugar maple (4111) was the only extensive cover type in presettlement Michigan and covered about 95% of the LTA (Table VII.1.2.C and Appendix 7.1.2.A).

Present vegetation (MIRIS current land cover): Much of the LTA has been converted to agriculture and cropland now occurs on 61% of the land area (Table VII.1.2.D and Appendix 7.1.2.B). Further, old fields of herbaceous vegetation and shrubs occur on 8% and 6% of the land area, respectively. Aspen/white birch forests, which did not occur in presettlement times, now cover 5% of the LTA.

Natural Disturbance: No natural disturbances were reported by GLO surveyors.

Lakes and streams: There are a few widely scattered marshy lakes within the LTA and most of the streams have been channelized.

Threatened and endangered species and exemplary natural communities: No special plants, animals, or natural communities have been reported from this LTA to date.

LTA 5—: Outwash Plain.

5231: Pitted outwash plain; poorly drained sand.

General description: LTA 5231, the smallest LTA in Sub-subsection VII.1.2, covers about 10% of the land area. The LTA is most concentrated in western Gladwin County.

Glacial and bedrock geology: LTA 5231 occurs as poorly drained glacial outwash plain that is pitted with ice-block depressions.

Topography and soils: Away from ice-block depressions, topography of LTA 5231 is level to locally rolling or undulating. Soils are dominated by somewhat poorly drained to poorly drained sands. The sands are sometimes underlain by loamy subsoil.

Presettlement vegetation: American Beech/hemlock forests (4119) covered about 68% of the unit in presettlement times (Table VII.1.2.C and Appendix 7.1.2.A). Much of the remaining land area was covered by mixed conifer (423), cedar (4231), and tamarack (4233) swamps.

Present vegetation (MIRIS current land cover): The vast hemlock/American beech forests of presettlement

Michigan have been eliminated from this landtype. The LTA now supports a wide variety of cover types including: hardwood swamps (22%), cropland (16%), shrub (10%) and grasslands (9%), aspen/white birch forests (6%), and residential areas (5%) (Table VII.1.2.D and Appendix 7.1.2.B).

Natural disturbance: No disturbances were reported by GLO surveyors.

Lakes and streams: Many large lakes, including Gambel, Island, Blue, and McGilvery Lakes, occur within this LTA; the largest of these, Prall Lake, is around 250 acres. Further, many small, marshy lakes also occur within the landtype. Apart from the Cedar and West Branch Cedar River, few streams occur within the landtype.

Threatened and endangered species and exemplary natural communities: Single occurrences of both wood turtle and pugnose shiner are reported from the LTA (Table VII.1.2.E)

5549: Narrow outwash channel; very poorly drained peat or muck.

General description: The single unit of LTA 5231 in Sub-subsection VII.1.2 occurs in Clare County and covers about six percent of the land area (Table VII.1.2.B).

Glacial and bedrock geology: LTA 5549 occurs as poorly drained channels of glacial outwash.

Topography and soils: Topography is generally very level. Soils are dominated by deep, very poorly drained organic mucks and peats, *e.g.* Rifle Peat, but inclusions of poorly drained sands are also mapped within this LTA.

Presettlement vegetation: Over one half of this LTA supported cedar swamps in presettlement times (4231) (Table VII.1.2.C and Appendix 7.1.2.A). Forests containing hemlock mixed with American beech (4119) or white pine (4227) occurred on less poorly drained or more sandy inclusions within this landform and collectively covered about 38% of the landform (Table VII.1.2.C and Appendix 7.1.2.A).

Present Vegetation (MIRIS current land cover): Conifer swamps now occupy only about 6% of this LTA (Table VII.1.2.D and Appendix 7.1.2.B). In contrast, aspen/white birch forest, an insignificant cover type in presettlement Michigan, now covers about 47% of the landform. Hardwood swamps, also insignificant in presettlement times, now cover about 21% of the land area.

Natural Disturbance: GLO surveyors frequently reported the occurrence of large wildfires within this LTA.

Lakes and streams: Streams are generally narrow, low gradient, and highly meandering. There are relatively few lakes associated with LTA 5549.

Threatened and Endangered Species and Exemplary Natural Communities: No special plants, animals, or natural communities have been reported from this LTA to date.

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APPENDICES

Appendix 7.1.1.A. Presettlement vegetation communities within each LTA in Subsection VII.1.1. Communities with less than 1% cover are not shown.

LTA	Code	Description	Acres	Percent
2123	4226	Hemlock	21029	44
	4111	Beech/sugar maple	10410	22
	4119	Beech/hemlock	9610	20
	4227	Hemlock/white pine	3205	7
	4211	White pine	1206	3
	4231	Cedar swamp	549	1
2133	4227	Hemlock/white pine	26040	29
	4119	Beech/hemlock	25093	28
	4111	Beech/sugar maple	16600	19
	4233	Tamarack swamp	4337	5
	4231	Cedar swamp	3912	4
	4226	Hemlock	3079	3
	4141	Black ash	2543	3
	4216	Red pine/white pine	2429	3
	4215	Red pine/jack pine	1354	2
	423	Lowland conifer	1221	1
2134	4227	Hemlock/white pine	5384	80
	4119	Beech/hemlock	791	12
	4231	Cedar swamp	282	4
	4233	Tamarack swamp	106	2
	4141	Black ash	86	1
2143	4227	Hemlock/white pine	15029	57
	423	Lowland conifer	3884	15
	4111	Beech/sugar maple	3388	13
	52	Lake or pond	1638	6
	4233	Tamarack swamp	848	3
	4231	Cedar swamp	662	3
	4141	Black ash	482	2
2333	4227	Hemlock/white pine	28807	64
	4119	Beech/hemlock	7668	17
	423	Lowland conifer	3603	8
	52	Lake or pond	2273	5
	4233	Tamarack swamp	976	2
	4226	Hemlock	773	2

Appendix 7.1.1.A continues on following page.

Appendix 7.1.1.A continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
3411	4216	Red pine/white pine	8654	55
	423	Lowland conifer	1505	9
	4227	Hemlock/white pine	1480	9
	4215	Red pine/jack pine	1030	7
	52	Lake or pond	815	5
	4231	Cedar swamp	670	4
	4111	Beech/sugar maple	598	4
	4213	Jack pine	576	4
5111	4213	Jack pine	31619	43
	333	Pine barrens	22926	31
	4215	Red pine/jack pine	13909	19
	4226	Hemlock	986	1
	423	Lowland conifer	941	1
5149	4231	Cedar swamp	10984	36
	4227	Hemlock/white pine	6657	22
	423	Lowland conifer	6057	20
	4111	Beech/sugar maple	5100	17
	52	Lake or pond	880	3
5549	423	Lowland conifer	11041	59
	4231	Cedar swamp	4942	27
	51	Major river	845	5
	4141	Black ash	722	4
	4111	Beech/sugar maple	356	2
	4212	Red pine	351	2
	4215	Red pine/jack pine	198	1
6111	4215	Red pine/jack pine	8930	31
	4213	Jack pine	5454	19
	4211	White pine	3615	13
	333	Pine barrens	2550	9
	4226	Hemlock	2486	9
	4212	Red pine	1930	7
	4231	Cedar swamp	1401	5
	423	Lowland conifer	979	3
	4111	Beech/sugar maple	788	3

Appendix 7.1.1.A continues on following page.

Appendix 7.1.1.A continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
6121	4216	Red pine/white pine	16257	43
	4119	Beech/hemlock	5861	16
	4213	Jack pine	3252	9
	4231	Cedar swamp	3173	8
	4227	Hemlock/white pine	2535	7
	4211	White pine	2177	6
	413	Aspen/white birch	1418	4
	4233	Tamarack swamp	1228	3
	414	Lowland hardwoods	625	2
6124	4111	Beech/sugar maple	2609	94
	54	Great lakes	79	3
	4141	Black ash	77	3
6131	4227	Hemlock/white pine	70845	57
	4231	Cedar swamp	20989	17
	4226	Hemlock	16739	13
	4119	Beech/hemlock	3356	3
	423	Lowland conifer	3212	3
	4233	Tamarack swamp	2738	2
	4237	Hemlock	1362	1
	413	Aspen/white birch	1260	1
6133	4226	Hemlock	12209	80
	4233	Tamarack swamp	1001	7
	423	Lowland conifer	966	6
	4231	Cedar swamp	400	3
	414	Lowland hardwoods	252	2
	4237	Hemlock	171	1
	4232	Black spruce	163	1
6134	4226	Hemlock	8518	40
	4231	Cedar swamp	5654	27
	4227	Hemlock/white pine	2528	12
	4119	Beech/hemlock	1960	9
	423	Lowland conifer	1307	6
	4111	Beech/sugar maple	815	4

Appendix 7.1.1.A continues on following page.

Appendix 7.1.1.A continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
6135	4226	Hemlock	6283	80
	4227	Hemlock/white pine	735	9
	414	Lowland hardwoods	344	4
	4233	Tamarack swamp	236	3
	4213	Jack pine	160	2
6141	423	Lowland conifer	16737	38
	4231	Cedar swamp	8470	19
	4226	Hemlock	6955	16
	414	Lowland hardwoods	4646	11
	4119	Beech/hemlock	3036	7
	4227	Hemlock/white pine	1862	4
	6222	Great lakes marsh	661	2
	4141	Black ash	561	1
6144	4231	Cedar swamp	16514	30
	4141	Black ash	14230	26
	4227	Hemlock/white pine	5304	10
	414	Lowland hardwoods	4637	8
	4233	Tamarack swamp	3393	6
	4111	Beech/sugar maple	3364	6
	4226	Hemlock	2678	5
	4238	White pine	1455	3
	6222	Great lakes marsh	745	1
	423	Lowland conifer	640	1
	6226	Lakeplain prairie	575	1
	6145	414	Lowland hardwoods	7641
423		Lowland conifer	1941	18
4141		Black ash	526	5
4143		Silver/red maple	179	2
4233		Tamarack swamp	144	1
54		Great lakes	114	1

Appendix 7.1.1.A continues on following page.

Appendix 7.1.1.A continued: Presettlement vegetation by LTA.

LTA	Code	Description	Acres	Percent
6149	4233	Tamarack swamp	41019	25
	4231	Cedar swamp	29141	17
	423	Lowland conifer	23304	14
	4141	Black ash	22410	13
	4227	Hemlock/white pine	18083	11
	414	Lowland hardwoods	13512	8
	6221	Emergent marsh	4821	3
	4119	Beech/hemlock	1932	1
	6222	Great lakes marsh	1893	1
6311	4231	Cedar swamp	7030	24
	4213	Jack pine	5545	19
	4212	Red pine	5011	17
	333	Pine barrens	3783	12
	6221	Emergent marsh	1376	5
	4219	White pine/beechn/red maple	1357	5
	4211	White pine	1095	4
	423	Lowland conifer	840	3
	4233	Tamarack swamp	820	3
	54	Great lakes	613	2
	52	Lake or pond	524	2
	4215	Red pine/jack pine	492	2
	414	Lowland hardwoods	398	1
	72	Beach, Riverbank	341	1
6421	4226	Hemlock	568	71
	4227	Hemlock/white pine	217	27
	4233	Tamarack swamp	10	1
6521	4215	Red pine/jack pine	2810	42
	4211	White pine	1337	20
	4216	Red pine/white pine	1292	19
	4227	Hemlock/white pine	549	8
	4231	Cedar swamp	546	8
	6221	Emergent marsh	94	1

Appendix 7.1.1.B. Current landcover types (MIRIS) for each LTA in Subsection VII.1.1. Types with less than 1% cover are not shown.

LTA	Code	Description	Acres	Percent
2123	21	Cropland	25847	55
	414	Lowland hardwood forest	4379	9
	24	Permanent pasture	3754	8
	32	Shrub (upland)	3361	7
	412	Central hardwood forest	3121	7
	31	Herbaceous (upland)	2221	5
	413	Aspen/white birch association	2192	5
2133	21	Cropland	38326	43
	413	Aspen/white birch association	12264	14
	31	Herbaceous (upland)	8231	9
	414	Lowland hardwood forest	6289	7
	411	Northern hardwood forest	5431	6
	32	Shrub (upland)	4920	6
	24	Permanent pasture	3595	4
	412	Central hardwood forest	2955	3
	612	Shrub, scrub wetlands	1910	2
	421	Pine forest	1218	1
2134	413	Aspen/white birch association	1250	19
	21	Cropland	1137	17
	31	Herbaceous (upland)	998	15
	412	Central hardwood forest	855	13
	411	Northern hardwood forest	833	13
	414	Lowland hardwood forest	647	10
	32	Shrub (upland)	519	8
	144	Road transportation	84	1
	24	Permanent pasture	79	1

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current land cover by LTA.

LTA	Code	Description	Acres	Percent
2143	411	Northern hardwood forest	6919	26
	21	Cropland	4347	17
	612	Shrub, scrub wetlands	2955	11
	413	Aspen/white birch association	2679	10
	414	Lowland hardwood forest	2021	8
	32	Shrub (upland)	1806	7
	31	Herbaceous (upland)	1747	7
	52	Lake	1680	6
	113	Residential	684	3
423	Lowland conifer forest	610	2	
2333	413	Aspen/white birch association	11443	25
	21	Cropland	7455	17
	24	Permanent pasture	5016	11
	411	Northern hardwood forest	4287	9
	414	Lowland hardwood forest	4006	9
	31	Herbaceous (upland)	3484	8
	52	Lake	2308	5
	612	Shrub, scrub wetlands	1809	4
	113	Residential	1614	4
32	Shrub (upland)	1577	3	
3411	412	Central hardwood forest	4623	29
	413	Aspen/white birch association	3336	21
	421	Pine forest	1955	12
	423	Lowland conifer forest	1577	10
	113	Residential	996	6
	414	Lowland hardwood forest	899	6
	52	Lake	813	5
	32	Shrub (upland)	376	2
	612	Shrub, scrub wetlands	292	2
	31	Herbaceous (upland)	250	2
	411	Northern hardwood forest	237	1
	622	Emergent marsh	175	1

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current land cover by LTA.

LTA	Code	Description	Acres	Percent
5111	421	Pine forest	50461	69
	412	Central hardwood forest	11883	16
	413	Aspen/white birch association	3217	4
	411	Northern hardwood forest	1997	3
	113	Residential	1278	2
	414	Lowland hardwood forest	1112	2
	423	Lowland conifer forest	1021	1
5149	411	Northern hardwood forest	7623	25
	414	Lowland hardwood forest	4440	15
	413	Aspen/white birch association	3934	13
	32	Shrub (upland)	2775	9
	21	Cropland	2770	9
	423	Lowland conifer forest	2721	9
	612	Shrub, scrub wetlands	2175	7
	31	Herbaceous (upland)	1194	4
	52	Lake	954	3
	113	Residential	521	2
	422	Other upland conifer	462	2
	24	Permanent pasture	447	1
	5549	423	Lowland conifer forest	5540
53		Reservoir	3971	21
413		Aspen/white birch association	3689	20
414		Lowland hardwood forest	1530	8
421		Pine forest	786	4
612		Shrub, scrub wetlands	764	4
412		Central hardwood forest	507	3
51		Stream	358	2
411		Northern hardwood forest	235	1
622		Emergent marsh	193	1
621		Aquatic bed	190	1

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current land cover by LTA.

LTA	Code	Description	Acres	Percent
6111	412	Central hardwood forest	10544	37
	421	Pine forest	5891	21
	414	Lowland hardwood forest	3684	13
	141	Air transportation	1710	6
	413	Aspen/white birch association	1381	5
	113	Residential	919	3
	31	Herbaceous (upland)	803	3
	126	Institutional	655	2
	32	Shrub (upland)	445	2
	411	Northern hardwood forest	353	1
	423	Lowland conifer forest	353	1
	21	Cropland	343	1
	6121	411	Northern hardwood forest	12242
412		Central hardwood forest	6580	18
414		Lowland hardwood forest	3909	10
113		Residential	3257	9
413		Aspen/white birch association	2980	8
422		Other upland conifer	2113	6
32		Shrub (upland)	1856	5
421		Pine forest	986	3
612		Shrub, scrub wetlands	885	2
52		Lake	702	2
31		Herbaceous (upland)	586	2
21		Cropland	423	1
6124	414	Lowland hardwood forest	502	19
	21	Cropland	479	18
	171	Open pit mine	477	18
	31	Herbaceous (upland)	395	15
	113	Residential	326	12
	32	Shrub (upland)	262	10
	412	Central hardwood forest	119	4
	413	Aspen/white birch association	37	1
	411	Northern hardwood forest	35	1
	193	Outdoor recreation	30	1

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current land cover by LTA.

LTA	Code	Description	Acres	Percent
6131	413	Aspen/white birch association	40584	33
	414	Lowland hardwood forest	25355	20
	21	Cropland	12358	10
	411	Northern hardwood forest	10418	8
	32	Shrub (upland)	6884	6
	612	Shrub, scrub wetlands	5231	4
	31	Herbaceous (upland)	4992	4
	412	Central hardwood forest	3971	3
	113	Residential	3143	3
	421	Pine forest	2763	2
	611	Wooded wetlands	1458	1
	53	Reservoir	1413	1
	6133	21	Cropland	4856
414		Lowland hardwood forest	2933	19
413		Aspen/white birch association	1885	12
31		Herbaceous (upland)	1475	10
32		Shrub (upland)	1072	7
411		Northern hardwood forest	811	5
412		Central hardwood forest	689	5
421		Pine forest	341	2
113		Residential	259	2
612		Shrub, scrub wetlands	215	1
24		Permanent pasture	200	1
6134	21	Cropland	13245	63
	31	Herbaceous (upland)	2160	10
	414	Lowland hardwood forest	1423	7
	32	Shrub (upland)	1058	5
	24	Permanent pasture	1035	5
	411	Northern hardwood forest	647	3
	413	Aspen/white birch association	571	3
	421	Pine forest	541	3

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current cover by LTA.

LTA	Code	Description	Acres	Percent
6135	21	Cropland	3279	46
	414	Lowland hardwood forest	1594	22
	32	Shrub (upland)	754	10
	31	Herbaceous (upland)	546	8
	412	Central hardwood forest	497	7
	421	Pine forest	282	4
	113	Residential	116	2
6141	414	Lowland hardwood forest	11747	30
	413	Aspen/white birch association	5804	15
	31	Herbaceous (upland)	5557	14
	21	Cropland	4332	11
	411	Northern hardwood forest	3069	8
	32	Shrub (upland)	2913	7
	612	Shrub, scrub wetlands	1302	3
	421	Pine forest	1080	3
	113	Residential	914	2
	53	Reservoir	731	2
	622	Emergent marsh	526	1
	611	Wooded wetlands	445	1
6144	21	Cropland	34009	68
	414	Lowland hardwood forest	6420	13
	31	Herbaceous (upland)	2325	5
	32	Shrub (upland)	2231	4
	24	Permanent pasture	1171	2
	412	Central hardwood forest	833	2
	113	Residential	746	1
6145	21	Cropland	5723	59
	414	Lowland hardwood forest	2229	23
	32	Shrub (upland)	581	6
	31	Herbaceous (upland)	423	4
	421	Pine forest	161	2
	412	Central hardwood forest	148	2
	24	Permanent pasture	136	1
113	Residential	128	1	

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current cover by LTA.

LTA	Code	Description	Acres	Percent
6149	414	Lowland hardwood forest	59698	36
	413	Aspen/white birch association	20045	12
	612	Shrub, scrub wetlands	19687	12
	21	Cropland	12397	7
	412	Central hardwood forest	10707	6
	421	Pine forest	7705	5
	622	Emergent marsh	6328	4
	423	Lowland conifer forest	6318	4
	31	Herbaceous (upland)	5829	4
	32	Shrub (upland)	4290	3
	611	Wooded wetlands	3810	2
	411	Northern hardwood forest	3247	2
	113	Residential	1955	1
	6311	421	Pine forest	5454
414		Lowland hardwood forest	4789	17
113		Residential	4591	16
411		Northern hardwood forest	2726	9
413		Aspen/white birch association	2478	9
412		Central hardwood forest	1851	6
423		Lowland conifer forest	1552	5
612		Shrub, scrub wetlands	1436	5
622		Emergent marsh	929	3
31		Herbaceous (upland)	447	2
32		Shrub (upland)	440	2
52		Lake	430	1
193		Outdoor recreation	348	1
124		Secondary/ Neighborhood Services	331	1
6421	413	Aspen/white birch association	566	71
	31	Herbaceous (upland)	62	8
	411	Northern hardwood forest	62	8
	21	Cropland	47	6
	414	Lowland hardwood forest	32	4
	24	Permanent pasture	25	3

Appendix 7.1.1.B continues on following page.

Appendix 7.1.1.B continued: Current cover by LTA.

LTA	Code	Description	Acres	Percent
6521	412	Central hardwood forest	2674	40
	413	Aspen/white birch association	1680	25
	421	Pine forest	1371	20
	414	Lowland hardwood forest	623	9
	612	Shrub, scrub wetlands	198	3
	611	Wooded wetlands	84	1

Appendix 7.1.2.A. Presettlement vegetation communities within each LTA in Subsection 7.1.2. Communities with less than 1% cover are not shown.

LTA	Code	Description	Acres	Percent
1123	4119	Beech/hemlock	2679	97
	423	Lowland conifer	72	3
2123	4119	Beech/hemlock	50502	72
	4231	Cedar swamp	4082	6
	4111	Beech/sugar maple	4062	6
	4227	Hemlock/white pine	3543	5
	4226	Hemlock	1804	3
	423	Lowland conifer	1727	2
	414	Lowland hardwoods	1053	1
	4233	Tamarack swamp	845	1
	4141	Black ash	707	1
2223	4119	Beech/hemlock	13561	95
	423	Lowland conifer	222	2
	4231	Cedar swamp	208	1
	4141	Black ash	175	1
5231	4119	Beech/hemlock	7218	68
	423	Lowland conifer	1008	9
	4231	Cedar swamp	964	9
	4233	Tamarack swamp	638	6
	4141	Black ash	400	4
	52	Lake or pond	213	2
5549	4231	Cedar swamp	3170	53
	4119	Beech/hemlock	1579	27
	4227	Hemlock/white pine	670	11
	414	Lowland hardwoods	161	3
	4233	Tamarack swamp	151	3
	4216	Red pine/white pine	128	2

Appendix 7.1.2.B. Current landcover types (MIRIS) for each LTA in Subsection VII.1.2. Types with less than 1% cover are not shown.

LTA	Code	Description	Acres	Percent
1123	21	Cropland	1581	57
	31	Herbaceous (upland)	415	15
	414	Lowland hardwood forest	180	7
	411	Northern hardwood forest	156	6
	32	Shrub (upland)	148	5
	611	Wooded wetlands	57	2
	413	Aspen/white birch association	54	2
	113	Residential	49	2
	421	Pine forest	42	2
2123	21	Cropland	23121	33
	31	Herbaceous (upland)	10937	16
	413	Aspen/white birch association	9538	14
	414	Lowland hardwood forest	6820	10
	32	Shrub (upland)	6444	9
	411	Northern hardwood forest	4043	6
	612	Shrub, scrub wetlands	1977	3
	24	Permanent pasture	1404	2
	423	Lowland conifer forest	1129	2
	611	Wooded wetlands	1129	2
	412	Central hardwood forest	993	1
	421	Pine forest	729	1
			0	
2223	21	Cropland	8777	61
	31	Herbaceous (upland)	1203	8
	32	Shrub (upland)	838	6
	413	Aspen/white birch association	754	5
	414	Lowland hardwood forest	482	3
	113	Residential	450	3
	411	Northern hardwood forest	358	3
	412	Central hardwood forest	316	2
	612	Shrub, scrub wetlands	240	2
	193	Outdoor recreation	178	1
	24	Permanent pasture	173	1
	611	Wooded wetlands	173	1

Appendix 7.1.2.B continues on following page.

Appendix 7.1.2.B continued; Current land cover by LTA.

LTA	Code	Description	Acres	Percent
5231	414	Lowland hardwood forest	2333	22
	21	Cropland	1727	16
	32	Shrub (upland)	1077	10
	31	Herbaceous (upland)	986	9
	612	Shrub, scrub wetlands	850	8
	413	Aspen/white birch association	680	6
	113	Residential	586	5
	411	Northern hardwood forest	462	4
	53	Reservoir	432	4
	611	Wooded wetlands	376	4
	421	Pine forest	267	3
	423	Lowland conifer forest	255	2
	52	Lake	190	2
	24	Permanent pasture	143	1
	412	Central hardwood forest	128	1
	5549	413	Aspen/white birch association	2790
414		Lowland hardwood forest	1265	21
423		Lowland conifer forest	353	6
32		Shrub (upland)	316	5
31		Herbaceous (upland)	272	5
421		Pine forest	208	3
412		Central hardwood forest	195	3
612		Shrub, scrub wetlands	180	3
21		Cropland	119	2
113		Residential	89	1
52		Lake	74	1

APPENDIX C: Landtype Association Maps

Map 1: Landtype Associations of Section VII

**Map 2: Landtype Associations of Sub-subsection VII.1.1
and VII.1.2**

**Maps 3 – 9: Individual Maps of Counties Within
Subsection VII.1:**

Map 3: Alcona County

Map 4: Arenac County

Map 5: Bay County

Map 6: Clare Traverse County

Map 7: Gladwin County

Map 8: Iosco County


Map 9: Ogemaw County

Landtype Associations of Arenac Subsection VII.1

























Northern Lower Michigan

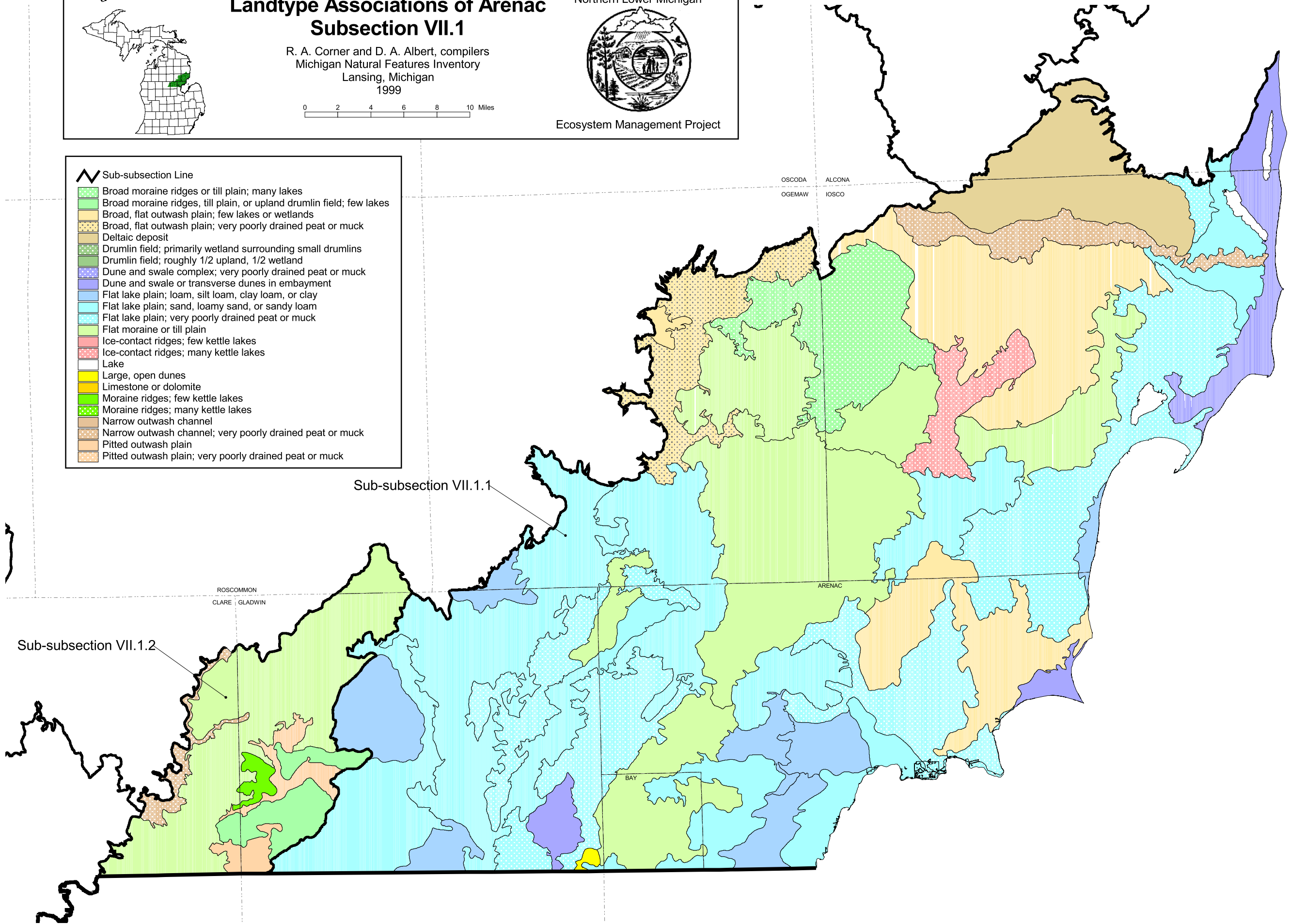
R. A. Corner and D. A. Albert, compilers
Michigan Natural Features Inventory
Lansing, Michigan
1999

0 2 4 6 8 10 Miles



Ecosystem Management Project

- Sub-subsection Line
-  Broad moraine ridges or till plain; many lakes
 -  Broad moraine ridges, till plain, or upland drumlin field; few lakes
 -  Broad, flat outwash plain; few lakes or wetlands
 -  Broad, flat outwash plain; very poorly drained peat or muck
 -  Deltaic deposit
 -  Drumlin field; primarily wetland surrounding small drumlins
 -  Drumlin field; roughly 1/2 upland, 1/2 wetland
 -  Dune and swale complex; very poorly drained peat or muck
 -  Dune and swale or transverse dunes in embayment
 -  Flat lake plain; loam, silt loam, clay loam, or clay
 -  Flat lake plain; sand, loamy sand, or sandy loam
 -  Flat lake plain; very poorly drained peat or muck
 -  Flat moraine or till plain
 -  Ice-contact ridges; few kettle lakes
 -  Ice-contact ridges; many kettle lakes
 -  Lake
 -  Large, open dunes
 -  Limestone or dolomite
 -  Moraine ridges; few kettle lakes
 -  Moraine ridges; many kettle lakes
 -  Narrow outwash channel
 -  Narrow outwash channel; very poorly drained peat or muck
 -  Pitted outwash plain
 -  Pitted outwash plain; very poorly drained peat or muck



Landtype Associations of Bay County, Michigan

Prepared by Dennis A. Albert and Richard A. Corner
Michigan Natural Features Inventory
Lansing, Michigan
1998



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Scale 1:180,000



 LTA Boundary
 Sub-subsection Boundary

Landtype Associations of Gladwin County, Michigan

Prepared by Dennis A. Albert and Richard A. Corner
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Lansing, Michigan
1998



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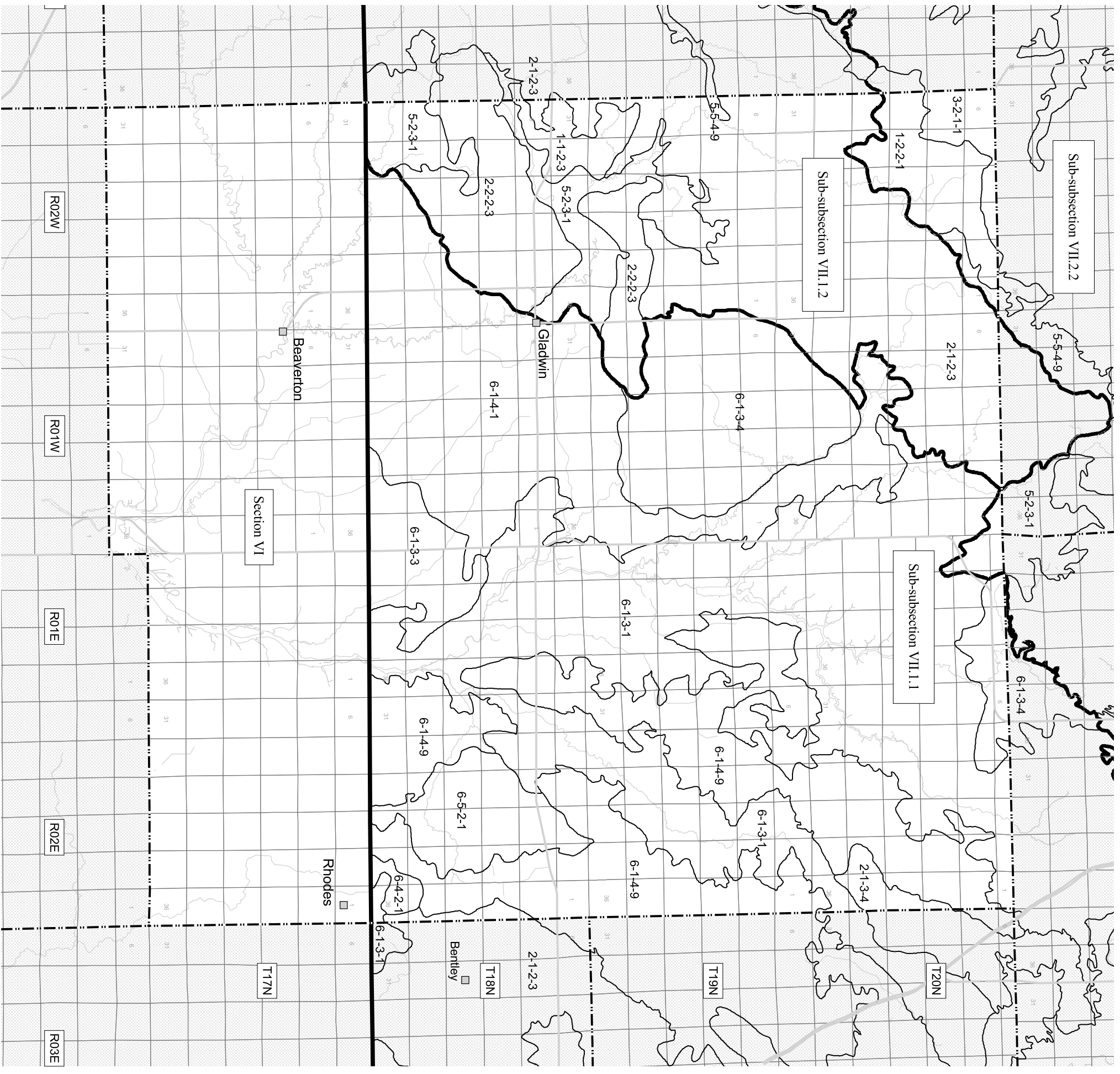


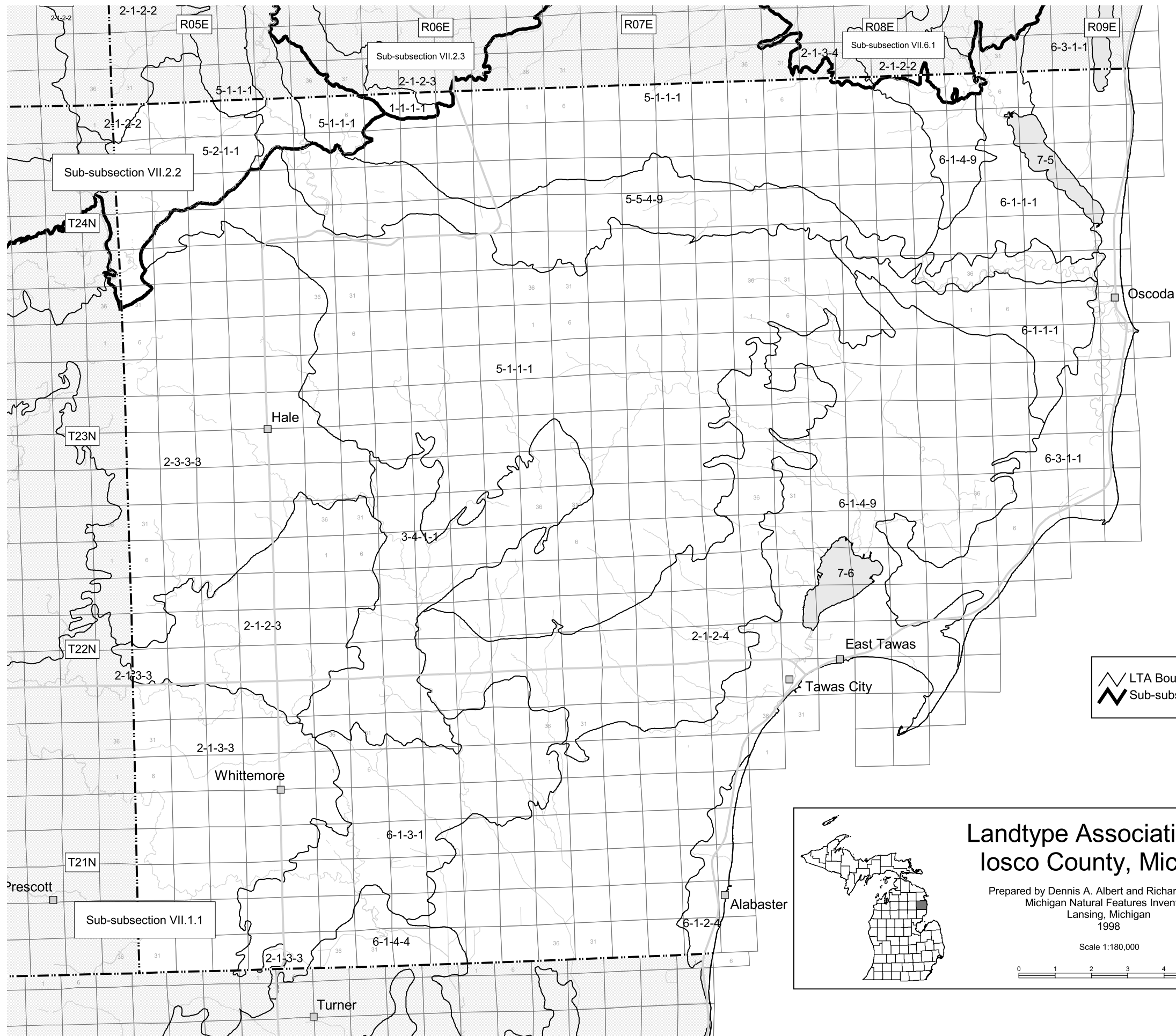
Ecosystem Management Project



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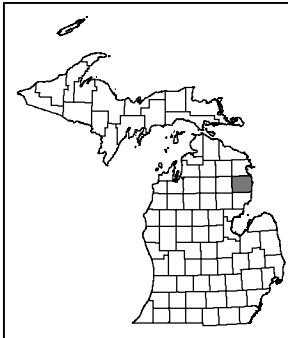


LTA Boundary
Sub-subsection Boundary





 LTA Boundary
 Sub-subsection Boundary



Landtype Associations of Iosco County, Michigan

Prepared by Dennis A. Albert and Richard A. Corner
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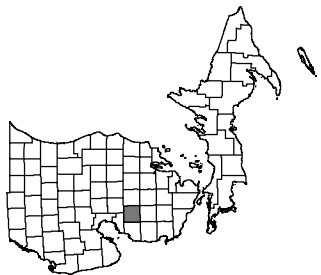
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Landtype Associations of Ogemaw County, Michigan

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Northern Lower Michigan



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LTA Boundary
Sub-subsection Boundary

