Appendix F: Criterion Four Additional Data

10.3 Soil properties

The USDA Forest Service, Forest Inventory and Analysis (FIA) Program monitors total soil carbon, estimated bare soil, bulk density and calcium-aluminum ratio on a subset of the standard FIA plots. The scale of sampling limits the use of these data for state-level analysis, so no conclusions were drawn from the results.

The sampling intensity is one plot to 96,000 acres and these plots are referred to as the FIA Phase 3 plots. Data was obtained from the USDA Forest Service, Forest Inventory and Analysis Program through a special request. The FIA soils protocols were designed for use with soils models for regional and national analysis. Since the sampling is not intensive enough to measure spatial distribution (expansion factors were not developed), data is reported in the tables below by the percentage of plots.

Soil carbon is assessed through soil sample collections, which are submitted to a regional laboratory for analysis. Soil carbon is analyzed for three depths: forest floor, 0-10 cm (0-4 inches), and 10-20 cm (4-8 inches). Total soil carbon (carbon at all three depths) is reported in Table E.1. The soil carbon results are based on 125 plots collected from 2001-2004.

Table F.1: Total soil carbon in Wisconsin forest land

Percent of total soil carbon on plots	Percent of plots
10% - 25%	1%
26% - 50%	37%
51% - 75%	40%
76% - 100%	17%
101% - 400%	5%

Estimates of bare soil are made visually, in four subplots within each plot. Percent bare soil is reported in Table E.2. Bare soil was visually estimated on 163 plots from 2001-2004.

Table F.2: Estimated bare soil in Wisconsin forest land

Percent bare soil	Percent of plots
0%	15%
.1% - 1.0%	26%
1.1% - 10.0%	41%
10.1% - 20.0%	9%
20.1% - 50.0%	8%
50.1% - 75.0%	1%

Bulk density is assessed through the collection of soil samples, which are submitted to a regional laboratory for analysis. Bulk density is analyzed for two depths: 0-10 cm (0-4 inches) and 10-20 cm (4-8 inches). Bulk density at the 0-10 cm depth is reported in Table E.3. Bulk density samples were collected on 106 plots from 2001-2004.

Table F.3: Bulk density at 0-10 cm soil depth in Wisconsin forest land

Bulk density (grams per cubic centimeter)	Percent of plots
<1.00	45%
1.01 – 1.25	31%
1.26 – 1.50	20%
1.51 – 1.75	4%

Calcium and aluminum are assessed through the collection of soil samples, which are submitted to a regional laboratory for analysis. Calcium and aluminum are analyzed for two depths: 0-10 cm (0-4 inches) and 10-20 cm (4-8 inches). The ratio of calcium to aluminum (at 0-10 cm) is reported in Table E.4. Calcium and aluminum samples were collected on 85 plots from 2001-2004.

Table F.4: Calcium – aluminum ratio at 0-10 cm soil depth in Wisconsin forest land

Calcium – aluminum ratio	Percent of plots
0 – 0.2	6%
0.3 – 0.5	12%
0.6 – 1.0	8%
1,1 – 1.5	4%
>1.5	71%

10.4 Mining activities

Landforms

Wisconsin is unusual because it contains large areas of pre-Cambrian bedrock outcrops that are aged at 1,640 million years. Their unique structure, which has been preserved by erosion resistant caprock, has drawn scientists from around the world.

Prominent bedrock features of Wisconsin are the Gogebic Range, Baraboo Range, Barron Hills, Rib Mountain, McCaslin Mountain Silurian "Niagara" escarpment in the east, Blue Mounds, and the dolomite escarpment that forms Military Ridge in the southwest. Bedrock affects mineral composition of soils locally and the eight major soil regions of Wisconsin relate closely to land forms and geologic materials.

Glaciation has largely determined the surface and topography of the state. Glaciers repeatedly advanced into and retreated from the area that is now Wisconsin between 2.4 million years ago. About 11,000 years ago about two-thirds of the sate was covered by glacial ice.

When the most recent glaciers melted, they left a rolling terrain covered in layers of glacial till and outwash. Among the characteristic landforms left behind by the glaciers are moraines, till plains, drumlins, outwash plains, eskers, kames, and lacustrine plains. During glacial retreat, loess was deposited by wind on the surface of many adjoining areas, whether recently glaciated or not. The profusion of lakes, spring ponds, headwater streams, and wetlands found throughout the northern portion of the state are the result of glacial action, which interrupted the normally dendridic drainage pattern of the streams.

Though glacial deposits covered most of the bedrock in the eastern potion of the state, outcrops of dolomite, limestone, sandstone, basalt, granite, quartzite, and serpentine also occur. Such outcrops can be biologically significant because they provide a substrate for a number of plants including some that are rare.

Another geographic region of interest is the driftless portion of the Central Plain, also known as the Central Sands. Many process contributed to its topography. One formative agent was Glacial Lake Wisconsin.

Within the Driftless Area of the Western Upland, the primary geomorphic processes are fluvial erosion (erosion by flowing water); mass-wasting (weathering of bedrock in place), and Karst formation (the dissolution and deposition of carbonates). Karst landforms include caves.

An important forest will have unique landforms and enhance their associated biologic communities.

Mineral Resources

Mining for metals such as copper, lead, iron and zinc shaped the history of several regions of Wisconsin beginning with the Old Copper Culture, 4000 to 1000 BC, to the lead mining activities of the early European settlers. The first permanent European settlers in Wisconsin were lead prospectors and miners who sought out deposits of lead and zinc in the southwestern part of the state in Grant, Iowa and Lafayette counties. Mineral Point, located just west of Madison, was an early mining town.

Other important mineral mining activity occurs, and has occurred, around the rest of the state. Iron ore is found in Jackson County. There are some large deposits in Ashland and Iron counties. Zinc deposits are found in northern Wisconsin. Sulfide deposits containing large amounts of copper and zinc are found in Forest, Oneida and Rusk counties. The sulfide deposits at Crandon in Forest County are believed to include one of the five largest supplies of zinc ever discovered in North America.

In addition to mineral, stone, gravel, basalt, clay, peat, quartzite, sandstone, sand, silica sand, shale, peat, and rich soils are mined in Wisconsin. Stone, such as dolomite and granite, is a valuable resource in Wisconsin. Dolomite is found mainly in the southern part of the state and granite in the central and northern areas. Red granite became the state rock in 1971. Red granite was selected because of its beauty, economic value as a construction material, historical significance, and because it is unique to the state of Wisconsin.

Because of the gravel bound up in the great ice sheets, the continental glaciers, which moved across Wisconsin, almost all of the counties of Wisconsin have sand and gravel deposits. The Southwest corner of the state has the smallest gravel resource. As the glacial ice melted the sand and gravel were released in streams of outwash, the material was sorted by stream action. These outwash plains are rich sources of sand and gravel and have been mined since the days of early settlement. The sand and gravel were important to settlers and loggers during the early years of road construction.

Mining

Mining has shaped the landscape in some parts of the State and continues to do so at present. Where mining could present an impact on the sustainability of the forest within a legacy tract, easement language and management plan recommendations will reflect the need to protect and sustain the forest systems first and foremost. In some cases, where a high potential for conversion to active surface mining exists in a proposed legacy tract, the purchase on mineral rights will be part of the conservation easement.

Mining activities are regulated by state and local authorities. Environmental concerns include air quality, water quality, soil erosion, and site reclamation.

Mining has long played a role in Wisconsin's development. From 4000 BC to 1000 BC, during the Old Copper Culture, Native Americans mined copper along the shores of Lake Superior to use for spear points, knives, axes and other implements. More recently, the first permanent

European settlers in Wisconsin were miners and prospectors who sought out deposits of lead and zinc in southwestern Wisconsin.

There are no metal mines operating in Wisconsin, but deposits of iron ore are still found in Jackson, Ashland and Iron counties. In addition, sulfide deposits containing copper and zinc are documented in northern Wisconsin. The sulfide deposits in Forest County are believed to include one of the largest supplies of zinc ever discovered in North America.

There are an estimated 2,500 to 3,000 active nonmetallic mines in the state. Nonmetallic mines are generally rock quarries and gravel pits. Sand and gravel deposits can be found throughout the state. Small gravel pits are commonly found on state and county forests for road surfacing and other projects. In addition, when purchasing new lands or conservation easements, ownership of mineral rights is investigated. On state forests, the mineral rights are retained by the State.