Chapter 2 - Environment

Overview

The greatest attraction for the residents and visitors of northern Michigan is the area's environment and rural characteristics. Recreational activities such as hunting, fishing, golfing, snowmobiling, boating and a multitude of other outdoor activities attract people from urban areas of Michigan, as well as from other states. Many long time visitors have chosen to move to northern Michigan upon retirement. Because of the abundant outdoor recreation opportunities, the natural environment is a major economic base and income generator.

Climate

The continental type of climate at Grayling is characterized by larger temperature ranges than in areas at the same latitude near the Great Lakes, which have moderated temperatures. As a result of the prevailing westerly winds, this region experiences some lake effect. However, this is minimal and is essentially limited to increased cloudiness and snowfall during the late fall and early winter. Diminished wind speeds or winds which do not traverse large, unfrozen lakes often produce clearing skies and the colder temperatures expected at continental locations.

Moderately warm temperatures dominate summers. The warmest days occur in the month of July. Between the years of 1971-2000, there was an average of 7 days per year that exceeded the 90-degree mark. Temperatures over 100 degrees have been recorded in the months of June, July, August and September and temperatures in the high 80's have occurred as early as March and as late as October. Normal temperatures for the area range from the high 70's to the low to mid 40's in the summer and from the low 30's to single digits in the winter (**Table 2.1**).

The following temperature extremes for this station are:
Maximum: 104 °F (July 11, 1936)
Minimum: -45 °F (February 3, 1898)
Warmest monthly mean: 75.5 °F (July 1921)
Coldest monthly mean: 4.4 °F (February 1904)

Based on the 1971-2000 period, the average date of the last freezing temperature in the spring was May 30, while the average date of the first freezing temperature in the fall was September 17. The freeze-free period, or growing season, averaged 110 days annually.

In the summer, precipitation comes mainly in the form of afternoon showers and thundershowers. Most precipitation occurs in the months of April-September, which received an average of 20.76 inches or 62% of the average annual total for the 1971-2000 period. During this same period the average wettest month was September, which averaged 4.01 inches, while the average driest month was February which averaged 1.27 inches. The average seasonal snowfall was 104.7 inches. During the 1971 –2000 period, 123 days per season averaged 1 inch or more of snow on the ground but varied greatly from season to season.

The following precipitation extremes for Crawford County are:
Greatest one day precipitation total: 5.02 inches (August 8-9, 1965)
Greatest monthly total: 12.51 inches (September 1986)

Least monthly total: 0.00 inches (April 1889)
Soil moisture replenishment during the fall and winter months plays an important role in the success of agriculture for this area. While drought occurs periodically, the Palmer Drought Index indicated drought conditions reached extreme severity only 2% of the time.

Severe Weather

Data from the National Oceanic and Atmospheric Administration shows that from 2006 through Spring of 2012 there were 37 severe weather events in Crawford County causing over $815,000 in damages.

Although relatively rare, tornados have occurred in Crawford County. Michigan is located on the northeast fringe of the Midwest tornado belt. The lower frequency of tornadoes occurring in Michigan may be, in part, the result of the colder water of Lake Michigan during the spring and early summer months, a prime period of tornado activity. Over the past 35 years, 9 tornados touched down in the County injuring16 people and causing over $350,000 in property damage. Seven of the nine tornados occurred between 1:00 P.M. and 8:00 P.M. The majority of tornados have occurred in the months of May-August, although tornados have occurred as early as April 19 and as late as September 7. The magnitude of a tornado is described by using the Fujita Scale. The Scale ranks tornados from F0 to F6 based on wind speed and intensity. F0 and F1 tornados are described as weak tornados with wind speeds from 40 to 112 mph, F2 and F3 are strong tornados with wind speeds from 113-206 mph, F4 and F5 are violent tornados with wind speeds from 207 to 318 mph, and an F6 is an inconceivable tornado with wind speeds above 319 mph. Of the 9 tornados that have struck Crawford County, two were F2, five were F1, and two were F0. The most destructive tornado was an F2 that occurred on April 19, 1975, causing $250,000 in property damage and injuring 14.

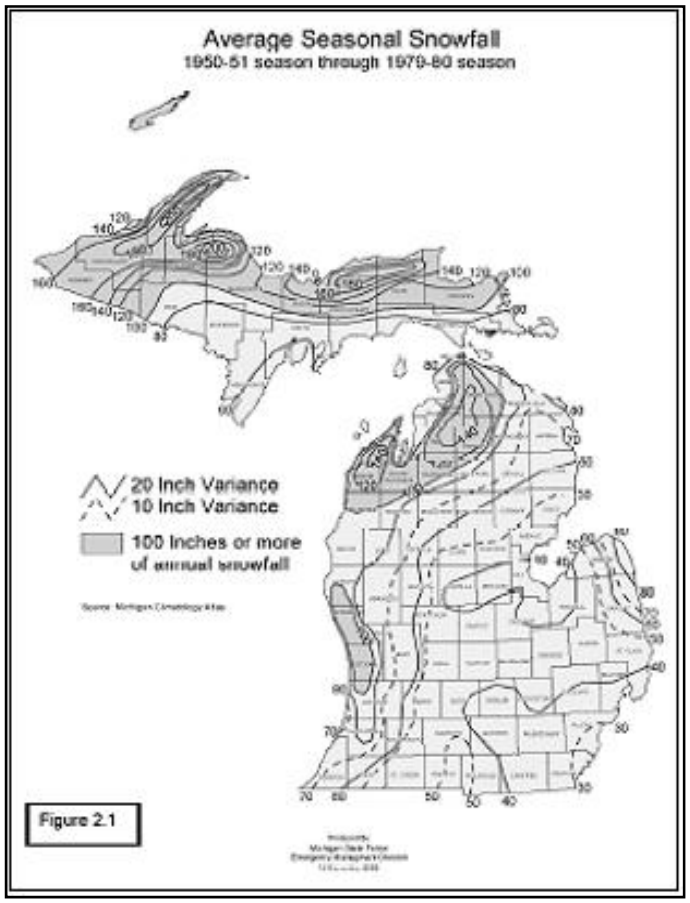


Figure 2.1

Strong winds and thunderstorm winds are the most prevalent severe weather that affects Crawford County. Annually, thunderstorms will occur on an average of 30 days per year with an average of one per year that has severe winds. From 1996 to 2012 there have been six thunderstorm severe wind events in the County. One of the most powerful windstorms ever recorded in the Great Lakes region occurred on November 10, 1998. Wind speeds from this powerful storm reached 82 knots and straight-line winds caused extensive damage in several northern Michigan communities
Winter storms consisting of heavy snow, freezing rain and blizzards are common seasonal hazards that can be expected to occur several times every year. Heavy snowstorms have happened most often in December and January. Freezing rain events have been recorded

January, February, and March and have caused wide spread damage to trees and power lines. Crawford County's location at the southeastern edge of Lower Michigan's "Snow Belt", does not experience intense lake effect snows experienced further north along the I-75 corridor. Snow fall extremes, based on the time period of this station's published record, are:

Greatest observation-day total: 14.0 inches (March 9, 1942)
Greatest monthly total: 59.0 inches (December 1985)
Greatest seasonal total: 172.8 inches (1989-90)
Least seasonal total: 35.5 inches (1920-21)
Greatest snow depth: 51 inches (March 2, 1922)

Table 2.1
Temperature and Precipitation Summary 1981-2010

	Temperature Averages			Precipitation Averages	
Month	**Max**	**Min**	**Mean**	**Precip. Equivilent**	**Snow**
JAN.	25.8	7.9	16.8	1.71	30.1
FEB.	28.8	8.0	18.4	1.29	20.7
MAR.	38.8	15.4	27.1	1.72	14.2
APR.	53.4	28.8	41.1	2.77	3.8
MAY	66.0	39.3	52.7	3.27	.1
JUNE	75.8	49.2	62.5	3.69	.0
JULY	79.8	53.9	66.8	3.58	.0
AUG.	77.6	51.9	64.7	3.68	.0
SEPT	69.5	43.7	56.6	3.75	.0
OCT.	56.0	33.9	45.0	3.77	1.3
NOV.	42.4	25.3	33.8	2.61	11.3
DEC.	30.5	15.6	23.1	1.76	26.5
ANNUAL	53.7	31.1	42.4	33.6	108.0

Source: Midwestern Regional Climate Center, Champaign IL, Station 203391 Grayling MI

Topography

Most of the county is nearly level or gently rolling. Local differences in elevation are slight, in a few places exceeding 100 feet, although the hills and plateau like ridges appear to rise above adjacent sand plains when viewed from a distance. Slopes of hilly land are both long and expansive or, where the relief is choppy, smooth and rounded. There are no steep slopes except along watercourses.

The northern part of the county consists of three broad highland plateaus having a general north-south direction, three complementary broad sand valleys, and a wide sandy plain on the east. The central part, from eastern to western boundaries, is a wide level sand plain through which the AuSable River and its tributaries have cut narrow shallow trenches. Several detached swells or ridges, irregular in outline but having general east to west trends, characterize the southern part of the county. Here the general relief is gently rolling or moderately hilly. Level sand plain and swamps intervene between masses of higher land.

Geology

Two main bedrock formations underlie Crawford County. The northern part of the county is underlain by bedrock of the Napoleon Formation. This formation is composed of 50 to 100 feet of white and light gray sandstone of late Mississippian age. The southern part of the county is underlain by the slightly younger Michigan formation, also of late Mississippian age. This formation is composed of interbedded layers shale sandstone and limestone and is as much as 500 feet thick. These two formations are covered by glacial drift ranging from 600 to 800 feet thick in the northern part of the county to less than 200 feet thick in the southern part. The bedrock formations contain deposits of gas and oil which are being exploited. **Figure 2.2** is a map that shows locations of wells that are color coded to show well types and **Table 2.2** shows well by status. As can be seen, there are concentrations of wells in western Beaver Creek Township; northern Federic and Maple Forest Townships; south-central South Branch Township and northeastern Lovells Township.

Table 2.2
Oil and Gas Exploration in Crawford County

Well Type	Number
Brine Disposal Well	13
Dry Hole	114
Gas Well	221
Gas Brine Disposal Well	2
Lost Hole	2
Location only - not yet completed	306
Mineral Well	1
Oil Well	223
Other Part 615 Injection Well	1
Water Injection Well	66

Source: Michigan DEQ 2011

Soils

Surface geology is directly related to the advancing and retreating glaciers of thousands of years ago. The surface geology of Crawford County consists of moraines, till plains and outwash plains. Moraines are linear hilly ridges that represent the former position of a glaciers edge and are made up of unconsolidated sand, gravel, rock, and clay. Moraines are found south of Grayling running east to west and three moraines that trend north and south are found just north of Grayling. Till plains are the level areas between moraines and consist of unconsolidated sand, gravel, rock, and clay. Outwash plains are water-laid deposits formed from the melting glacier consisting of stratified deposits of sand, gravel, rock, and clay. The only outwash plain in the county is located in Beaver Creek and South Branch Townships.

When planning for types and intensity of land uses, soil types and slopes are two important factors that determine the carrying capacity of land. Additionally, knowledge of the location of excessively drained soils will assist in identifying wildfire prone areas. Soil types influence the location of plant communities that grow in the county. Pine forests, particularly jack pine, are adapted to grow on sandy, draughty soils. While northern hardwood forests thrive on sandy loam soils and cedar forests prefer mucky wet soils.

The Natural Resource Conservation Service completed a detailed soil survey of Crawford County. A digital or computerized version of the soil survey maps was acquired from the Michigan Center for Geographic Information and used to analyze soils conditions and generate color thematic soil maps.

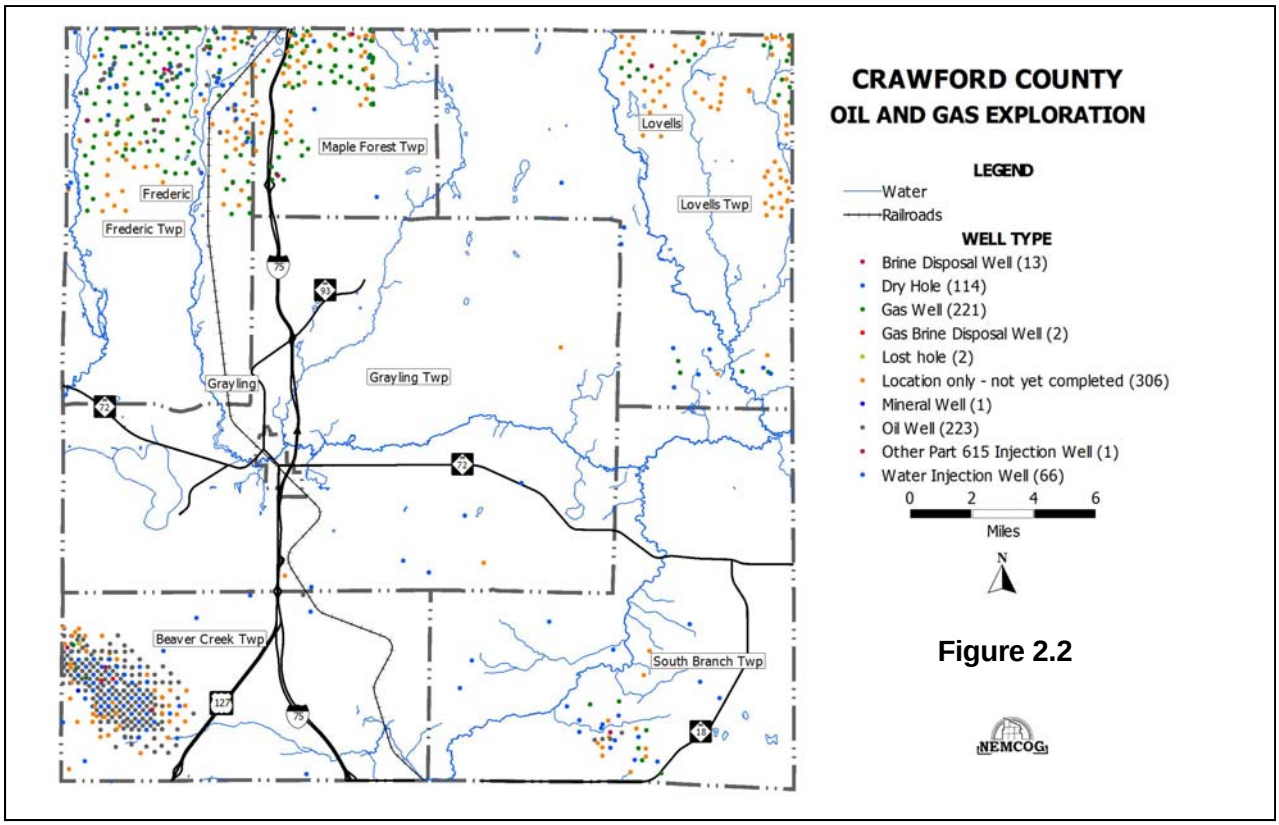


Figure 2.2

Hydric Soils and Steeply Sloped Areas

Figure 2.3 is a map that classifies hydric soils and soil units with slopes 18% and greater. The hydric soils (colored green on the map) are mainly located adjacent to streams and creeks. This connectivity of riparian wetlands and surface water features can be seen throughout the landscape. Areas colored light brown are soils with small areas of hydric inclusions (areas too small to be delineated from the primary soils type). Hydric soils have high water tables and will not support heavy equipment. These areas can be barriers when deploying fire suppression equipment. Hills and steeply rolling terrain may provide opportunities for spectacular views of the landscape. However, steeply sloped sites have severe building constraints and are more difficult and costly to develop. Steeply sloped areas influence fire behavior and are difficult to access when fighting wildfires. Areas with slopes 18 percent or greater are colored red on the map.

Soil Drainage Class

Figure 2.4 is a map that classifies soil drainage classes. "Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual." – Natural Resource Conservation Service.

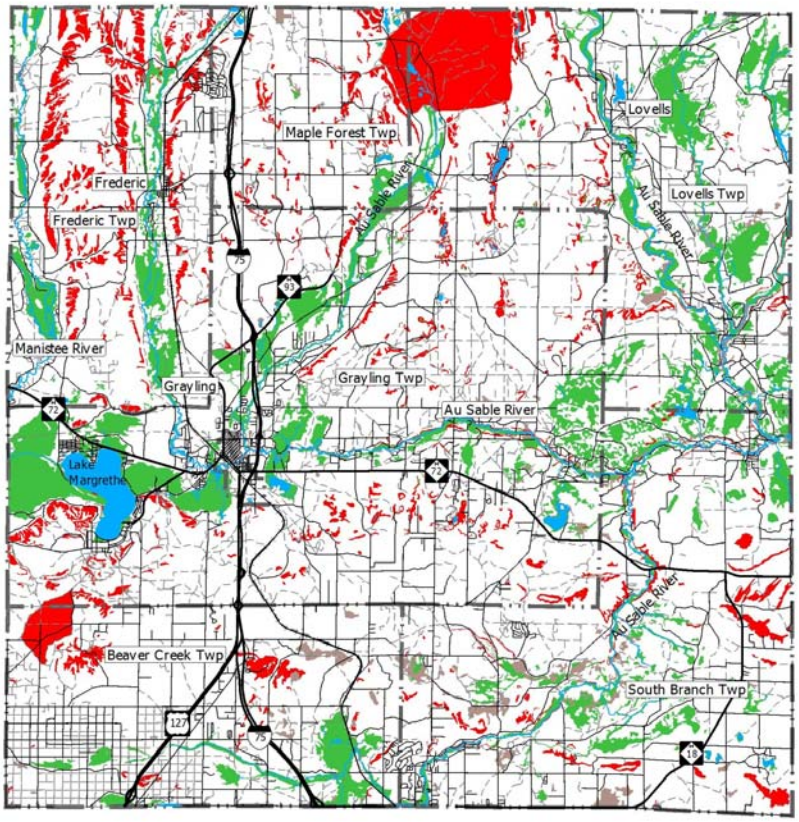


Figure 2.3

CRAWFORD COUNTY

SOILS CONSTRAINTS MAP

UNIMPROVED ROADS
CO. ROADS
RAILROADS
HIGHWAYS

HYDRIC SOILS & STEEP SLOPES

SLOPES 18% & GREATER
HYDRIC SOILS
HYDRIC SOILS IN MAPPING UNIT
WATER

0 2 4 6
Miles

N

NEMCOG

DATA SOURCE:
NATURAL RESOURCE CONSERVATION SERVICE
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

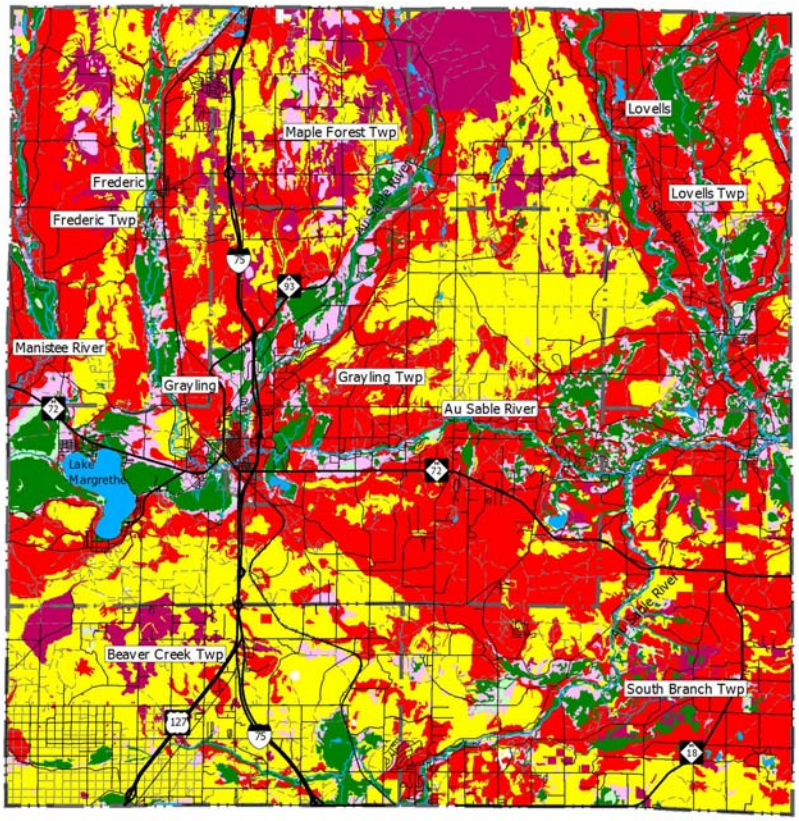


Figure 2.4

CRAWFORD COUNTY

SOILS CONSTRAINTS MAP

UNIMPROVED ROADS
CO. ROADS
RAILROADS
HIGHWAYS

Rating

Excessively drained
Moderately well drained
Poorly drained
Somewhat excessively drained
Somewhat poorly drained
Very poorly drained
Well drained

0 2 4 6
Miles

N

NEMCOG

DATA SOURCE:
NATURAL RESOURCE CONSERVATION SERVICE
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

Excessively drained and somewhat excessively drained sandy soils support vegetation that can tolerate draughty conditions. Jack, red and white pine; northern pin, red and white oak; bigtooth and quaking aspen; paper birch and red maple are common. Jack pine and northern pin oak are most common on the sandy excessively drained soils. Plants produce ample amounts of fuels, and during spring months and other dry times of the year conditions are conducive to wildfires.

Water Resources

Crawford County has an abundance of lakes and streams. The county has a total of 53 lakes that are 1 acre or larger. The largest body of water in the county is Lake Margrethe in Grayling Township with a surface area of 1,928 acres, an average depth of 16 feet, and a maximum depth of 65 feet. Seven lakes are over 100 acres. The large majority of the lakes are less than 50 acres in size. The county is predominantly within the AuSable water shed. The Manistee River drains the western portion of the county. There are 45 miles of inland shoreline in Crawford County with approximately 25 miles open to the public. Almost all of the lakes and streams provide good fishing and many tourists come to the county to fish. Lake Margrethe is at the headwaters of the Manistee River Watershed and is a popular recreational and tourist area in the county. Other significant lakes in the county include Shupac Lake, Shellengarger Lake and Jones Lakes. Smaller lakes are quite numerous.

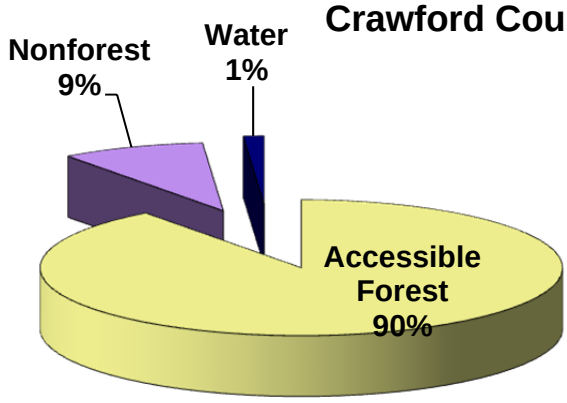
Woodland Resources

According to 2001 U.S. Forest Service statistics, forestland accounts for approximately 90% of the county's total land area**, Figure 2.5.** The majority of timberland in the county is in public ownership. 52% is state owned and 16% is federally owned in the form of the Au Sable State Forest and the Huron National Forest, **Figure 2.6.** Most of these lands are managed under a multi-use concept, which is directed toward recreation. The use of military forestland is not geared toward commercial forest production. Some areas have been determined as refuge areas for the endangered Kirtland Warbler. The next largest ownership class is in individual ownership at 32%.

Major forest species found in the county are Jack Pine (27%), Oak/Hickory Group (23%) and Aspen (21%). The Maple/Beech/Birch Group totals 12%. A small amount of forestland is comprised of Black Spruce (6%), Balsam Fir (4%), and Red Pine (4%) Smaller acreages of Eastern White Pine, White Spruce, Northern White Cedar, White Pine/Red Oak/White Ash, and Paper Birch are also present. The abundance of jack pine and oak forests dramatically increase wildfire hazard for Crawford County.

The Michigan Department of Natural Resources has compiled pre-European settlement vegetation maps of counties in Michigan. The maps were generated from information contained in the first government land survey notes in the 1800's along with information such as current vegetation, land forms and soils. A review of the pre-settlement vegetation map of Crawford County shows extensive areas were covered with jack pine-red pine forest, white pine-red pine forest, pine barrens and pine/oak barrens, see **Figure 2.7.** Note extensive areas of pine barrens and oak barrens (colored yellow), which clearly shows wildfires were very much part of the natural ecosystem, prior to logging and associated wildfires in the late 1800's. Logging, land clearing and wildfires have resulted in a greater presence of aspen and oak. Also, with better wildfire control and reforestation efforts, there's actually more forestland today than in the early 1800's.

Figure 2.5
Crawford County Forestland



Source: U.S. Forest Service 2001

Figure 2.6
Crawford County Forestland Ownership

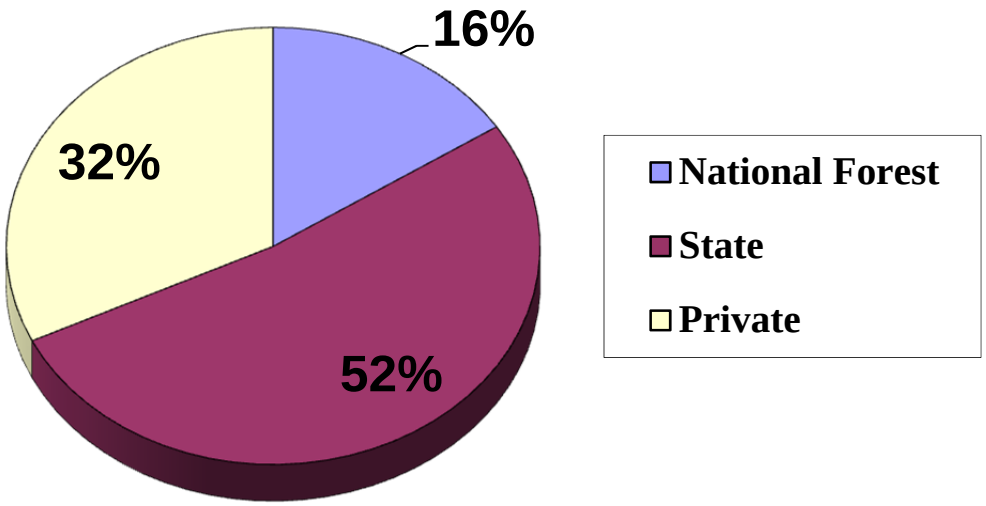
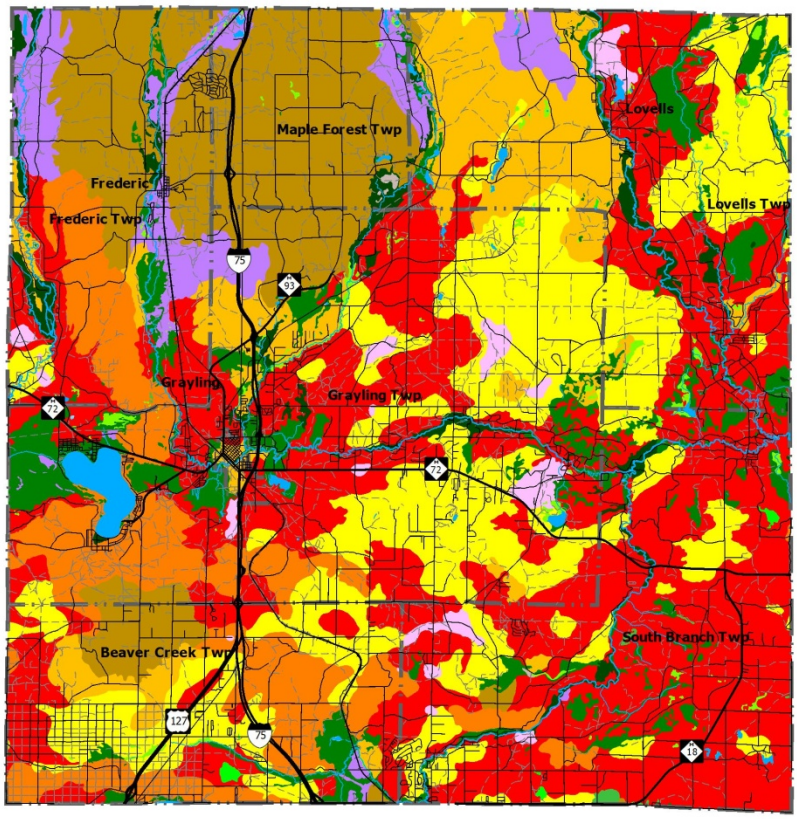


Figure 2.8 shows forest types generated from the Michigan Resource Information System inventory in the 1980's. The map shows the continued dominance of pine forest types in the County. The map depicts the urban-rural interface of residential development in areas dominated by Jack Pine and Red Oak indicating wildfire susceptibility.



CRAWFORD COUNTY

PRE-SETTLEMENT VEGETATION
COVERTYPE

- ASPEN-BIRCH FOREST
- BEECH-SUGAR MAPLE-HEMLOCK FOREST
- CEDAR SWAMP
- GRASSLAND
- HEMLOCK-WHITE PINE FOREST
- JACK PINE-RED PINE FOREST
- LAKE/RIVER
- MIXED CONIFER SWAMP
- MIXED HARDWOOD SWAMP
- MIXED PINE-OAK FOREST
- MUSKEG/BOG
- OAK/PINE BARRENS
- PINE BARRENS
- SAND DUNE
- SHRUB SWAMP/EMERGENT MARSH
- WHITE PINE-RED PINE FOREST

0 2 4 6
Miles
10-12-04

N

Figure 2.7

DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
MICHIGAN DEPARTMENT OF NATURAL RESOURCES

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

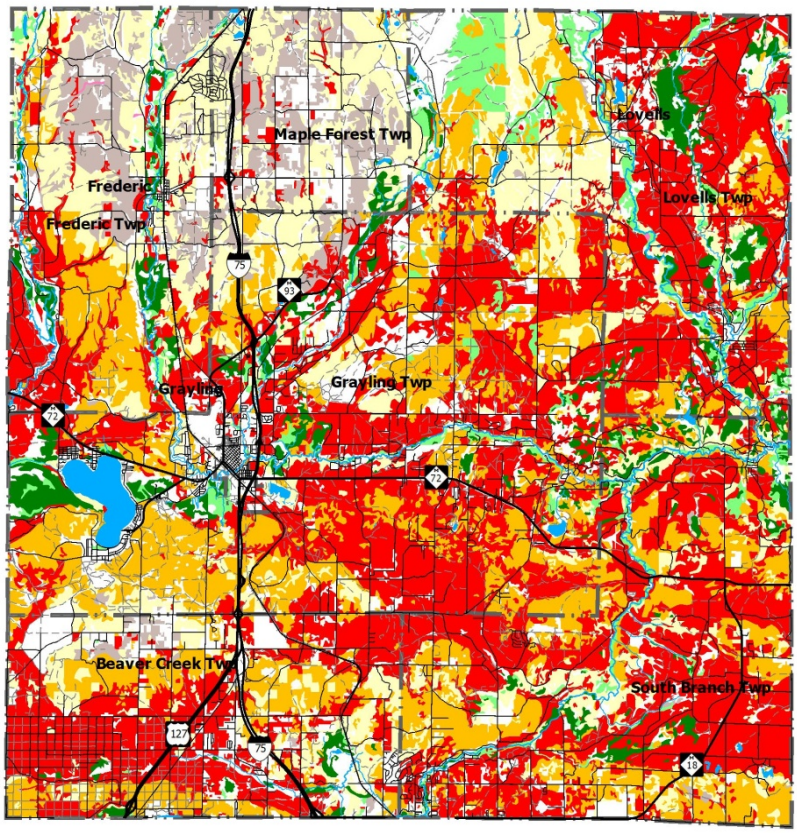


Figure 2.8

CRAWFORD COUNTY
FOREST COVER MAP

- UNIMPROVED ROADS
- CO. ROADS
- RAILROADS
- HIGHWAYS

FOREST TYPES

- Aspen, Birch
- Central Hardwood
- Lowland Conifer
- Lowland Hardwood
- Northern Hardwood
- Other Upland Conifer
- Pine

0 2 4 6
Miles
MIRIS 1978

N

NEMCOG

DATA SOURCE:
MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION
CRAWFORD COUNTY

MAP BY:
NORTHEAST MICHIGAN COUNCIL OF GOVERMMENTS

Contamination Sites

The Michigan Environmental Response Act (Part 201 of PA 451 of 1994, as amended) provides for the identification, evaluation and risk assessment of sites of environmental contamination in the State. The Environmental Response Division (ERD) is charged with administering this law. A site of environmental contamination, as identified by ERD, is "a location at which contamination of soil, ground water, surface water, air or other environmental resource is confirmed, or where there is potential for contamination of resources due to site conditions, site use or management practices.

The agency publishes a list of environmentally contaminated sites by county showing the sites by name pollutant(s) and site status (**Table 2.3**). A Site Assessment Model (SAM) score is computed to assess the relative risk a site may pose and to help determine the aggressiveness of cleanup efforts. SAM scores range from 0 to 48 with 0 being the least contaminated and 48 the most contaminated. In some instances where the score is high and further contamination is possible, immediate response may be required. Conversely, a location where the score is low and the conditions of the site are not likely to change; no action may be the preferred course.

Table 2.3
Crawford County Contamination Sites

Site ID & Status	Location	Source	Pollutant	SAM Score
20000002 Interim Response in progress	North I-75 BL	National security	PCE , TCE	28
20000003 Active	Sherman Rd	Landfill	Fe; Solid wastes	24
20000004 Remedial Action in Progress	6636 AuSable Street (Old 27)	Gasoline Service Station	1,2,4 TMB; 1,3,5 TMB; Naphthalene; PCE; Xylenes	30
20000007 Interim Response in progress	Rt #1, 7 Mile Rd.	Pumps & Pumping Equipment	BTEX	31
20000009 Inactive	5453 M-18 Hwy	Gasoline Service Station	BTEX , 1,2 DCA	27
20000010 No Action Taken	123 Barbara St	Private Households	BTEX	22
20000028 Monitoring Only	427 South Grayling Road	Auto Dealer & Service Stations	Solvents	17
20000049 Active	Industrial Dr	Sewerage Systems	Fe	24
20000058 Active	106 Jonassen	Private Households	Heating Oil , Ethylbenzene	14
20000060 Remedial Action in Progress	2459 Industrial Drive	Wood Preserving	Cr+6	20
20000064	200 West Michigan	Railroad	As;	29

Inactive	Ave.	Transportation	Benzo(a)anthracene; Benzo(a)pyrene	
20000065 Inactive	9851 Beech Terrace Drive	Private Households	Fuel Oil	20
20000066 Inactive	308 Huron Street (M-72)	Lumber & Wood Products	Acenaphthylene; Benzo(a)pyrene; Dibenzo(a,h)anthracene; Fluoranthene; Phenanthrene	21
20000071 Interim Response in progress	Camp Grayling	National Security	Pb	17
20000073 Interim Response in progress	N. Down River Rd. & Stephan Bridge Rd.	Sporting & Athletic Goods	1,2,4 TMB; 1,3,5 TMB; Benzene; Ethylbenzene; PCE; Toluene; Xylenes; n-Propylbenzene	31
20000074 Interim Response in progress	10360 W. Deward Rd.	Pipelines	Ethylbenzene	22
20000075 Interim Response in progress	4364 North Down River Rd	Fabricated Metal Products	PCE; TCE; cis-1,2 DCE	34
20000077	9439 East North Down River Rd.	Gasoline Service Station	1,2,4 TMB; 1,3,5 TMB; Benzene; Ethylbenzene; Naphthalene; Toluene; Xylenes	31
20000090 Inactive	4622 Young Street	Lumber &Wood Products	1,2,4 TMB; Pb	27
Source: Department of Environmental Quality				