

# **Conditions & Trends**

## **2<sup>nd</sup> Generation Southeast Landscape Plan**

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**MFRC Southeast Regional Landscape Committee**

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**February 2014**



Minnesota Forest Resources Council (MFRC)

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## Executive Summary

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The Minnesota Forest Resources Council was established in 1995 by the Minnesota Legislature to provide advice to public and private organizations on forest sustainability issues through the Sustainable Forest Resources Act (SFRA). This legislation provided authorization for establishing regional landscape committees to foster landscape-based forest resource planning and coordination. These regional committees provide an opportunity to involve private citizens, forestry professionals and members of various interest groups in developing and implementing landscape-level plans that promote forest sustainability.

The SFRA defines landscape-level planning as “*long-term or broad based efforts that may require extensive analysis or planning over large areas that may involve or require extensive coordination across all ownerships.*” It charges the regional committees to: 1) include representative interests, 2) serve as a forum to discuss issues, 3) identify and implement an open and public process whereby landscape-level strategic planning can occur, 4) identify sustainable forest resource goals for the landscape and strategies to achieve those goals, and 5) provide a regional perspective on forest sustainability to the Council.

From 1998 to 2005, the first generation landscape plans were prepared for each of the six forested regions in the state. The first generation Southeast Landscape Plan was approved by the Council in 2003. Now with over ten years of implementation, it is time to update the landscape plan as well as the technical documents that support its preparation.

The Council established a general planning process for the development of landscape plans. The process includes the following steps:

- Prepare an assessment of current conditions and trends in the landscape;
- Determine vision, goals, and issues that address existing and potential conditions considered desirable for the region;
- Develop strategies for implementing the vision, goals and/or resolve issues in the region;
- Encourage voluntary implementation of the strategies by coordination between landowners; and
- Conduct an evaluation to determine how well the strategies accomplish the vision and goals and resolve issues.

The purpose of the first step in the general planning process – conducting a landscape assessment – is to provide a common understanding of ecological and socioeconomic conditions in order to further planning and coordination among multiple landowners and interests. This assessment information provides a scientific base for the goal-setting and collaborative-decision making in the landscape plan development process.

This Conditions and Trends Report gives as accurate a picture of the thirteen-county Southeast Minnesota Landscape (Dodge, Fillmore, Freeborn, Goodhue, Houston, Le Sueur, Mower, Olmsted, Rice, Steele, Wabasha, Waseca, Winona) as possible given the limitations of available information and resources. It also points to areas where more specific assessments are needed to resolve the primary issue of sustainability in the landscape over time as well as points out gaps

where more information is needed. This report is a starting point for addressing forest sustainability in southeastern Minnesota, not the end result.

To guide the regional forest resource committees as they carry out landscape-level planning and coordination, the Council also established four broad goals that describe overarching strategies for sustaining forests. The MFRC used the Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota to develop these goals. This updated Southeast Conditions and Trends report is structured around these four goals. The goals are stated below with the findings, recommendations and additional data needs concerning that goal.

*Notes to Reader:* Additional regional data can be found in the report, “Demographic Data Report: 2<sup>nd</sup> Generation Southeast Landscape Plan”, MFRC Southeast Planning Committee, 2014. Updates/revisions to some of the following summary statements may be found in the *Southeast Landscape Plan: A Regional Plan to Guide Sustainable Forest Management*.

**Goal 1: Forestland Cover.** Land area covered by forests within a region’s landscape will be the same or larger.

#### Key Findings

- **Historic loss of upland forests.** The region, which covers nearly 5 million acres, has lost approximately one-third – over 330,000 acres – of “upland forests” to agriculture and development since European settlement. The most heavily impacted counties include Le Sueur County and Rice County, as well as Wabasha County, Houston County, and parts of Olmsted County.
- **Forest cover is increasing.** Despite historic losses, forestland is increasing in recent years. According to the United States Forest Service Forest Inventory and Analysis (USFS FIA) definitions and estimates of forestland, forest cover in the 13-county region increased by a total of 92,333 acres (14.6%) between 1990 and 2012. This total includes an initial decrease of approximately 60,000 acres between 1990 and 2003.
- **Agriculture remains the prevailing land cover.** Despite decreases in agricultural land and increases in upland grass land cover, agriculture remains the dominate land use in southeast Minnesota, comprising over 54% of the total landscape according to the 2006 National Land Cover Dataset.
- **Farmland and farm operations:** Land defined as “ag land,” “crop land,” and pasture only” decreased between 1997 and 2007, but overall acres operated as part of a farm (including land not in production) remained relatively consistent with slight increase.
- **Development continues to rise.** Developed acres increase by over 230% between 1992 and 2006 (approximately 111,000 acres to just over 367,000).
- **Forested acres are greatest in Houston County and least in and Freeborn County.** According to USFS FIA estimates, Houston County contains 21.6% of the Southeast Landscape’s approximately 724,000 forested acres, followed by Winona County with 20.8% and Fillmore County with 13.2%. Mower, Steele, and Freeborn counties contain a combined 10.8% of the forested acres in the Southeast Landscape.
- **Forest and Agriculture cover by Subsection:** Of the three most predominate Ecological Subsections in the region, the Blufflands contains the most forest/woody wetland cover (over 40%), and the least agriculture cover (18.5%) for the area within the Southeast Landscape. The Rochester Plateau/Southeast Landscape intersection contains

approximately 8.8% forest/woody wetland and 53.4% agriculture, and the Oak Savanna/Southeast Landscape intersection contains 3.5% forest/woody wetland cover and 78.1% agriculture.

**Goal 2: Land Ownership.** Forests within a region’s landscape will be in a variety of ownerships, serving both public and private interests.

#### Key Findings

- **Private ownership remains the vast majority ownership pattern.** Over 96% of total land cover and over 85% of timberland cover in the Southeast Landscape is in private ownership. Between 1990 and 2012, public timberland increased by 3,843 acres and private timberland increased by 75,088 acres. The ratio of publically- to privately-owned land remained relatively stable between 1990 and 2012, though there was a slight overall increase in the amount of private to public land.
- **Public Land ownership is minimal.** Most public land is scattered along the Mississippi River. Whitewater State Park comprises a large portion of this public land.
- **Most of the Richard J. Dorer Memorial Hardwood Forest is privately owned.** Nearly all of the Richard J. Dorer forest is within the MFRC Southeast Landscape; of the area within the Southeast Landscape, over 93% of the land is privately owned.
- **Total federally-owned timberland decreased between 1990 and 2012.** Inconsistent with the general trend of forest land in southeast Minnesota between 1990 and 2012, which according to FIA data experienced an overall increase for private, state and local, and total timberland acres, federally-owned timberland decreased by 15.8 – about 3,000 acres – during that time.
- **Forest Stewardship Plan coverage is limited in IFRAs.** Approximately 5% of the Important Forest Resource Areas (IFRAs) acreage identified by the MN DNR in the Southeast Landscape is currently covered by a Forest Stewardship Plan. This exceeds the state-wide coverage by approximately 0.8%.
- **Farm operation falls mainly to full or part owners.** The majority of farm operations are operated by full owners, but the majority of farm acreage is operated by part owners. Tenant landowners make up less than 1/10 of the operation/acreage control in the region.

**Goal 3: Healthy Forests.** Within forested landscapes, healthy, resilient, and functioning ecosystems will be maintained within appropriate mixes of forest cover types and age classes to promote timber production, biological diversity, and viable forest-dependent fish and wildlife habitats.

#### Key Findings

- **Areas of highest biodiversity significance appear to be concentrated along riparian areas in the eastern half of the region.** (See Figure 11)
- **Biodiversity significance is high in the region overall.** One-third of the area surveyed in the Southeast Landscape by the Minnesota Biological Survey was classified as having “High” or “Outstanding” biodiversity significance, which amounts to 3.3% of the total land in the region. It is possible that more sites of biodiversity significance exist within un-surveyed areas.

- **Tree species abundance has changed since pre-settlement.** Based on an analysis completed by John Almendinger that compared 1990 FIA data and Marschner’s pre-settlement data from the Public Land Survey, between the late 1800’s and 1990 disturbance-loving species such as box-elder (*Acer negundo*) and eastern redcedar (*Juniperus virginiana*) increased greatly in population, while a variety of oak species, such as Black oak (*Quercus nigra*), bur oak (*Quercus macrocarpa*), and jack oak (northern pin oak - *Quercus ellipsoidalis*) declined in numbers.
- **Large-diameter oak/hickory forests comprised the most timberland acreage over time.** Oak/hickory forest made up over half of the timberland in the Southeast Landscape between 1990 and 2012, and a large component of this was large-diameter trees.
- **There are nearly 900 million cubic feet of growing stock timber in the Southeast Landscape.** The greatest amount of growth and mortality was among “other eastern soft hardwoods.” The greatest amount of removal was for cottonwood and aspen.
- **There are over 3.1 billion board feet of sawtimber (International ¼-inch rule) in the Southeast Landscape.** “Select red oaks” had the greatest net volume, but other eastern soft hardwoods experienced the greatest net growth.
- **Over half of Minnesota’s plant species are found in the Southeast Landscape.** The region contains 1,376 of Minnesota’s 2,250 species of plants. 1179 of these plants are native, 193 are introduced, four have unknown status; 75 of these plant species are found nowhere else in the state, and 11 are found nowhere else in the state beyond Houston County.
- **The Southeast Landscape contains significant vertebrate diversity.** At least 21 species of small (or incidental) mammals, 44 species of amphibians and reptiles, and 156 species of breeding birds are found in the region.
- **The Southeast Landscape contains 4 endangered, 5 threatened, and 27 special concern vertebrate species (excluding fish).** Over half of the forest-associated species of endangered, threatened, and special concerns species in the state are found in this region.
- **The Blufflands Subsection contains the greatest number of Species of Greatest Conservation Need (SGCN) in the region.** The Blufflands contains 156 SGCN, the Rochester Plateau contains 94 SGCN, and the Oak Savanna contains 93 SGCN.
- **Terrestrial invasive species are commonly observed.** The most frequently observed invasive terrestrial species on public land in the Southeast Landscape include reed canary grass, wild parsnip, and common buckthorn. Observations may differ on private land.
- **Emerald ash borer is present in Southeast Minnesota.** Quarantines have been placed on Houston and Winona Counties; risk of spread is highest to lumber vending and processing sites such as firewood dealers and sawmills, and to human-frequented areas such as campgrounds and urban areas.
- **Over half of the counties in the region have evidence of gypsy moth invasion.** Eight of 13 counties in the region had evidence of gypsy moth invasion in 2013. Moth numbers increased dramatically in 2008 for reasons that are unclear in this dataset, then decreased again in subsequent years, possibly due in part to a treatment implemented in 2009.
- **Aquatic invasive species are present in major waterways.** The Mississippi and Zumbro rivers and lakes along the Cannon River have been designated as infested waters by the Minnesota Department of Natural Resources.

- **Watershed health scores decrease in a westwardly directly across the region.** There are over 42,000 acres of contaminated lakes and 1500 miles of contaminated streams in the Southeast Landscape.
- **The Southeast Landscape remains an important area for trout stream protection.** In southeast Minnesota, there are over 800 miles of designated trout streams and over 1000 miles of protected tributaries to trout streams located in Goodhue, Wabasha, Winona, Houston, and Fillmore Counties, and a small part of Olmstead County.
- **Many water pollutants show no trend or decreasing trend over time, except nitrate/nitrite pollutants.** All contaminants monitored by the MPCA have decreased or remained stable in the region over time, except for nitrites/nitrates, which have increased over time in the majority of test sites.
- **Karst geology in the region facilitates the movement of nitrogen pollution.** The karstic nature of the region’s limestone facilitates rapid underground movement of nitrite/nitrate-enriched groundwater. Extensive cover of thick sediment (>50 feet) is needed to ensure resistance to nitrite/nitrate contamination of groundwater, as even patchy areas of thinner cover can allow infiltration of contaminants into underground water sources.
- **Row cropping and nitrogen pollution are correlated.** The MPCA has found a strongly correlated positive relationship between percentage of corn/soy in an area and concentration of nitrates in trout streams.
- **Increased groundwater consumption and agricultural tiling seem to be leading to decreased groundwater base flow, increased runoff and stream flow.** Despite steady precipitation rates since 1990, base flow of rivers (the component of flow based primarily on groundwater discharge rather than precipitation and runoff) has declined with the increase of groundwater and surface water consumption and agricultural tiling; groundwater consumption has nearly doubled since 1990. However, annual stream flow as a result of runoff seems to be increasing in the agricultural areas of southern Minnesota, due primarily to land use changes.

**Goal 4: Economic and Social Values.** Forests within a region’s landscape will be providing a full range of products, services, and values, including timber products, wildlife and tourism that are major contributors to economic stability, environmental quality, social satisfaction, and community well-being.

#### Key Findings

- **The Southeast Landscape contains 5 active silica sand mines, 4 proposed mine sites, and 5 prospective mine sites.** Six proposed or prospective mine sites occur in southwest Winona County, an area where currently no active silica sand mines exist.
- **Nearly 12 million vehicles travel approximately 22.5 million miles along 7800 miles of roads in the Southeast Landscape daily.** Approximately 1 in 25 vehicles are considered “heavy commercial” and make up 8.8% of daily vehicle miles travelled in the region.
- **The Southeast Landscape contains a variety of diverse, multi-purpose trails.** Snowmobile trails are the most popular trail-type in the Southeast Landscape, following by hiking. ATV trails are less common in the southeast than the rest of the state.

- **In 2013 there were 323 forest-related payroll jobs in the Southeast Landscape.** Over the last decade, forest-related payroll jobs have ranged from 271 (2010) to 604 (2005).
- **Minnesota had over 40,000 jobs** and \$9.7 billion in direct economic impact related to forestry, logging, and primary and secondary forest products manufacturing in 2008.
- **8,425 cord equivalents of timber were harvested in the Southeast Landscape in 2011.** Comparatively, in 2009 over 21,000 cord equivalents were processed in the region, suggesting that the region imports timber from other areas for processing.
- **There were at least 26 saw mills in the Southeast Landscape in 2007.**
- **In 2010, Minnesota ranked 8<sup>th</sup> among the 50 states in terms of gross state product per capita for combined pulp and paper and wood products.**
- **In 2012, the state had nearly 1500 forest industry-related facilities** including four pulp and paper mills.
- **Farmland, tillable land, and timberland prices have increased dramatically in the last two decades.** Farmland price per acre has increased 10-fold in Houston county in the last 20 years, and 4.5 to 9 fold in all other counties in the region during that time period. Tillable land increased 4.5 to 7.5 fold across the region during the 20-year period, with Fillmore County seeing the largest percent increase. Timberland was not documented in all counties over the 20-year period, but increased approximately 12 to 14 fold for the counties of Fillmore, Wabasha, and Houston during that time, and only 4 to 5 fold in Goodhue and Winona Counties. Farmland and Tillable land was highest in Mower County in 2013 and Timberland was highest in Olmsted County in 2013.
- **There are five active dimension stone or silica sand mines in the Southeast Landscape,** and many crushed stone and sand/gravel quarries throughout the region.
- **As of 2013, no new “frac sand” mines are proposed for the region,** though many small silica sand mines for agricultural bedding exist throughout the region.
- **Citizens of southern Minnesota prefer walking/hiking, boating, and swimming as their top three outdoor activities.**
- **Leisure and Hospitality is a nearly \$1 billion industry** in the 13-county Southeast Landscape, providing over 20,000 jobs.
- **Whitewater State Park is an important Minnesota tourist destination.** In 2010, Whitewater state park was the most popular tourist attraction (of facilities reporting to Explore Minnesota) in the 38-county South Region of Minnesota with over 250,000 visitors that year.
- **Survey results indicate that trout angling in Southeast Minnesota was most popular among locals and Twin Cities residents.** In 2005, trout anglers in southeast Minnesota caught over 214,000 trout in nearly 191,000 angling-hours. Over 90% of anglers interviewed were from Minnesota. Over 50% of interviewees were from the 11-county southeast study area, while over 30% were from the Twin Cities metro.
- **Trout angling has economic impact in the Driftless Area.** Resident trout anglers of southeast Minnesota may spend over \$200 per outing, while non-resident anglers may spend nearly double that amount per outing, according to 2008 estimates.
- **Population model estimates indicates relatively stable deer populations in the region between 2008 and 2013,** having decreased somewhat in designated permit areas that had the highest deer densities in 2008. Deer harvest numbers have dropped slightly since 2003, potentially due to changes in hunting regulations.

- **Landowner perceptions of deer population and impacts** - A 2013 survey of 2,312 landowners (with 40 acres or more) in Goodhue, Wabasha, Houston, and Winona counties indicated that the largest percentage of both hunting and non-hunting landowners felt that deer populations were “about right” around their property; however, landowners who do not hunt were more likely to report that numbers were “too high” than those who do hunt (45% of non-hunters compared to 23% of hunters). Respondents estimated a total of \$3.5 million worth of damage to crops (in large part, corn) in 2011 due to deer.
- **Based on car counts, deer hunting pressure in the Whitewater Wildlife Management Area has decreased steadily** over the last 3 decades for the opening day of the second season, but remained relatively steady for the opening day of the first season, and increasing in 2010 and 2011 for this day.



## Goal 1 – Forest Land Cover

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**MFRC Goal 1: Land area covered by forests within a region’s landscape will be the same or larger.**

The MFRC Southeast Landscape Region contains the counties of Dodge, Fillmore, Freeborn, Goodhue, Houston, Le Sueur, Mower, Olmsted, Rice, Steele, Wabasha, Waseca, and Winona. These thirteen counties cover 4,885,507 acres, of which 724,139 acres (14.8%) are forested. The data in this section shows the extent of forestlands across the region at present and in recent decades.

### 1.1 – Land Cover Data Sources

Pre-settlement Vegetation of Minnesota: is based on Francis J. Marschner's original analysis done in the 1930's of 19th century of Public Land Survey notes. Marschner compiled his results in map format which has been subsequently captured in digital format.

1990 Census Land Use and Cover: integrates six different source data sets to provide a simplified 8-category view of Minnesota's land use / cover in 30 meter grid cells.

1992 GAP Analysis Project: created land cover datasets as part of its mission to identify habitats that need further protection. This dataset is based on similar satellite imagery to the National Land Cover Database, however it provides a more detailed classification system than the NLCD and places special emphasis on natural plant communities.

2001 and 2006 National Land Cover Database (NLCD): is a 16-class land cover classification scheme that has been applied consistently across the conterminous United States at a spatial resolution of 30 meters. NLCD is based primarily on Landsat satellite data and a variety of supporting information.

Forest Inventory Analysis (FIA): is the systematic collection of data and forest information by the U.S. Forest Service for assessment or analysis to assess America's forests. This continuous forest census reports on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and in forest land ownership. This data is not meant to be represented spatially.

## **1.2 – Spatial Forestland Cover Analysis (Pre-settlement, GAP, and NLCD)**

Between pre-settlement times and 2006, this region has lost over 330,000 acres – or approximately one third – of its Upland Forest land cover (Table 1). However, it should be noted that the loss by 1992 had been much greater – nearly 600,000 acres of forestland. Thus, southeast Minnesota saw a recovery of over 200,000 acres of Upland Forest land cover between 1992 and 2006. This time period was also marked by a decrease in agricultural land and an increase in Upland Grass, with decreases in Upland Shrub and increases in developed land. The figures and tables below provide detail on quantity and location of all land cover types in 1895 (Table 2, Figure 1), 1992 (Table 3, Figure 2), 2001 (Table 4, Figure 3), and 2006 (Table 5, Figure 4).

It should be noted that the land cover classifications discussed above are novel comparative classes meant to provide a common metric across the four different datasets presented below (Marschner’s pre-settlement data, GAP Land Cover, and NLCD 2001 and 2006); this reclassification was done to better demonstrate change over time. Each map has an accompanying cross-walk table to demonstrate how the datasets’ original land cover classifications compare to the reclassifications.

**Table 1:** Land cover change in the Southeast Landscape, Pre-settlement to 2006.

| Comparative Class             | Marschner's Pre-settlement (1895) |              |                             |                               | GAP Land Cover (1992) |              |                             |                               |
|-------------------------------|-----------------------------------|--------------|-----------------------------|-------------------------------|-----------------------|--------------|-----------------------------|-------------------------------|
|                               | Area (Acres)                      | % of Total   | NA                          | NA                            | Area (Acres)          | % of Total   | Change 1895 to 1992 (Acres) | Change 1895 to 1992 (% Cover) |
| Upland Forest                 | 1,054,837                         | 21.2         | -                           | -                             | 469,866               | 9.4          | -584,971                    | -11.7                         |
| Upland Shrub                  | 224,998                           | 4.5          | -                           | -                             | 33,003                | 0.7          | -191,995                    | -3.9                          |
| Upland Grass                  | 3,228,472                         | 64.8         | -                           | -                             | 834,838               | 16.8         | -2,393,634                  | -48.1                         |
| Lowland Vegetation            | 390,224                           | 7.8          | -                           | -                             | 147,744               | 3.0          | -242,480                    | -4.9                          |
| Agriculture                   | 0                                 | 0.0          | -                           | -                             | 3,291,895             | 66.1         | 3,291,895                   | 66.1                          |
| Open Water                    | 56,754                            | 1.1          | -                           | -                             | 91,037                | 1.8          | 34,283                      | 0.7                           |
| Barren                        | 0                                 | 0.0          | -                           | -                             | 121                   | 0.0          | 121                         | 0.0                           |
| Developed                     | 0                                 | 0.0          | -                           | -                             | 110,896               | 2.2          | 110,896                     | 2.2                           |
| Unclassified                  | 24,144                            | 0.5          | -                           | -                             | 29                    | 0.0          | -24,114                     | -0.5                          |
| Comparative Class             | NLCD (2001)                       |              |                             |                               | NLCD (2006)           |              |                             |                               |
|                               | Area (Acres)                      | % of Total   | Change 1992 to 2001 (Acres) | Change 1992 to 2001 (% Cover) | Area (Acres)          | % of Total   | Change 2001 to 2006 (Acres) | Change 2001 to 2006 (% Cover) |
| Upland Forest                 | 673,365                           | 13.5         | 203,499                     | 4.1                           | 672,341               | 13.5         | -1,024                      | 0.0                           |
| Upland Shrub                  | 10,759                            | 0.2          | -22,244                     | -0.4                          | 11,327                | 0.2          | 568                         | 0.0                           |
| Upland Grass                  | 1,003,655                         | 20.2         | 168,817                     | 3.4                           | 998,160               | 20.0         | -5,495                      | -0.1                          |
| Lowland Vegetation            | 115,586                           | 2.3          | -32,158                     | -0.6                          | 118,124               | 2.4          | 2,538                       | 0.1                           |
| Agriculture                   | 2,709,445                         | 54.4         | -582,450                    | -11.7                         | 2,704,690             | 54.3         | -4,755                      | -0.1                          |
| Open Water                    | 104,064                           | 2.1          | 13,027                      | 0.3                           | 104,309               | 2.1          | 245                         | 0.0                           |
| Barren                        | 3,214                             | 0.1          | 3,094                       | 0.1                           | 3,412                 | 0.1          | 198                         | 0.0                           |
| Developed                     | 359,339                           | 7.2          | 248,443                     | 5.0                           | 367,064               | 7.4          | 7,725                       | 0.2                           |
| Unclassified                  | 0                                 | 0.0          | -29                         | 0.0                           | 0                     | 0.0          | 0                           | 0.0                           |
| <b>Total Southeast Region</b> | <b>4,979,428</b>                  | <b>100.0</b> |                             |                               | <b>4,979,428</b>      | <b>100.0</b> |                             |                               |

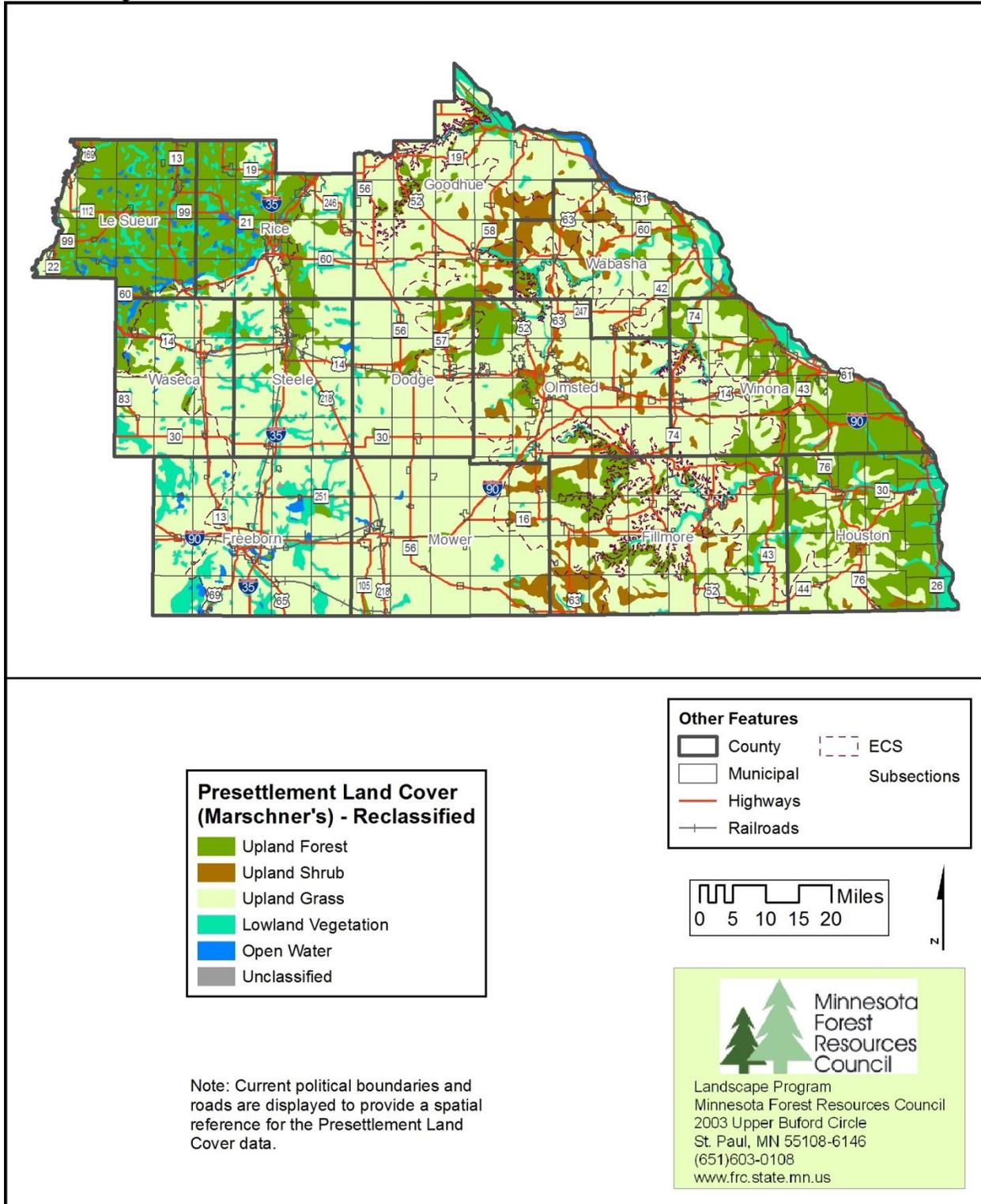
Sources: MN DNR Data Deli, Multi-Resolution Land Characteristics Consortium, adapted by Jeff Reinhart (2013).

**Table 2:** Comparative classes of vegetation vs. original Marschner classifications.

| <b>Comparative Class</b>             | <b>Presettlement Land Cover (Marschner's)</b>         | <b>Area (Acres)</b> |
|--------------------------------------|---|---------------------|
| Upland Forest                        | Aspen-Oak Land  | 157,930             |
|                                      | Big Woods - Hardwoods (oak, maple, basswood, hickory) | 896,907             |
| <b>Subtotal (Upland Forest)</b>      |   | <b>1,054,837</b>    |
| Upland Shrub                         | Brush Prairie   | 224,998             |
| <b>Subtotal (Upland Shrub)</b>       |   | <b>224,998</b>      |
| Upland Grass                         | Oak openings and barrens                              | 1,620,956           |
|                                      | Prairie   | 1,607,516           |
| <b>Subtotal (Upland Grass)</b>       |   | <b>3,228,472</b>    |
| Lowland Vegetation                   | River Bottom Forest                                   | 129,542             |
|                                      | Wet Prairie   | 260,682             |
| <b>Subtotal (Lowland Vegetation)</b> |   | <b>390,224</b>      |
| Open Water                           | Lakes (open water)                                    | 56,754              |
| <b>Subtotal (Open Water)</b>         |   | <b>56,754</b>       |
| Unclassified                         | Undefined   | 24,144              |
| <b>Subtotal (Unclassified)</b>       |   | <b>24,144</b>       |
| <b>Total Southeast Region</b>        |   | <b>4,979,428</b>    |

Source: Minnesota DNR Data Deli, adapted by Jeff Reinhart (2013).

**Figure 1:** Pre-settlement land cover in the Southeast Landscape from Marschner’s Map, 1895. [Note: Categories reclassified, see Table 2]



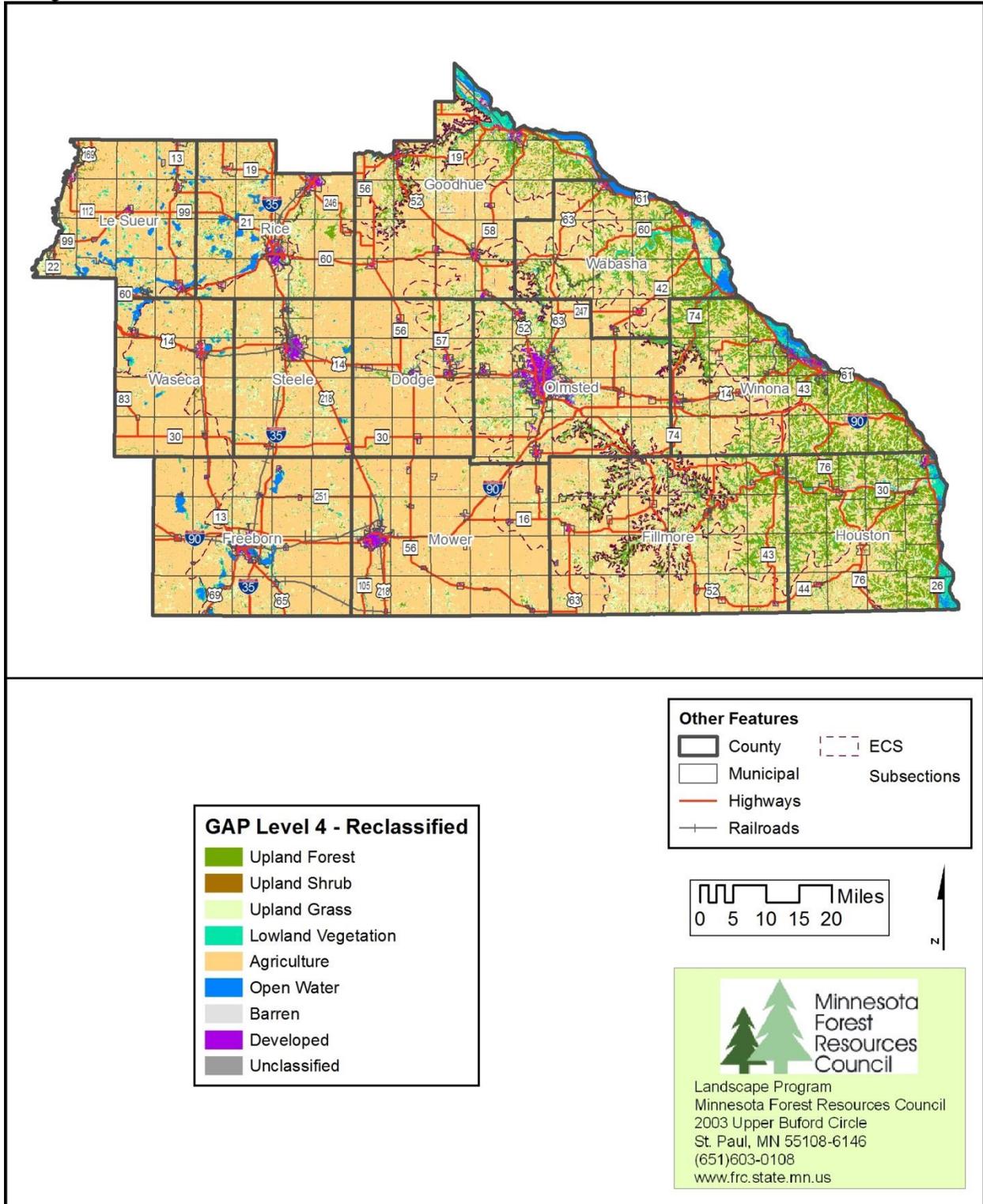
Source: Minnesota DNR Data Deli, adapted by Jeff Reinhart (2013).

**Table 3:** Comparative classes of vegetation vs. original 1992 GAP classifications.

| Comparative Class                    | GAP Level 4                  | Area (Acres)     |
|--------------------------------------|------------------------------|------------------|
| Upland Forest                        | Aspen/White Birch            | 202              |
|                                      | Bur/White Oak                | 41,428           |
|                                      | Maple/Basswood               | 17,410           |
|                                      | Red Oak                      | 288,369          |
|                                      | Red Pine                     | 2,399            |
|                                      | Red/White Pine               | 486              |
|                                      | Red/White Pine-Deciduous mix | 1,136            |
|                                      | Redcedar                     | 1,529            |
|                                      | Redcedar-Deciduous mix       | 5,311            |
|                                      | Upland Deciduous             | 13,504           |
|                                      | White Pine mix               | 785              |
|                                      | White/Red Oak                | 97,308           |
| <b>Subtotal (Upland Forest)</b>      |                              | <b>469,866</b>   |
| Upland Shrub                         | Upland Shrub                 | 33,003           |
| <b>Subtotal (Upland Shrub)</b>       |                              | <b>33,003</b>    |
| Upland Grass                         | Grassland                    | 834,838          |
| <b>Subtotal (Upland Grass)</b>       |                              | <b>834,838</b>   |
| Lowland Vegetation                   | Broadleaf Sedge/Cattail      | 23,353           |
|                                      | Cottonwood                   | 1,342            |
|                                      | Floating Aquatic             | 1,024            |
|                                      | Lowland Deciduous            | 62,272           |
|                                      | Lowland Deciduous Shrub      | 25,525           |
|                                      | Sedge Meadow                 | 11,145           |
|                                      | Silver Maple                 | 23,074           |
| Tamarack                             | 8                            |                  |
| <b>Subtotal (Lowland Vegetation)</b> |                              | <b>147,744</b>   |
| Agriculture                          | Cropland                     | 3,291,895        |
| <b>Subtotal (Agriculture)</b>        |                              | <b>3,291,895</b> |
| Open Water                           | Water                        | 91,037           |
| <b>Subtotal (Open Water)</b>         |                              | <b>91,037</b>    |
| Barren                               | Barren                       | 121              |
| <b>Subtotal (Barren)</b>             |                              | <b>121</b>       |
| Developed                            | Low intensity urban          | 56,845           |
|                                      | Transportation               | 28,932           |
|                                      | High intensity urban         | 25,118           |
| <b>Subtotal (Developed)</b>          |                              | <b>110,896</b>   |
| Unclassified                         | Unidentified                 | 29               |
| <b>Subtotal (Unclassified)</b>       |                              | <b>29</b>        |
| <b>Total Southeast Region</b>        |                              | <b>4,979,428</b> |

Source: Minnesota DNR Data Deli, adapted by Jeff Reinhart (2013).

**Figure 2:** Land use and cover for the Southeast Landscape, 1992 GAP analysis. [Note: Categories reclassified, see Table 3]



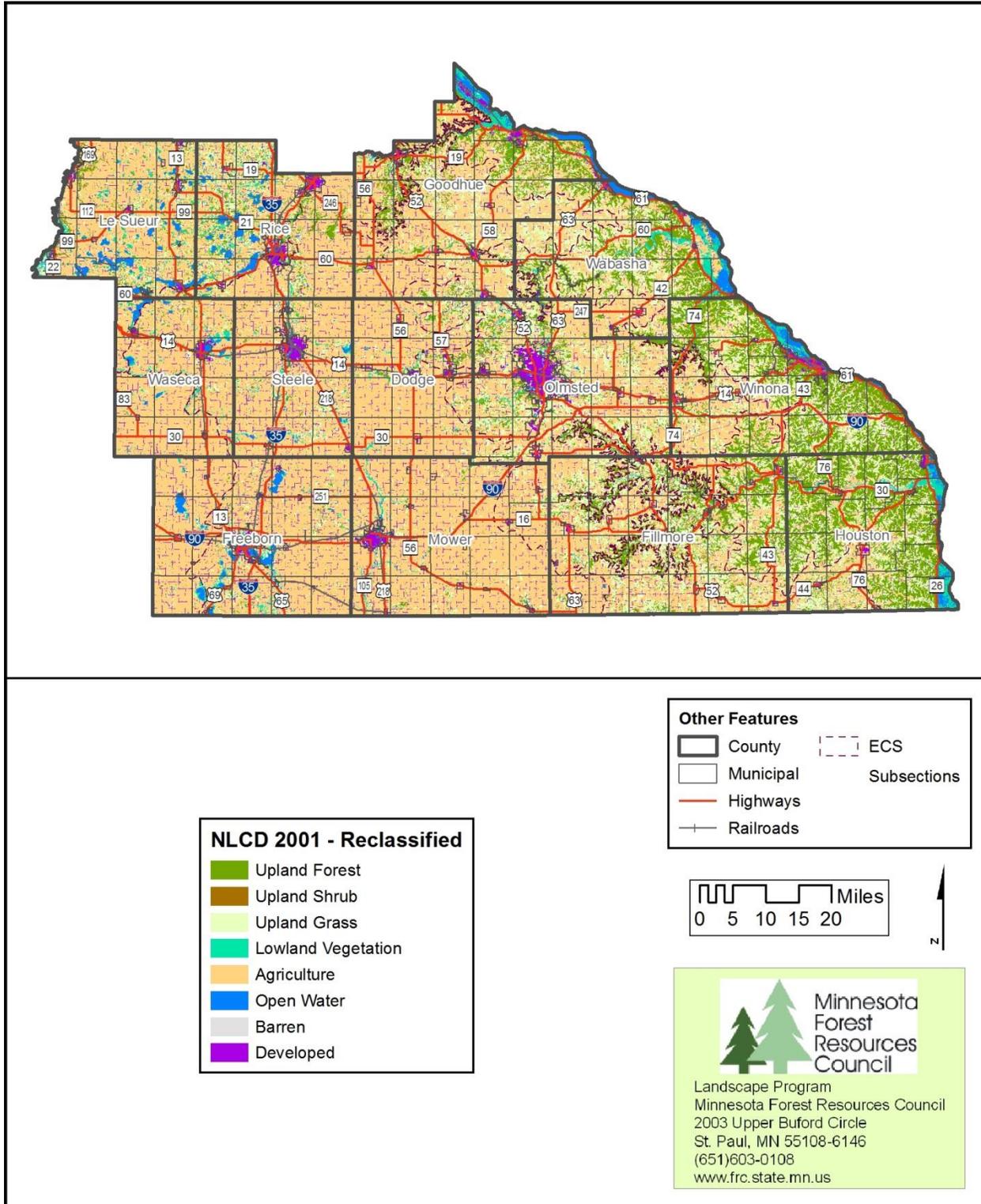
Source: Minnesota DNR Data Deli, adapted by Jeff Reinhart (2013).

**Table 4:** Comparative classes of vegetation vs. original 2001 NLCD classifications.

| <b>Comparative Class</b>             | <b>National Land Cover Dataset 2001</b> | <b>Area (Acres)</b> |
|--------------------------------------|---|---------------------|
| Upland Forest                        | Deciduous Forest                        | 662,880             |
|                                      | Evergreen Forest                        | 9,868               |
|                                      | Mixed Forest                            | 616                 |
| <b>Subtotal (Upland Forest)</b>      |   | <b>673,365</b>      |
| Upland Shrub                         | Shrub/Scrub                             | 10,759              |
| <b>Subtotal (Upland Shrub)</b>       |   | <b>10,759</b>       |
| Upland Grass                         | Grassland/Herbaceous                    | 400,996             |
|                                      | Pasture/Hay                             | 602,659             |
| <b>Subtotal (Upland Grass)</b>       |   | <b>1,003,655</b>    |
| Lowland Vegetation                   | Woody Wetlands                          | 55,792              |
|                                      | Emergent Herbaceous Wetlands            | 59,795              |
| <b>Subtotal (Lowland Vegetation)</b> |   | <b>115,586</b>      |
| Agriculture                          | Cultivated Crops                        | 2,709,445           |
| <b>Subtotal (Agriculture)</b>        |   | <b>2,709,445</b>    |
| Open Water                           | Open Water                              | 104,064             |
| <b>Subtotal (Open Water)</b>         |   | <b>104,064</b>      |
| Barren                               | Barren Land (Rock/Sand/Clay)            | 3,214               |
| <b>Subtotal (Barren)</b>             |   | <b>3,214</b>        |
| Developed                            | Developed, Open Space                   | 246,238             |
|                                      | Developed, Low Intensity                | 88,100              |
|                                      | Developed, Medium Intensity             | 18,751              |
|                                      | Developed, High Intensity               | 6,250               |
| <b>Subtotal (Developed)</b>          |   | <b>359,339</b>      |
| <b>Total Southeast Region</b>        |   | <b>4,979,428</b>    |

Source: Multi-Resolution Land Characteristics Consortium, adapted by Jeff Reinhart (2013).

**Figure 3:** Southeast landscape land Cover, NLCD 2001. [Note: Categories have been reclassified, see Table 4.]



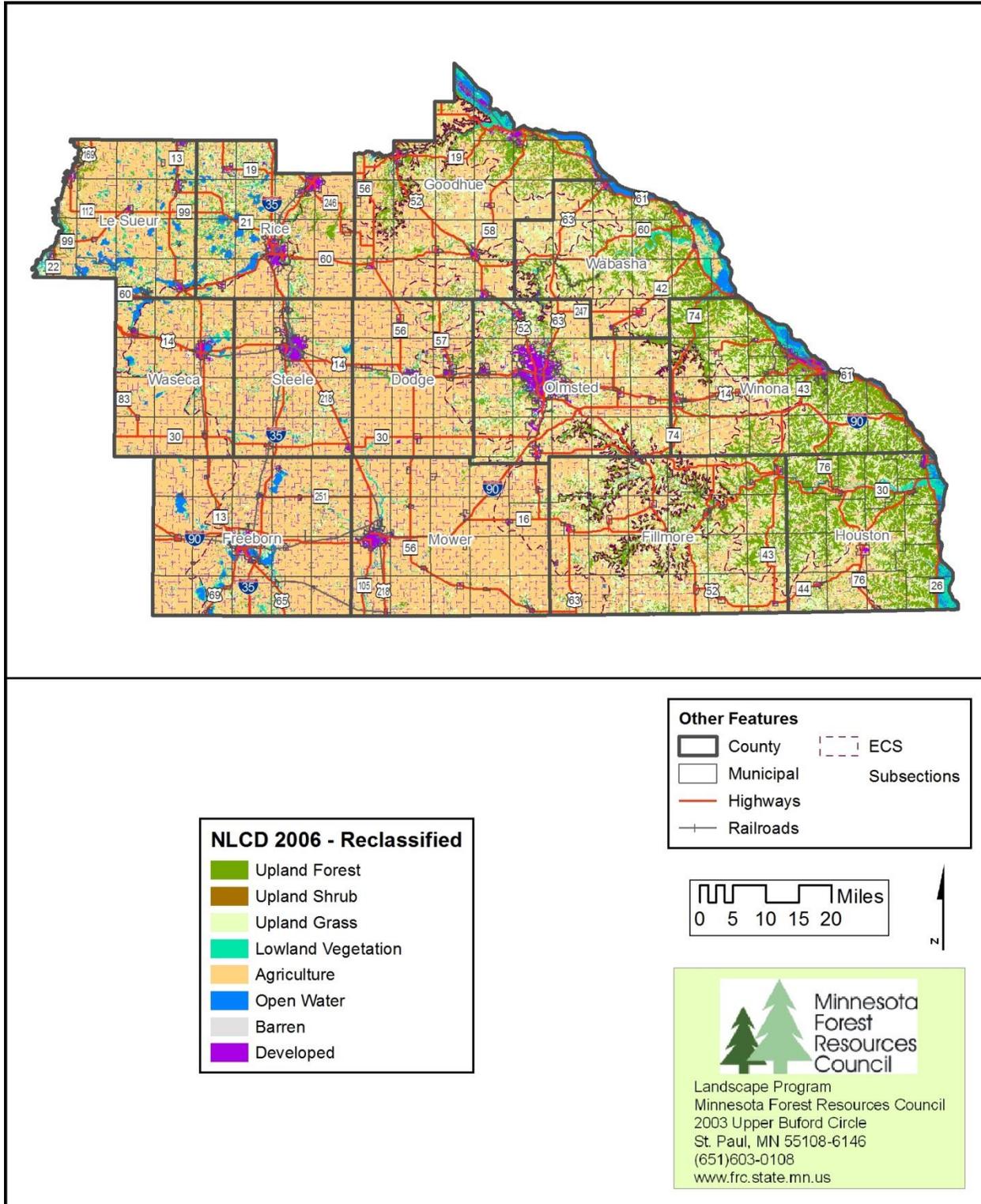
**Source:** Multi-Resolution Land Characteristics Consortium, adapted by Jeff Reinhart (2013).

**Table 5:** Comparative classes of vegetation vs. original 2006 NLCD classifications.

| Comparative Class                    |  | National Land Cover Dataset 2006 | Area (Acres)     |
|--------------------------------------|--|----------------------------------|------------------|
| Upland Forest                        |  | Deciduous Forest                 | 661,882          |
|                                      |  | Evergreen Forest                 | 9,829            |
|                                      |  | Mixed Forest                     | 630              |
| <b>Subtotal (Upland Forest)</b>      |  |                                  | <b>672,341</b>   |
| Upland Shrub                         |  | Shrub/Scrub                      | 11,327           |
| <b>Subtotal (Upland Shrub)</b>       |  |                                  | <b>11,327</b>    |
| Upland Grass                         |  | Grassland/Herbaceous             | 397,202          |
|                                      |  | Pasture/Hay                      | 600,958          |
| <b>Subtotal (Upland Grass)</b>       |  |                                  | <b>998,160</b>   |
| Lowland Vegetation                   |  | Woody Wetlands                   | 56,702           |
|                                      |  | Emergent Herbaceous Wetlands     | 61,422           |
| <b>Subtotal (Lowland Vegetation)</b> |  |                                  | <b>118,124</b>   |
| Agriculture                          |  | Cultivated Crops                 | 2,704,690        |
| <b>Subtotal (Agriculture)</b>        |  |                                  | <b>2,704,690</b> |
| Open Water                           |  | Open Water                       | 104,309          |
| <b>Subtotal (Open Water)</b>         |  |                                  | <b>104,309</b>   |
| Barren                               |  | Barren Land (Rock/Sand/Clay)     | 3,412            |
| <b>Subtotal (Barren)</b>             |  |                                  | <b>3,412</b>     |
| Developed                            |  | Developed, Open Space            | 248,553          |
|                                      |  | Developed, Low Intensity         | 90,652           |
|                                      |  | Developed, Medium Intensity      | 21,086           |
|                                      |  | Developed, High Intensity        | 6,773            |
| <b>Subtotal (Developed)</b>          |  |                                  | <b>367,064</b>   |
| <b>Total Southeast Region</b>        |  |                                  | <b>4,979,428</b> |

Source: Multi-Resolution Land Characteristics Consortium, adapted by Jeff Reinhart (2013).

**Figure 4:** Southeast landscape land Cover, NLCD 2006. [Note: Categories have been reclassified, see Table 5]



**Source:** Multi-Resolution Land Characteristics Consortium, adapted by Jeff Reinhart (2013).

### 1.3 – The Extent of Forestland in Recent Decades

#### Section 1.3.1: Land use in the Southeast Landscape

According to United States Forest Service (USFS) Forest Inventory and Analysis (FIA) estimates, between 1990 and 2012, the MFRC Southeast Landscape increased its forested acreage by over 90,000 acres overall, despite a decrease of approximately 60,000 acres between 1990 and 2003 (Table 6). As of 2012, there were approximately 17 acres of forested land to every 100 acres of non-forested land in the region; nearly 15% of total terrestrial acreage in the region is forested.

According to USFS FIA estimates from 2008-2012, Houston County contains 21.6% of the Southeast Landscape’s approximately 724,000 forested acres, followed by Winona County with 20.8% and Fillmore County with 13.2% (Table 7). Mower, Steele, and Freeborn counties are the three least-forested counties, containing a combined 10.8% of the forested acres in the Southeast Landscape.

The Southeast Landscape saw a decrease in acreage defined as “ag land,” “crop land,” and pasture only” land by the USDA National Agricultural Statistics Service (NASS) between 1997 and 2007, according to census information (Table 8). This type of acreage decreased by about 43%, falling from over 156,500 acres to less than 90,000 over the decade. However, total acreage operated as part of a “farm operation” (including, woodland, wasteland, house lot, etc.) remained relatively stable during this time, and actually increasing slightly (Table 9).

**Table 6:** Estimated extent of forestland in the Southeast Landscape, 1990-2012.

| Land Use                               | 1990 area        | 2003 area        | 2012 area        |
|--|------------------|------------------|------------------|
| Forestland <sup>A</sup>                | 631,806          | 571,785          | 724,139          |
| Non-forestland <sup>B</sup>            | 4,274,462        | 4,270,964        | 4,161,368        |
| <i>Total</i>                           | <i>4,906,268</i> | <i>4,842,749</i> | <i>4,885,507</i> |
| Ratio of forestland to non-forestland: | 15/100           | 13/100           | 17/100           |

**Source:** Forest Inventory and Analysis estimate.

<sup>A</sup> FIA defines forestland as: Land that is at least 10 percent stocked by forest trees of any size, or land formerly having such tree cover, and not currently developed for a non-forest use. The minimum area for classification as forest land is one acre. Roadside, stream-side, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams and other bodies of water, or natural clearings in forested areas are classified as forest, if less than 120 feet in width or one acre in size. Grazed woodlands, reverting fields, and pastures that are not actively maintained are included if the above qualifications are satisfied. Forest land includes three sub-categories: timberland, reserved forestland, and other forestland.

<sup>B</sup> All terrestrial acres not designated as forestland.

Note: Area estimates are based on FIA samples and affected by stratification of the sample into categories and by non-sampled rates leading to some artificial variability in area estimates from survey to survey.

**Table 7:** Estimated acres of forestland<sup>a</sup> per county in the MFRC Southeast Landscape, in order from greatest to least (in total acres) in 2012.

| County   | Forestland (in acres) |
|----------|-----------------------|
| Houston  | 156,643               |
| Winona   | 150,358               |
| Fillmore | 95,869                |
| Wabasha  | 88,513                |
| Goodhue  | 73,883                |
| Olmsted  | 52,744                |
| Rice     | 40,470                |
| Le Sueur | 21,791                |
| Dodge    | 15,869                |
| Waseca   | 10,008                |
| Mower    | 7,231                 |
| Steele   | 6,492                 |
| Freeborn | 4,267                 |

Source: Forest Inventory and Analysis estimate, 2012.

<sup>a</sup>FIA defines forestland as: Land that is at least 10 percent stocked by forest trees of any size, or land formerly having such tree cover, and not currently developed for a non-forest use. The minimum area for classification as forest land is one acre. Roadside, stream-side, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams and other bodies of water, or natural clearings in forested areas are classified as forest, if less than 120 feet in width or one acre in size. Grazed woodlands, reverting fields, and pastures that are not actively maintained are included if the above qualifications are satisfied. Forest land includes three sub-categories: timberland, reserved forestland, and other forestland.

Note: Area estimates are based on FIA samples and affected by stratification of the sample into categories and by non-sampled rates leading to some artificial variability in area estimates from survey to survey.

Table 8: Number of acres of land defined as “ag land,” “crop land”, and “pastured only” land in the Southeast Landscape; 1997, 2002, 2007.

| County   | 2007   | 2002   | 1997   |
|----------|--------|--------|--------|
| FREEBORN | 9,150  | 4,343  | 3,722  |
| LE SUEUR | 3,895  | 2,925  | 4,249  |
| RICE     | 7,850  | 5,662  | 7,609  |
| STEELE   | 3,454  | 4,401  | 3,245  |
| WASECA   | 2,156  | 1,185  | 2,350  |
| DODGE    | 4,757  | 4,535  | 5,601  |
| FILLMORE | 13,677 | 18,340 | 26,430 |
| GOODHUE  | 8,501  | 12,827 | 19,719 |
| HOUSTON  | 8,343  | 12,369 | 22,561 |
| MOWER    | 5,015  | 3,904  | 6,818  |
| OLMSTED  | 7,196  | 12,535 | 18,954 |

|                     |        |         |         |
|---------------------|--------|---------|---------|
| WABASHA             | 7,714  | 14,188  | 17,105  |
| WINONA              | 8,194  | 13,418  | 18,210  |
| Total SE Landscape: | 89,902 | 110,632 | 156,573 |

Source: USDA National Agricultural Statistics Service Quick Stats. Accessed Feb. 13, 2014. Available at: <http://quickstats.nass.usda.gov/>

Table 9: Total acres operated as part of a farm operation in the Southeast Landscape; 1997, 2002, 2007.

|                    | 2007      | 2002      | 1997      |
|--------------------|-----------|-----------|-----------|
| FREEBORN           | 388,488   | 394,408   | 376,923   |
| LE SUEUR           | 250,696   | 238,076   | 217,338   |
| RICE               | 253,094   | 248,818   | 256,572   |
| STEELE             | 266,199   | 281,847   | 235,872   |
| WASECA             | 254,531   | 231,328   | 243,634   |
| DODGE              | 248,125   | 233,375   | 253,543   |
| FILLMORE           | 446,331   | 441,153   | 432,804   |
| GOODHUE            | 396,743   | 384,108   | 396,367   |
| HOUSTON            | 244,404   | 253,600   | 301,114   |
| MOWER              | 419,889   | 412,145   | 407,685   |
| OLMSTED            | 296,039   | 313,020   | 303,388   |
| WABASHA            | 262,263   | 267,058   | 256,970   |
| WINONA             | 305,560   | 310,976   | 299,386   |
| Total SE Landscape | 4,032,362 | 4,009,912 | 3,981,596 |

Source: USDA National Agricultural Statistics Service Quick Stats. Accessed Feb. 13, 2014. Available at: <http://quickstats.nass.usda.gov/>

### Section 1.3.2: Land use by Subsection

Upland Forest and Woody Wetlands make up over 40% or over 500,000 acres of land in the intersection between the Southeast Landscape and the Blufflands Subsection (Table 10). This is significantly more forested land than is present in the intersection between the Southeast Landscape and the other two predominating Subsections within the Landscape – the Rochester Plateau (8.8%, about 115, 000 acres) (Table 11) and the Oak Savanna (3.5%, over 56,000 acres) (Table 12). Agriculture predominates in these latter two subsections at 53.4% cover in the Rochester Plateau/Southeast Landscape intersection and 78.1% in the Oak Savanna intersection, while comprising only 18.5% of land cover in the Blufflands/Southeast Landscape intersection. Upland Forest/Woody Wetland cover in the less dominate subsections is somewhat minimal, including 8.8% cover in the Big Woods intersection and 1.3% in the Minnesota River Prairie (Table 13). However, the acreage of forested/woody wetland land in the small Big Woods (Table 14) intersection with the Southeast Landscape is comparable to that in the total Oak Savanna intersection, where forests are much more spread out. This suggests a greater concentration of forests in the northwest corner of the region than in the rest of the western portion of the region.

Table 10: Land classification in the Blufflands Subsection

| Comparative Class                               | National Land Cover Dataset 2006 | Area (Acres)     | % of Total   |
|---|----------------------------------|------------------|--------------|
| Upland Forest                                   | Deciduous Forest                 | 470,269          | 36.8         |
|   | Evergreen Forest                 | 7,419            | 0.6          |
|   | Mixed Forest                     | 456              | 0.0          |
| <b>Subtotal (Upland Forest)</b>                 |                                  | <b>478,144</b>   | <b>37.4</b>  |
| Upland Shrub                                    | Shrub/Scrub                      | 776              | 0.1          |
| <b>Subtotal (Upland Shrub)</b>                  |                                  | <b>776</b>       | <b>0.1</b>   |
| Upland Grass                                    | Grassland/Herbaceous             | 124,299          | 9.7          |
|   | Pasture/Hay                      | 265,035          | 20.7         |
| <b>Subtotal (Upland Grass)</b>                  |                                  | <b>389,334</b>   | <b>30.5</b>  |
| Lowland Vegetation                              | Woody Wetlands                   | 31,737           | 2.5          |
|   | Emergent Herbaceous Wetlands     | 19,275           | 1.5          |
| <b>Subtotal (Lowland Vegetation)</b>            |                                  | <b>51,012</b>    | <b>4.0</b>   |
| Agriculture                                     | Cultivated Crops                 | 236,481          | 18.5         |
| <b>Subtotal (Agriculture)</b>                   |                                  | <b>236,481</b>   | <b>18.5</b>  |
| Open Water                                      | Open Water                       | 52,464           | 4.1          |
| <b>Subtotal (Open Water)</b>                    |                                  | <b>52,464</b>    | <b>4.1</b>   |
| Barren  | Barren Land (Rock/Sand/Clay)     | 718              | 0.1          |
| <b>Subtotal (Barren)</b>                        |                                  | <b>718</b>       | <b>0.1</b>   |
| Developed                                       | Developed, Open Space            | 45,186           | 3.5          |
|   | Developed, Low Intensity         | 18,311           | 1.4          |
|   | Developed, Medium Intensity      | 4,716            | 0.4          |
|   | Developed, High Intensity        | 1,385            | 0.1          |
| <b>Subtotal (Developed)</b>                     |                                  | <b>69,598</b>    | <b>5.4</b>   |
| <b>Total The Blufflands in Southeast Region</b> |                                  | <b>1,278,527</b> | <b>100.0</b> |

Table 11: Land classification in the Rochester Plateau Subsection

| Comparative Class               | National Land Cover Dataset 2006 | Area (Acres)   | % of Total  |
|---------------------------------|----------------------------------|----------------|-------------|
| Upland Forest                   | Deciduous Forest                 | 108,091        | 8.3         |
|                                 | Evergreen Forest                 | 1,304          | 0.1         |
|                                 | Mixed Forest                     | 29             | 0.0         |
| <b>Subtotal (Upland Forest)</b> |                                  | <b>109,424</b> | <b>8.4</b>  |
| Upland Shrub                    | Shrub/Scrub                      | 108            | 0.0         |
| <b>Subtotal (Upland Shrub)</b>  |                                  | <b>108</b>     | <b>0.0</b>  |
| Upland Grass                    | Grassland/Herbaceous             | 174,354        | 13.4        |
|                                 | Pasture/Hay                      | 208,502        | 16.1        |
| <b>Subtotal (Upland Grass)</b>  |                                  | <b>382,856</b> | <b>29.5</b> |
| Lowland                         | Woody Wetlands                   | 5,513          | 0.4         |

|  |                              |                  |              |
|--|------------------------------|------------------|--------------|
| Vegetation   | Emergent Herbaceous Wetlands | 1,380            | 0.1          |
| <b>Subtotal (Lowland Vegetation)</b>               |                              | <b>6,893</b>     | <b>0.5</b>   |
| Agriculture  | Cultivated Crops             | 693,516          | 53.4         |
| <b>Subtotal (Agriculture)</b>                      |                              | <b>693,516</b>   | <b>53.4</b>  |
| Open Water   | Open Water                   | 1,646            | 0.1          |
| <b>Subtotal (Open Water)</b>                       |                              | <b>1,646</b>     | <b>0.1</b>   |
| Barren   | Barren Land (Rock/Sand/Clay) | 697              | 0.1          |
| <b>Subtotal (Barren)</b>                           |                              | <b>697</b>       | <b>0.1</b>   |
| Developed  | Developed, Open Space        | 61,560           | 4.7          |
|  | Developed, Low Intensity     | 32,907           | 2.5          |
|  | Developed, Medium Intensity  | 7,016            | 0.5          |
|  | Developed, High Intensity    | 2,317            | 0.2          |
| <b>Subtotal (Developed)</b>                        |                              | <b>103,800</b>   | <b>8.0</b>   |
| <b>Total Rochester Plateau in Southeast Region</b> |                              | <b>1,298,940</b> | <b>100.0</b> |

Table 12: Land classification in the Oak Savanna Subsection

| Comparative Class                    | National Land Cover Dataset 2006 | Area (Acres)     | % of Total  |
|--------------------------------------|----------------------------------|------------------|-------------|
| Upland Forest                        | Deciduous Forest                 | 40,409           | 2.5         |
|                                      | Evergreen Forest                 | 336              | 0.0         |
|                                      | Mixed Forest                     | 14               | 0.0         |
| <b>Subtotal (Upland Forest)</b>      |                                  | <b>40,760</b>    | <b>2.5</b>  |
| Upland Shrub                         | Shrub/Scrub                      | 916              | 0.1         |
| <b>Subtotal (Upland Shrub)</b>       |                                  | <b>916</b>       | <b>0.1</b>  |
| Upland Grass                         | Grassland/Herbaceous             | 85,883           | 5.2         |
|                                      | Pasture/Hay                      | 39,178           | 2.4         |
| <b>Subtotal (Upland Grass)</b>       |                                  | <b>125,061</b>   | <b>7.6</b>  |
| Lowland Vegetation                   | Woody Wetlands                   | 15,650           | 1.0         |
|                                      | Emergent Herbaceous Wetlands     | 18,088           | 1.1         |
| <b>Subtotal (Lowland Vegetation)</b> |                                  | <b>33,739</b>    | <b>2.1</b>  |
| Agriculture                          | Cultivated Crops                 | 1,284,671        | 78.1        |
| <b>Subtotal (Agriculture)</b>        |                                  | <b>1,284,671</b> | <b>78.1</b> |
| Open Water                           | Open Water                       | 15,332           | 0.9         |
| <b>Subtotal (Open Water)</b>         |                                  | <b>15,332</b>    | <b>0.9</b>  |
| Barren                               | Barren Land (Rock/Sand/Clay)     | 595              | 0.0         |
| <b>Subtotal (Barren)</b>             |                                  | <b>595</b>       | <b>0.0</b>  |
| Developed                            | Developed, Open Space            | 108,552          | 6.6         |
|                                      | Developed, Low Intensity         | 26,519           | 1.6         |
|                                      | Developed, Medium Intensity      | 6,709            | 0.4         |
|                                      | Developed, High Intensity        | 2,167            | 0.1         |
| <b>Subtotal (Developed)</b>          |                                  | <b>143,947</b>   | <b>8.8</b>  |

|  |                  |              |
|--|------------------|--------------|
| <b>Total Oak Savanna in Southeast Region</b> | <b>1,645,020</b> | <b>100.0</b> |
|--|------------------|--------------|

Table 13: Land classification in the Minnesota River Prairie Subsection

| <b>Comparative Class</b>                                 | <b>National Land Cover Dataset 2006</b> | <b>Area (Acres)</b> | <b>% of Total</b> |
|--|---|---------------------|-------------------|
| Upland Forest  | Deciduous Forest                        | 1,863               | 0.7               |
|  | Evergreen Forest                        | 8                   | 0.0               |
|  | Mixed Forest                            | 0                   | 0.0               |
| <b>Subtotal (Upland Forest)</b>                          |   | <b>1,870</b>        | <b>0.7</b>        |
| Upland Shrub   | Shrub/Scrub                             | 0                   | 0.0               |
| <b>Subtotal (Upland Shrub)</b>                           |   | <b>0</b>            | <b>0.0</b>        |
| Upland Grass   | Grassland/Herbaceous                    | 3,761               | 1.5               |
|  | Pasture/Hay                             | 2,323               | 0.9               |
| <b>Subtotal (Upland Grass)</b>                           |   | <b>6,084</b>        | <b>2.4</b>        |
| Lowland Vegetation                                       | Woody Wetlands                          | 1,459               | 0.6               |
|  | Emergent Herbaceous Wetlands            | 2,412               | 1.0               |
| <b>Subtotal (Lowland Vegetation)</b>                     |   | <b>3,871</b>        | <b>1.5</b>        |
| Agriculture  | Cultivated Crops                        | 219,713             | 87.4              |
| <b>Subtotal (Agriculture)</b>                            |   | <b>219,713</b>      | <b>87.4</b>       |
| Open Water   | Open Water                              | 4,110               | 1.6               |
| <b>Subtotal (Open Water)</b>                             |   | <b>4,110</b>        | <b>1.6</b>        |
| Barren   | Barren Land (Rock/Sand/Clay)            | 62                  | 0.0               |
| <b>Subtotal (Barren)</b>                                 |   | <b>62</b>           | <b>0.0</b>        |
| Developed  | Developed, Open Space                   | 14,513              | 5.8               |
|  | Developed, Low Intensity                | 992                 | 0.4               |
|  | Developed, Medium Intensity             | 218                 | 0.1               |
|  | Developed, High Intensity               | 47                  | 0.0               |
| <b>Subtotal (Developed)</b>                              |   | <b>15,770</b>       | <b>6.3</b>        |
| <b>Total Minnesota River Prairie in Southeast Region</b> |   | <b>251,481</b>      | <b>100.0</b>      |

Table 14: Land classification in the Big Woods Subsection

| <b>Comparative Class</b>        | <b>National Land Cover Dataset 2006</b> | <b>Area (Acres)</b> | <b>% of Total</b> |
|---------------------------------|---|---------------------|-------------------|
| Upland Forest                   | Deciduous Forest                        | 41,249              | 8.2               |
|                                 | Evergreen Forest                        | 763                 | 0.2               |
|                                 | Mixed Forest                            | 131                 | 0.0               |
| <b>Subtotal (Upland Forest)</b> |   | <b>42,143</b>       | <b>8.3</b>        |
| Upland Shrub                    | Shrub/Scrub                             | 9,527               | 1.9               |
| <b>Subtotal (Upland Shrub)</b>  |   | <b>9,527</b>        | <b>1.9</b>        |
| Upland Grass                    | Grassland/Herbaceous                    | 8,906               | 1.8               |

|  |                              |                |              |
|--|------------------------------|----------------|--------------|
|  | Pasture/Hay                  | 85,919         | 17.0         |
| <b>Subtotal (Upland Grass)</b>             |                              | <b>94,825</b>  | <b>18.8</b>  |
| Lowland<br>Vegetation                      | Woody Wetlands               | 2,342          | 0.5          |
|  | Emergent Herbaceous Wetlands | 20,267         | 4.0          |
| <b>Subtotal (Lowland Vegetation)</b>       |                              | <b>22,609</b>  | <b>4.5</b>   |
| Agriculture                                | Cultivated Crops             | 270,309        | 53.5         |
| <b>Subtotal (Agriculture)</b>              |                              | <b>270,309</b> | <b>53.5</b>  |
| Open Water                                 | Open Water                   | 30,758         | 6.1          |
| <b>Subtotal (Open Water)</b>               |                              | <b>30,758</b>  | <b>6.1</b>   |
| Barren                                     | Barren Land (Rock/Sand/Clay) | 1,340          | 0.3          |
| <b>Subtotal (Barren)</b>                   |                              | <b>1,340</b>   | <b>0.3</b>   |
| Developed                                  | Developed, Open Space        | 18,743         | 3.7          |
|  | Developed, Low Intensity     | 11,923         | 2.4          |
|  | Developed, Medium Intensity  | 2,427          | 0.5          |
|  | Developed, High Intensity    | 856            | 0.2          |
| <b>Subtotal (Developed)</b>                |                              | <b>33,949</b>  | <b>6.7</b>   |
| <b>Total Big Woods in Southeast Region</b> |                              | <b>505,461</b> | <b>100.0</b> |



## Goal 2 – Land Ownership

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**MFRC Goal 2: Forests within a region’s landscape will be in a variety of ownerships, serving both public and private interests.**

Data presented in this section show recent trends in public and private forestland ownership in southeast Minnesota.

### 2.1. Land Ownership Data Sources

GAP Stewardship 2008: Created land ownership information for the entire state of Minnesota. These data were created specifically to support the GAP Analysis Project. The base cartography is derived from mathematically subdivided PLS quarter-quarter sections and the 40 acre polygons have been dissolved on the ownership values in the attribute table. Ownership reflects surface features only. Ownership is only as current as the source information and should not be considered comprehensive for the entire state. Land interest is expressed only when some organization owns or administers more than 50 percent of a forty except where sub-forty accuracy stewardship polygons were created.

Forest Inventory Analysis (FIA): The systematic collection of data and forest information by the U.S. Forest Service for assessment or analysis to assess America's forests. This continuous forest census reports on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and in forest land ownership. This data is not meant to be represented spatially but breaks forestland and timberland estimates down by ownership class.

#### MN DNR Private Forest Management Program, Forest Stewardship Program

- (FSP 2013): The Forest Stewardship program “provides technical advice and long-range forest management planning to interested landowners.” More information available at: <http://www.dnr.state.mn.us/grants/forestmgmt/stewardship.html>
- (Arends et al. 2009): Arends, Andrew, Gary Michael, and the Forest Stewardship Council. Nov. 23, 2009. “Charging for stewardship plans.” Available at: [http://files-intranet.dnr.state.mn.us/user\\_files/1865/changingstewardshipplans.pdf?ticket=ST-2616560-Oz8c867MPmLKUtuuOR24](http://files-intranet.dnr.state.mn.us/user_files/1865/changingstewardshipplans.pdf?ticket=ST-2616560-Oz8c867MPmLKUtuuOR24)
- (USFS 2009): U.S. Forest Service. 2009. Spatial Analysis Program. More information available at: <http://www.fs.fed.us/na/sap/products/mn.shtml>

MN DNR Data Deli: The internet-based spatial data acquisition site hosted by the Minnesota Department of Natural Resources. <http://deli.dnr.state.mn.us/index.html>

National Woodland Owner Survey (NWOS): The official census of forest owners in the United States. On an annual basis, the NWOS contacts forest-land owners from across the county to ask them questions about: The forest land they own, their reasons for owning it, how they use it, if

and how they manage it, sources of information about their forests, their concerns and issues related to their forests, their intentions for the future of their forests, and their demographics.

## 2.2 Land Ownership by Entity

The vast majority of timberland of forestland in the MFRC Southeast Landscape – over 85% – is privately-owned (Table 15). The ratio of public to private timberland stayed relatively consistent between 1990 and 2012, though there was a slight increase in the amount of private land relative to the amount of public land. Most publically-owned timberland is state- or locally-owned, while only a small percent of overall timberland in the area is federally-owned. Similar trends can be seen for forest land (Table 16). An even higher percentage of total land in the Southeast Landscape is privately owned – over 96%, excluding private conservancy land (Table 17, Figure 5). Only very slight differences can be seen between ownership and management of land in southeast Minnesota; for example, a small amount of land owned by the Federal Bureau of Indian Affairs is managed by the Dakota Indians (Table 18, Figure 6). Table 19 compares ownership to management of forest lands in the region.

Nearly all of the Richard J. Dorer Memorial Hardwood Forest is within the MFRC Southeast Landscape. While about 7% is owned by the State and other entities, most of the approximately one million acre forest is within private ownership (Table 20, Figure 7).

**Table 15:** Area of timberland by ownership group for the MFRC Southeast Landscape, 1990, 2003, 2012 (FIA).

| Ownership Group   | 1990    | 2003    | 2012    | % Change<br>1990-2012 |
|-------------------|---------|---------|---------|-----------------------|
| Total             | 623,616 | 539,199 | 702,547 | 12.7%                 |
| Public            | 94,310  | 69,750  | 98,153  | 4.1%                  |
| % of total        | 15.1%   | 12.9%   | 14.0%   |                       |
| • Other federal   | 19,500  | 6,109   | 16,410  | -15.8%                |
| % of total        | 3.1%    | 1.1%    | 2.3%    |                       |
| • State and local | 74,810  | 63,641  | 81,743  | 9.3%                  |
| % of total        | 12.0%   | 11.8%   | 11.6%   |                       |
| Private           | 529,305 | 469,449 | 604,393 | 14.2%                 |
| % of total        | 84.9%   | 87.1%   | 86.0%   |                       |

**Source:** Forest Inventory Analysis estimate.

Note: The FIA database combines Native American, Forest Industry, and Non-industrial Private land as 'Private'. For some analysis these categories cannot be separated due to disclosure laws.

**Table 16:** Area of forest land by ownership group for the MFRC Southeast Landscape, 1990, 2003, 2012 (FIA).

| <b>Ownership Group</b> | <b>1990</b>  | <b>2003</b>  | <b>2012</b>  | <b>% Change<br/>1990-2012</b> |
|------------------------|--------------|--------------|--------------|-------------------------------|
| Total                  | 631,806      | 571,785      | 724,139      | 14.6%                         |
| Public                 | 97,401       | 85,900       | 101,093      | 3.8%                          |
| <i>% of total</i>      | <i>15.4%</i> | <i>15.0%</i> | <i>14.0%</i> |                               |
| • Other federal        | 19,500       | 9,551        | 16,410       | -15.8%                        |
| <i>% of total</i>      | <i>3.1%</i>  | <i>1.7%</i>  | <i>2.3%</i>  |                               |
| • State and local      | 77,901       | 76,350       | 84,683       | 8.7%                          |
| <i>% of total</i>      | <i>12.3%</i> | <i>13.4%</i> | <i>11.7%</i> |                               |
| Private                | 534,405      | 485,885      | 623,046      | 16.6%                         |
| <i>% of total</i>      | <i>84.6%</i> | <i>85.0%</i> | <i>86.0%</i> |                               |

**Source:** Forest Inventory Analysis estimate.

Note: The FIA database combines Native American, Forest Industry, and Non-industrial Private land as ‘Private’. For some analysis these categories cannot be separated due to disclosure laws.

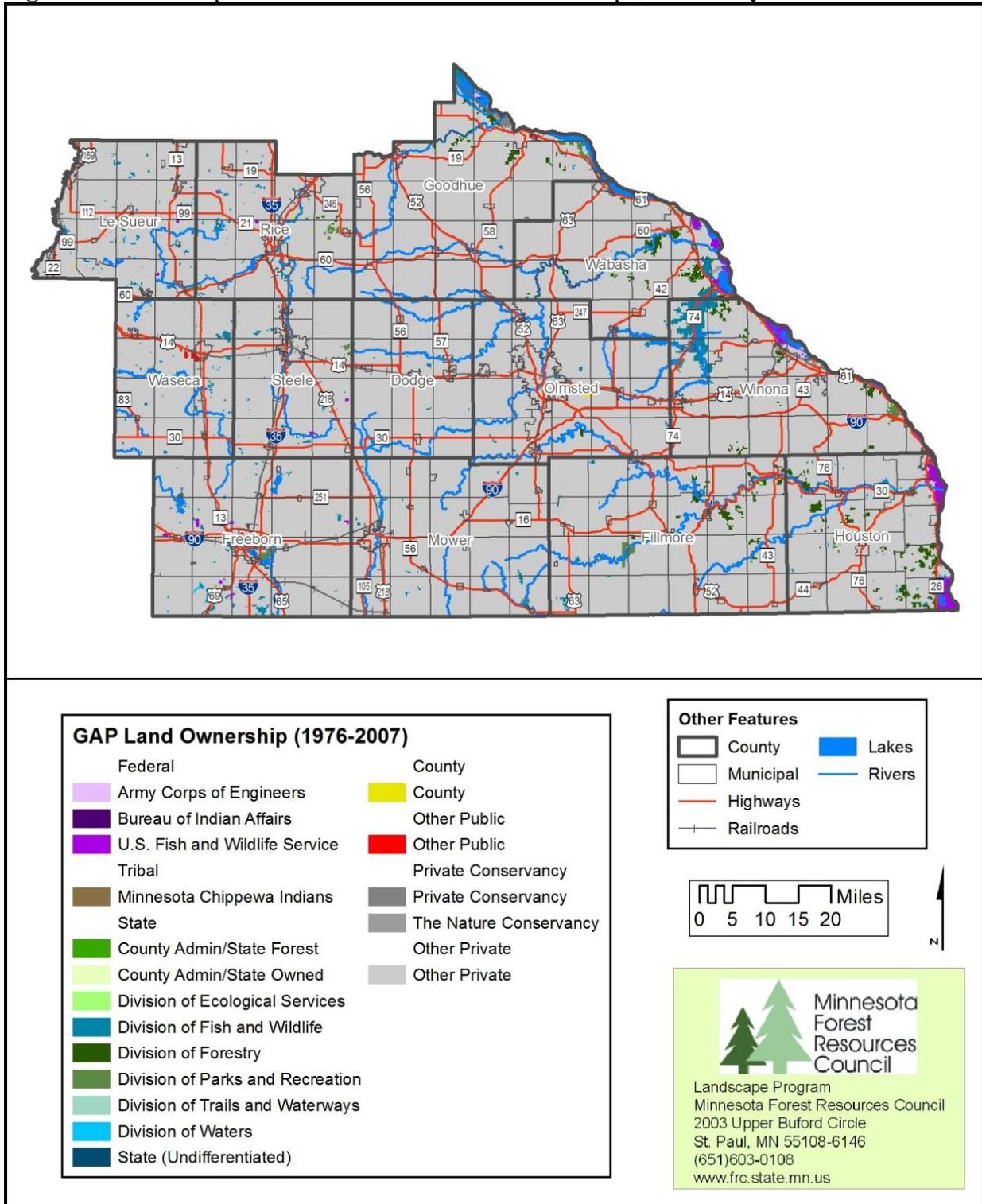
**Table 17:** Land ownership in the Southeast Landscape from GAP Stewardship 1976-2007.

| <b>Ownership Type</b> | <b>Land Ownership</b>            | <b>Acres</b>   | <b>% of Total</b> |
|-----------------------|----------------------------------|----------------|-------------------|
| Federal               | Army Corps of Engineers          | 1,212          | 0.0               |
|                       | Bureau of Indian Affairs         | 476            | 0.0               |
|                       | U.S. Fish and Wildlife Service   | 38,334         | 0.8               |
| <b>Total Federal</b>  |                                  | <b>40,022</b>  | <b>0.8</b>        |
| State                 | County Admin/State Forest        | 41             | 0.0               |
|                       | County Admin/State Owned         | 274            | 0.0               |
|                       | Division of Ecological Services  | 3,420          | 0.1               |
|                       | Division of Fish and Wildlife    | 67,336         | 1.4               |
|                       | Division of Forestry             | 47,106         | 0.9               |
|                       | Division of Parks and Recreation | 14,639         | 0.3               |
|                       | Division of Trails and Waterways | 345            | 0.0               |
|                       | Division of Waters               | 1,303          | 0.0               |
|                       | State (Undifferentiated)         | 608            | 0.0               |
| <b>Total State</b>    |                                  | <b>135,073</b> | <b>2.7</b>        |
| County                | County                           | 4,165          | 0.1               |
| <b>Total County</b>   |                                  | <b>4,165</b>   | <b>0.1</b>        |
| Other Public          | Other Public                     | 1,621          | 0.0               |

|   |                                   |                  |              |
|---|-----------------------------------|------------------|--------------|
| <b>Total Other Public</b>                   |                                   | <b>1,621</b>     | <b>0.0</b>   |
| Private                                     | Private Conservancy               | 2,307            | 0.0          |
| Conservancy                                 | The Nature Conservancy            | 1,024            | 0.0          |
| <b>Total Private Conservancy</b>            |                                   | <b>3,332</b>     | <b>0.1</b>   |
| <b>Total Public and Private Conservancy</b> |                                   | <b>184,212</b>   | <b>3.7</b>   |
| <b>Total Tribal</b>                         | <b>Minnesota Chippewa Indians</b> | <b>330</b>       | <b>0.0</b>   |
| <b>Total Private</b>                        | <b>Private</b>                    | <b>4,794,887</b> | <b>96.3</b>  |
| <b>Total Southeast Region</b>               |                                   | <b>4,979,428</b> | <b>100.0</b> |

Source: Minnesota DNR GIS Data Deli

**Figure 5:** Ownerships of all lands in the Southeast Landscape, GAP analysis 1976-2007.



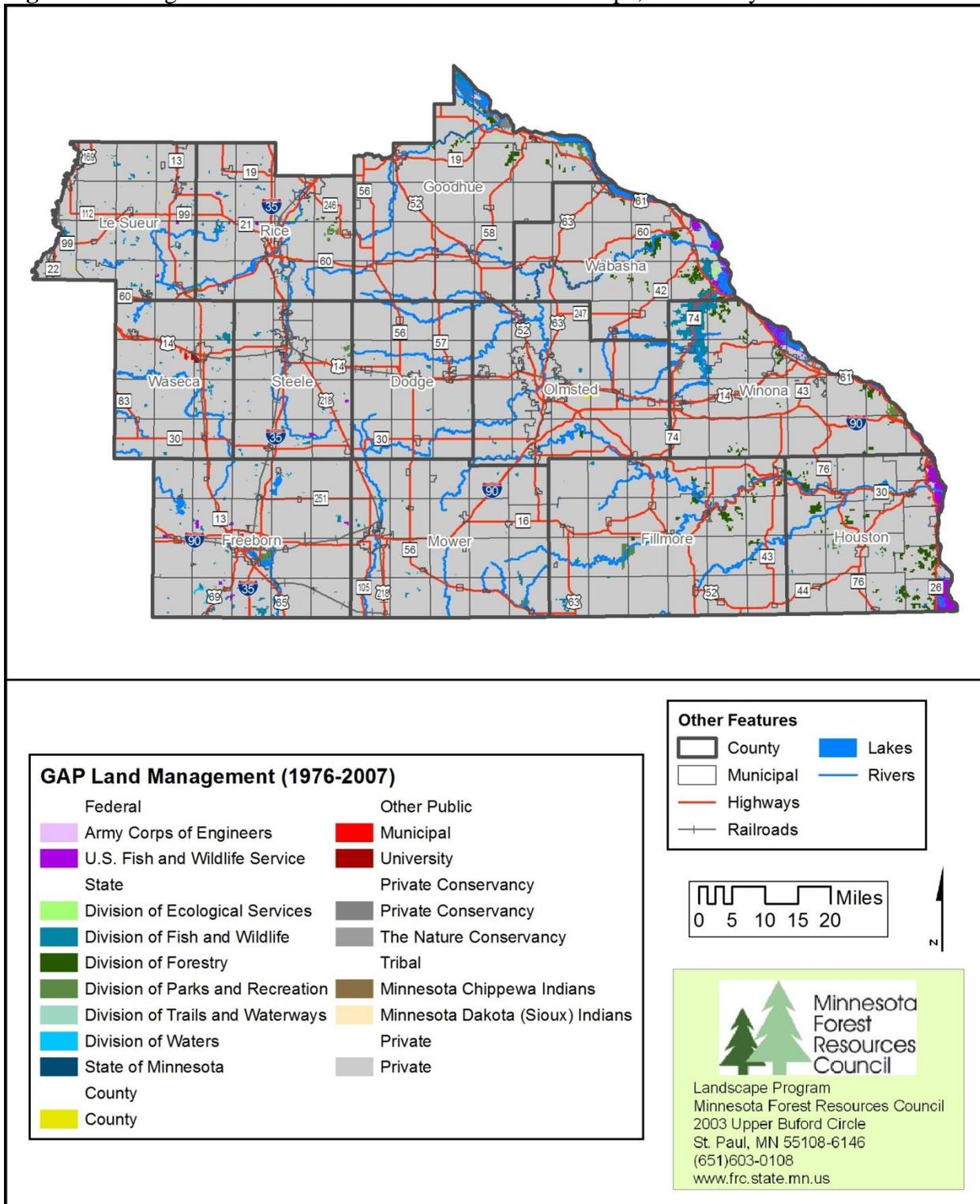
Source: Minnesota DNR Data Deli

**Table 18:** Land Management in the Southeast Landscape from GAP Stewardship 1976-2007.

| Management Type                             | Land Management                  | Acres            | % of Total  |
|---|----------------------------------|------------------|-------------|
| Federal                                     | Army Corps of Engineers          | 1,212            | 0.0         |
|   | U.S. Fish and Wildlife Service   | 38,334           | 0.8         |
| <b>Total Federal</b>                        |                                  | <b>39,546</b>    | <b>0.8</b>  |
| State                                       | Division of Ecological Services  | 4,336            | 0.1         |
|   | Division of Fish and Wildlife    | 67,336           | 1.4         |
|   | Division of Forestry             | 46,809           | 0.9         |
|   | Division of Parks and Recreation | 14,639           | 0.3         |
|   | Division of Trails and Waterways | 345              | 0.0         |
|   | Division of Waters               | 1,303            | 0.0         |
|   | State of Minnesota               | 608              | 0.0         |
| <b>Total State</b>                          |                                  | <b>135,377</b>   | <b>2.7</b>  |
| County                                      | Fillmore County                  | 20               | 0.0         |
|   | Freeborn County                  | 379              | 0.0         |
|   | Goodhue County                   | 136              | 0.0         |
|   | Houston County                   | 148              | 0.0         |
|   | Le Sueur County                  | 352              | 0.0         |
|   | Olmsted County                   | 1,893            | 0.0         |
|   | Rice County                      | 1,121            | 0.0         |
|   | Steele County                    | 38               | 0.0         |
|   | Wabasha County                   | 80               | 0.0         |
|   | Waseca County                    | 272              | 0.0         |
|   | Winona County                    | 41               | 0.0         |
| <b>Total County</b>                         |                                  | <b>4,480</b>     | <b>0.1</b>  |
| Other Public                                | Municipal                        | 799              | 0.0         |
|   | University                       | 822              | 0.0         |
| <b>Total Other Public</b>                   |                                  | <b>1,621</b>     | <b>0.0</b>  |
| Private Conservancy                         | Private Conservancy              | 2,307            | 0.0         |
|   | The Nature Conservancy           | 405              | 0.0         |
| <b>Total Private Conservancy</b>            |                                  | <b>2,712</b>     | <b>0.1</b>  |
| <b>Total Public and Private Conservancy</b> |                                  | <b>183,736</b>   | <b>3.7</b>  |
| Tribal                                      | Minnesota Chippewa Indians       | 330              | 0.0         |
|   | Minnesota Dakota (Sioux) Indians | 476              | 0.0         |
| <b>Total Tribal</b>                         |                                  | <b>806</b>       | <b>0.0</b>  |
| <b>Total Private</b>                        |                                  | <b>4,794,887</b> | <b>96.3</b> |

Source: Minnesota DNR Data Deli, GAP Stewardship 2008, adapted by Jeff Reinhart (2013).

**Figure 6:** Management of all lands in the Southeast Landscape, GAP analysis 1976-2007.



Source: Minnesota DNR Data Deli, GAP Stewardship 2008, adapted by Jeff Reinhart (2013).

**Table 19:** Comparisons of land ownership vs. management in Southeast MN.

| Ownership Type         | Land Ownership                   | Management Type     | Land Management                  | Acres            | % of Total   |
|------------------------|----------------------------------|---------------------|----------------------------------|------------------|--------------|
| Federal                | Army Corps of Engineers          | Federal             | Army Corps of Engineers          | 1,212            | 0.0          |
| Federal                | Bureau of Indian Affairs         | Tribal              | Minnesota Dakota (Sioux) Indians | 476              | 0.0          |
| Federal                | U.S. Fish and Wildlife Service   | Federal             | U.S. Fish and Wildlife Service   | 38,334           | 0.8          |
| Tribal                 | Minnesota Chippewa Indians       | Tribal              | Minnesota Chippewa Indians       | 330              | 0.0          |
| State                  | County Admin/State Forest        | County              | Winona County                    | 41               | 0.0          |
| State                  | County Admin/State Owned         | County              | Fillmore County                  | 20               | 0.0          |
| State                  | County Admin/State Owned         | County              | Houston County                   | 148              | 0.0          |
| State                  | County Admin/State Owned         | County              | Le Sueur County                  | 26               | 0.0          |
| State                  | County Admin/State Owned         | County              | Wabasha County                   | 80               | 0.0          |
| State                  | Division of Ecological Services  | State               | Division of Ecological Services  | 3,420            | 0.1          |
| State                  | Division of Fish and Wildlife    | State               | Division of Fish and Wildlife    | 67,336           | 1.4          |
| State                  | Division of Forestry             | State               | Division of Ecological Services  | 297              | 0.0          |
| State                  | Division of Forestry             | State               | Division of Forestry             | 46,809           | 0.9          |
| State                  | Division of Parks and Recreation | State               | Division of Parks and Recreation | 14,639           | 0.3          |
| State                  | Division of Trails and Waterways | State               | Division of Trails and Waterways | 345              | 0.0          |
| State                  | Division of Waters               | State               | Division of Waters               | 1,303            | 0.0          |
| State                  | State (Undifferentiated)         | State               | State of Minnesota               | 608              | 0.0          |
| County                 | County                           | County              | Freeborn County                  | 379              | 0.0          |
| County                 | County                           | County              | Goodhue County                   | 136              | 0.0          |
| County                 | County                           | County              | Le Sueur County                  | 326              | 0.0          |
| County                 | County                           | County              | Olmsted County                   | 1,893            | 0.0          |
| County                 | County                           | County              | Rice County                      | 1,121            | 0.0          |
| County                 | County                           | County              | Steele County                    | 38               | 0.0          |
| County                 | County                           | County              | Waseca County                    | 272              | 0.0          |
| Other Public           | Other Public                     | Other Public        | Municipal                        | 799              | 0.0          |
| Other Public           | Other Public                     | Other Public        | University                       | 822              | 0.0          |
| Private Conservancy    | Private Conservancy              | Private Conservancy | Private Conservancy              | 2,307            | 0.0          |
| Private Conservancy    | The Nature Conservancy           | Private Conservancy | The Nature Conservancy           | 405              | 0.0          |
| Private Conservancy    | The Nature Conservancy           | State               | Division of Ecological Services  | 619              | 0.0          |
| Private                | Private                          | Private             | Private                          | 4,794,887        | 96.3         |
| <b>Total SE Region</b> |                                  |                     |                                  | <b>4,979,428</b> | <b>100.0</b> |

Source: Minnesota DNR Data Deli, GAP Stewardship 2008, adapted by Jeff Reinhart (2013).

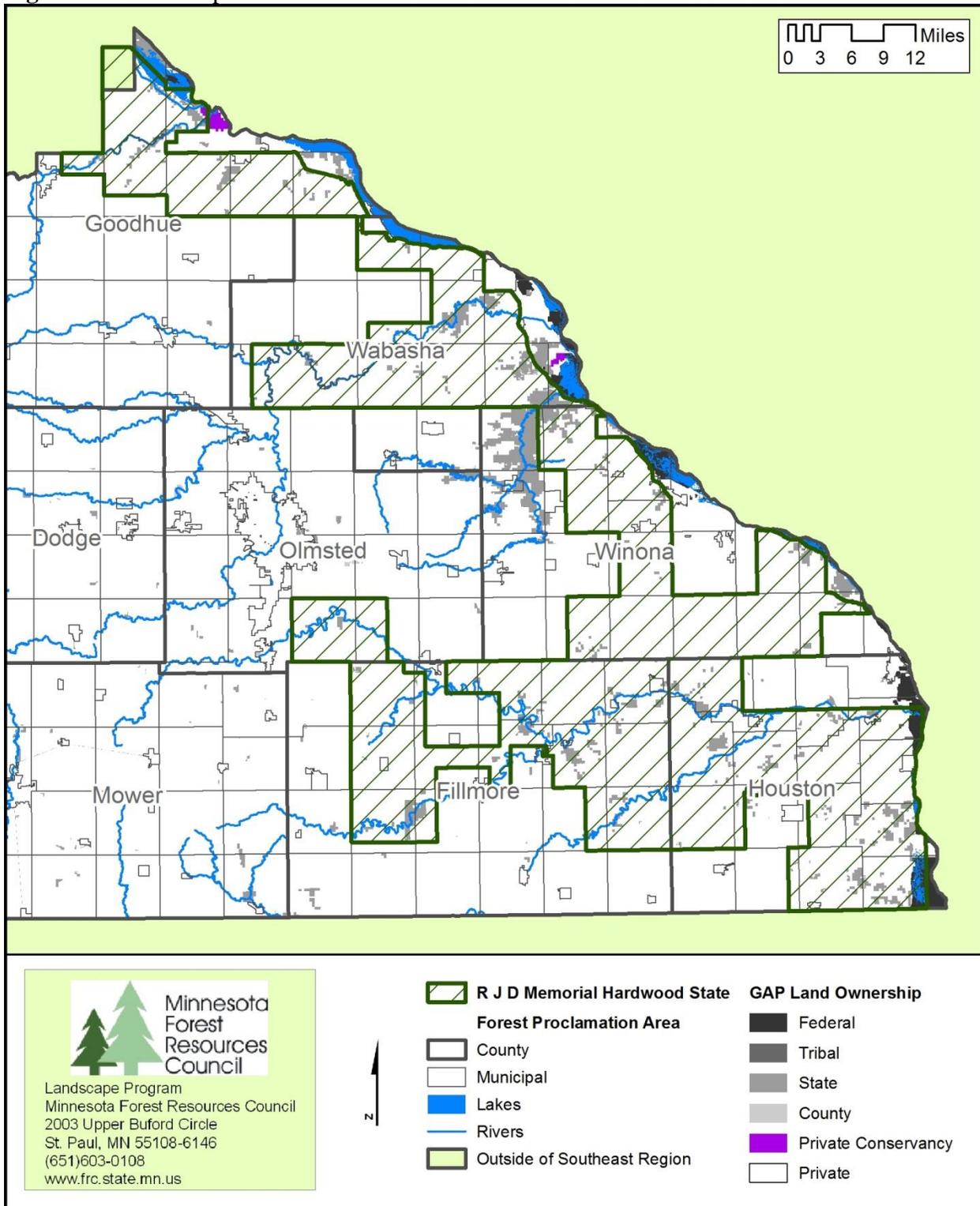
**Table 20:** Ownership within the Richard J. Dorer Memorial Hardwood Forest.

| <b>R J D Memorial Hardwood</b>                | <b>Acres</b>     | <b>% of Total</b> |
|---|------------------|-------------------|
| Outside of Southeast Landscape Region         | 7,597            | 0.7               |
| Within Southeast Landscape Region             | 1,008,630        | 99.3              |
| <b>Total Area for R J D Memorial Hardwood</b> | <b>1,016,227</b> | <b>100.0</b>      |

| <b>Ownership in R J D Memorial Hardwood in Southeast Region</b>   | <b>Acres</b>     | <b>% of Total</b> |
|---|------------------|-------------------|
| Federal   | 8,359            | 0.8               |
| Tribal  | 250              | 0.0               |
| State   | 59,040           | 5.9               |
| County  | 135              | 0.0               |
| Private Conservancy   | 487              | 0.0               |
| Private   | 940,359          | 93.2              |
| <b>Total Area for R J D Memorial Hardwood in Southeast Region</b> | <b>1,008,630</b> | <b>100.0</b>      |

Source: Minnesota DNR GIS Data Deli

**Figure 7:** Ownership within the Richard J. Dorer Memorial Hardwood Forest.



Source: Minnesota DNR Data Deli

## 2.3 Forest Stewardship Plans

According to the Minnesota Department of Natural Resources’ Forest Stewardship Program, “The DNR Forest Stewardship Program provides technical advice and long-range forest management planning to interested landowners. All aspects of the program are voluntary. Plans are designed to meet landowner goals while maintaining the sustainability of the land. The entire property except active farming areas, is covered by the plan.” (FSP 2013)

It should be noted that not all private forest land is eligible for a Forest Stewardship Plan; for example, a landowner must have at least 20 eligible acres to enroll. Non-forested land that meets certain criteria is eligible for the program as well; examples include agricultural land that will be converted to forest and non-forested wetlands (Arends et al. 2009).

The Spatial Analysis Project (SAP) was conducted by the Minnesota DNR Forestry Private Lands Program in 2006. The purpose of the SAP was to create “a GIS layer representing the level of “benefit” gained from potential forest stewardship work.” Several factors that were determined to “contribute to the overall benefits gained by active forest stewardship” were mapped, overlaid, and scored, and then scores were weighted by the importance of the factor. The resulting scores were then classified into low, medium and high potential benefit gained by active forest stewardship. Similar to Forest Stewardship Plan eligibility, the SAP process considered other factors in addition to areas of existing forest; therefore non-forested areas may have also been identified as gaining potential benefit from forest stewardship. More information on this process can be found at <http://www.fs.fed.us/na/sap/products/mn.shtml>. (USFS 2009).

To quantify Forest Stewardship Plan accomplishments, the USFS asked the states to designate Important Forest Resource Areas (IFRA). Accomplishments would then be based on how much of those areas are covered by current forest stewardship plans (plans are current for 10 years in Minnesota). For the IFRAs in Minnesota, the medium and high areas delineated in the SAP were used.

Forest stewardship plan areas in Minnesota were compared against the IFRAs. Table 21 lists the accomplishments for Minnesota state-wide and within the Southeast Landscape for forest stewardship plans current as of the end of the Federal Fiscal Year (Sept. 30, 2013). IFRAs across the State were at 4.20% coverage. In the Southeast Landscape, IFRAs were at 4.98% coverage.

**Table 21:** Areas covered by Forest Stewardship Plans (FSP) compared to Important Forest Resource Areas (IFRA)

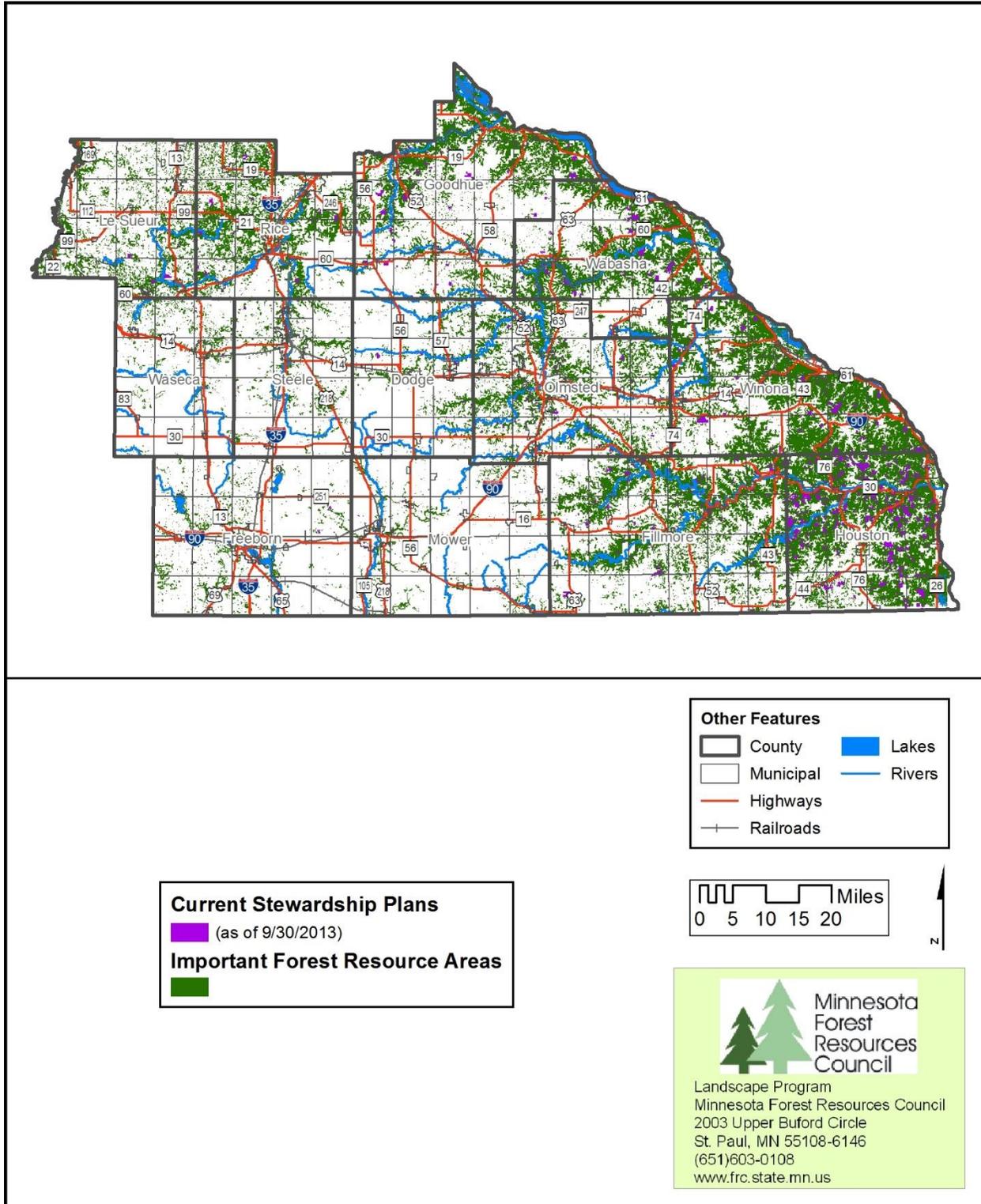
| Study Area | Metric   | Acres   |
|------------|--|---------|
| Southeast  | Acres covered by current forest stewardship plans                                    | 66,870  |
|            | Acres of Important Forest Resource Areas   | 826,556 |
|            | Acres in Important Forest Resource Areas covered by current Forest Stewardship Plans | 41,184  |
| Minnesota  | Acres covered by current forest stewardship  | 618,682 |

|  |  |           |
|--|--|-----------|
|  | plans  |           |
|  | Acres of Important Forest Resource Areas   | 9,898,192 |
|  | Acres in Important Forest Resource Areas covered by current Forest Stewardship Plans | 415,893   |

**Source:** Spatial Analysis Project (SAP), Minnesota DNR Forestry Community and Private Lands Program (2006). For further information on this data, contact the MN DNR Private Forest Management Program.

**Notes:** The SAP that created the IFRA used GAP Land Cover (1992) data to determine forested acres. IFRA acres exceed 1992 forested acres because the SAP process considered areas of potential forest gain and areas that could have significant effect on forests as well. Acres covered by forest stewardship plans only include forest stewardship plans submitted to the DNR; other plans may exist that were not submitted to the DNR.

**Figure 8:** Areas covered by Forest Stewardship Plans compared to Important Forest Resource Areas (IFRA)



Source: Spatial Analysis Project (SAP), Minnesota DNR Forestry Community and Private Lands Program (2006)

## 2.4 Ownership patterns for farm operations

The majority of farm operations in the Southeast Landscape are operated by “full owners,” as defined by the NASS (see note on Table 22). In 2007, over 64% of farm operations in the region were controlled by full owners, which was a slight increase in percentage over the previous decade. The majority of acres, however, were operated by “part owners” – about 62% in 2007. This percentage had also increased over the previous decade. “Tenant” operators made up only a small percentage of both acreage and operations operated – less than 10% - and both of these had seen a slight decrease in percentage among all ownership types over the decade.

Table 22: Acres operated and number of operations by full owners, part owners, and tenants in the Southeast Landscape; 1997, 2002, 2007.

|      | County             | Full Owner |            | Part Owner |            | Tenant  |            |
|------|--------------------|------------|------------|------------|------------|---------|------------|
|      |                    | Acres      | Operations | Acres      | Operations | Acres   | Operations |
| 1997 | FREEBORN           | 87,572     | 574        | 249,725    | 430        | 39,626  | 189        |
|      | LE SUEUR           | 71,939     | 566        | 134,860    | 302        | 10,539  | 66         |
|      | RICE               | 102,669    | 846        | 133,951    | 348        | 19,952  | 96         |
|      | STEELE             | 63,792     | 416        | 156,604    | 295        | 15,476  | 92         |
|      | WASECA             | 60,324     | 348        | 153,918    | 279        | 29,392  | 108        |
|      | DODGE              | 76,350     | 395        | 152,012    | 251        | 25,181  | 70         |
|      | FILLMORE           | 199,894    | 1,055      | 199,558    | 424        | 33,352  | 146        |
|      | GOODHUE            | 144,814    | 943        | 218,272    | 490        | 33,281  | 149        |
|      | HOUSTON            | 131,475    | 661        | 154,411    | 279        | 15,228  | 58         |
|      | MOWER              | 124,477    | 624        | 237,479    | 401        | 45,729  | 141        |
|      | OLMSTED            | 118,317    | 914        | 156,647    | 358        | 28,424  | 127        |
|      | WABASHA            | 126,576    | 627        | 115,430    | 289        | 14,964  | 87         |
|      | WINONA             | 132,237    | 662        | 146,667    | 350        | 20,482  | 91         |
|      | Total SE Landscape | 1,440,436  | 8,631      | 2,209,534  | 4,496      | 331,626 | 1,420      |
| 2002 | FREEBORN           | 106,696    | 617        | 247,244    | 420        | 40,468  | 135        |
|      | LE SUEUR           | 73,002     | 635        | 150,150    | 286        | 14,924  | 53         |
|      | RICE               | 81,234     | 857        | 150,469    | 360        | 17,115  | 79         |
|      | STEELE             | 99,555     | 576        | 171,944    | 253        | 10,348  | 70         |
|      | WASECA             | 66,810     | 419        | 143,164    | 266        | 21,354  | 74         |
|      | DODGE              | 65,249     | 423        | 142,746    | 220        | 25,380  | 54         |
|      | FILLMORE           | 183,495    | 1,070      | 235,220    | 442        | 22,438  | 88         |
|      | GOODHUE            | 141,002    | 1,078      | 216,155    | 470        | 26,951  | 131        |
|      | HOUSTON            | 135,650    | 744        | 103,267    | 238        | 14,683  | 49         |
|      | MOWER              | 153,610    | 650        | 216,104    | 342        | 42,431  | 96         |
|      | OLMSTED            | 124,137    | 955        | 160,327    | 347        | 28,556  | 93         |
|      | WABASHA            | 117,294    | 647        | 132,584    | 299        | 17,180  | 53         |
|      | WINONA             | 151,886    | 757        | 146,255    | 311        | 12,835  | 57         |
|      | Total SE           | 1,499,620  | 9,428      | 2,215,629  | 4,254      | 294,663 | 1,032      |

|      | Landscape          |           |       |           |       |         |       |
|------|--------------------|-----------|-------|-----------|-------|---------|-------|
| 2007 | FREEBORN           | 66,253    | 673   | 280,370   | 438   | 41,865  | 146   |
|      | LE SUEUR           | 66,345    | 738   | 161,223   | 288   | 23,128  | 65    |
|      | RICE               | 97,196    | 1,072 | 142,384   | 349   | 13,514  | 73    |
|      | STEELE             | 68,571    | 612   | 187,922   | 264   | 9,706   | 58    |
|      | WASECA             | 61,606    | 493   | 176,782   | 302   | 16,143  | 53    |
|      | DODGE              | 41,471    | 406   | 168,207   | 230   | 38,447  | 87    |
|      | FILLMORE           | 155,354   | 1,090 | 272,068   | 480   | 18,909  | 97    |
|      | GOODHUE            | 112,848   | 1,010 | 243,090   | 527   | 40,805  | 107   |
|      | HOUSTON            | 128,274   | 770   | 106,549   | 232   | 9,581   | 39    |
|      | MOWER              | 98,432    | 602   | 289,653   | 402   | 31,804  | 84    |
|      | OLMSTED            | 100,441   | 950   | 172,879   | 356   | 22,719  | 78    |
|      | WABASHA            | 108,521   | 645   | 142,201   | 275   | 11,541  | 56    |
|      | WINONA             | 129,605   | 807   | 163,686   | 330   | 12,269  | 66    |
|      | Total SE Landscape | 1,234,917 | 9,868 | 2,507,014 | 4,473 | 290,431 | 1,009 |

**Source:** USDA National Agricultural Statistics Service Quick Stats. Accessed Feb. 20, 2014. Available at: <http://quickstats.nass.usda.gov/>

Note: The NASS defines ownership as follows: “Full owners operated only land they owned. Part owners operated land they owned and also land they rented from others. Tenants operated only land they rented from others or worked on shares for others. Farms with hired managers are classified according to the land ownership characteristics reported. For example, a corporation owns all the land used on the farm and hires a manager to run the farm. The hired manager is considered the farm operator, and the farm is classified with a tenure type of “full owner” even though the hired manager owns none of the land he/she operates.” Source: USDA National Agricultural Statistics Service. 2007 Census of Agriculture. “Appendix B. General Explanation and Census of Agriculture Report Form.”

[http://www.agcensus.usda.gov/Publications/2007/Full\\_Report/Volume\\_1,\\_Chapter\\_1\\_US/usappxb.pdf](http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_US/usappxb.pdf)

### 2.5. Additional Data Needs

- National Woodland Owner Survey data for the Southeast Landscape specifically
- School Trust Land data
- Updated Spatial Analysis Project (SAP)



## Goal 3 – Healthy Forests

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**MFRC Goal 3: Within forested landscapes, healthy, resilient, and functioning ecosystems will be maintained within appropriate mixes of forest cover types and age classes to promote timber production, biological diversity, and viable forest-dependent fish and wildlife habitats.**

This section includes a variety of data related to forest health in the MFRC’s Southeast Landscape. It includes data on pre-settlement forest patterns; tree species; forest composition and age structure; growth and removals on timberland; species richness and species at risk; invasive species; soils; and lake and stream water quality.

### 3.1. Healthy Forests Data Sources

Minnesota Ecological Classification System (ECS): According to the *Field Guide to the Native Plant Communities of Minnesota* (MN DNR 2005), “The Minnesota Department of Natural Resources and the U.S. Forest Service developed an Ecological Classification System for ecological mapping and landscape classification in Minnesota following the National Hierarchical Framework of Ecological Units (ECOMAP 1993).” For more information on this system see Section 3.2.

- Minnesota Department of Natural Resources (MN DNR). 2005. *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province*. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR St. Paul, MN.
- Minnesota Department of Natural Resources (MN DNR). 2013 (1). “Native Plant Community Classification.” Accessed 11/21/2013. Available at: [www.dnr.state.mn.us/npc/classification.html](http://www.dnr.state.mn.us/npc/classification.html).

Native Plant Communities (NPC): This is a classification system of the native vegetation of Minnesota developed by the Minnesota DNR. This system is intended to provide a framework and common language for improving vegetation management, surveys of natural areas, identifying research needs, and promoting the study and appreciation of native vegetation in Minnesota. For more information on this system see Section 3.3. For references, see ECS citations above.

Minnesota Biological Survey (MBS): The MBS is a systematic survey of rare biological features. The goal of the MBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and natural communities. More information on this system can be found in Section 3.4.

- Minnesota Department of Natural Resources (MN DNR). 2013 (2). “Minnesota County Biological Survey.” Accessed 11/21/2013. Available at: <http://www.dnr.state.mn.us/mbs/index.html>.

High conservation value forests (HCVF):

- Minnesota Department of Natural Resources (MN DNR). 2013 (9). Forest Certification: High conservation value forests.  
<http://www.dnr.state.mn.us/forestry/certification/hcvf.html>.

Pre-settlement Vegetation of Minnesota: The Public Land Survey of Minnesota started in 1847 and by 1908 the entire state of Minnesota had been mapped. As an essential part of the survey process, surveyors notched or blazed bearing trees to facilitate the relocation of survey corners. They also noted the species, diameter, and distance and azimuth from the corner for each bearing tree. This data has been used to estimate tree species abundance across the state prior to European settlement.

- Almendinger, John. 2000. Public Land Survey Bearing Tree Data, late 1800's and United States Forest Service Forest Inventory and Analysis. Available in: Minnesota Forest Resources Council. 2000. "Southeast Minnesota Landscape Current Conditions and Trends Assessment." Further information at:  
<http://files.dnr.state.mn.us/eco/nhnrp/brgtree.pdf>

Forest Inventory Analysis (FIA): The FIA is a systematic collection of data and forest information by the U.S. Forest Service for assessment or analysis to assess America's forests. This continuous forest census is designed to provide reliable estimates on the type, extent, growth, mortality, and removals of forestland. This data is not meant to be represented spatially but breaks forestland and timberland estimates down by ownership class.

- Barnett, Charles. United States Forest Service. Personal communication 11/21/2013.
- Forest Inventory and Analysis estimates. Miles, P.D. Tue Oct 22 2013. Forest Inventory EVALIDator web-application version 1.5.1.05. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.fed.us/Evalidator/tmattribute.jsp>]

MNTaxa: This database contains vascular plant species that reflect vouchered specimens present in herbarium collections at the University of Minnesota and University of Minnesota Duluth herbariums.

Animal species richness data:

- Cieminski, Karen. and Steve Stucker, Minnesota Biological Survey, MN DNR Division of Ecological and Water Resources, 2013
- Hall, Carol. 2013. Minnesota Biological Survey.
- Minnesota Department of Natural Resources (MN DNR). 2013 (3). Minnesota County Biological Survey distribution maps, updated October 30, 2013. Available online at:  
[http://files.dnr.state.mn.us/eco/mcbs/herp\\_maps/reptile\\_and\\_amphibian\\_maps\\_2ecs.pdf](http://files.dnr.state.mn.us/eco/mcbs/herp_maps/reptile_and_amphibian_maps_2ecs.pdf).

Minnesota's Endangered, Threatened, and Special Concern Species:

- Minnesota Department of Natural Resources (MN DNR). 2013 (4). "Minnesota's Endangered, Threatened, and Special Concern Species." Accessed 11/21/2013. Available at: <http://www.dnr.state.mn.us/ets/index.html>
- Minnesota Department of Natural Resources (MN DNR). 2013 (5). Minnesota's List of Endangered, Threatened, and Special Concern Species, 2013. MN DNR Division of

Ecological and Water Resources. Available online at:  
[http://files.dnr.state.mn.us/natural\\_resources/ets/endlist.pdf](http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf)

MN DNR Rare Species Guide: The Rare Species Guide is an online tool that can be used to query the MN DNR’s database of 439 endangered, threatened, and special concern species. This data is available through the MN DNR Division of Ecological and Water Resources and the Minnesota Natural Heritage System.

- Minnesota Department of Natural Resources (MN DNR). 2013 (6). “Rare Species Guide.” Accessed 11/21/2013. Available at: <http://www.dnr.state.mn.us/rsg/index.html>.

#### Invasive Species:

- Gupta, Angie. University of Minnesota Extension Service. Personal communication, 11/21/2013.
- Minnesota Department of Agriculture (MDA). 2013 (1). 2013 Noxious and Invasive Weeds Program. Available online at:  
<http://www.mda.state.mn.us/plants/badplants/~media/Files/plants/weeds/noxiouslists.ashx>
- Minnesota Department of Agriculture (MDA). 2013 (2). “Oriental Bittersweet.” Accessed 11/20/2013. Available at:  
<http://www.mda.state.mn.us/plants/badplants/orientalbittersweet.aspx>
- Minnesota Department of Natural Resources (MN DNR). 2013 (7). “Emerald Ash Borer (EAB).” Accessed 11/21/2013. Available at:  
<http://www.dnr.state.mn.us/invasives/terrestrialanimals/eab/index.html>.
- Minnesota Department of Agriculture (MDA). 2006. “Emerald Ash Borer Introduction Risk Model for Minnesota.” MDA Plant Protection Division, Invasive Species Exclusion Unit. Available at:  
<http://www.mda.state.mn.us/Global/MDADocs/pestsplants/eab/riskmodel.aspx>
- Minnesota Department of Agriculture (MDA). 2011. “Biological Control of Emerald Ash Borer in Minnesota.” Available at:  
<http://www.mda.state.mn.us/~media/Files/plants/eab/eabbiocontrolinmn.ashx>
- Minnesota Department of Natural Resources Division of Ecological and Water Resources. 2013 (8). MN DNR Deli. <http://deli.dnr.state.mn.us/index.html>
- Minnesota Department of Agriculture (MDA) Early Detection and Distribution Mapping System (EDD MapS). 2013. This application uses Google Maps to pinpoint locations where reports have come in for newly invasive terrestrial plant species:  
<http://gis.mda.state.mn.us/earlydetection/>

#### Water Health data:

- Minnesota DNR GIS Data Deli. <http://deli.dnr.state.mn.us/index.html>
- United States Geological Survey (USGS). 2013. “Hydrologic map units.” Accessed 11/21/2013. Available at: <http://water.usgs.gov/GIS/huc.html>.
- Minnesota Pollution Control Agency (MPCA). 2013 (1). “Impaired Waters List.” Accessed 11/21/2013. Available at: <http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/impaired-waters-list.html>.
- Minnesota Pollution Control Agency (MPCA). 2013 (2). “More About the Section 319 Program.” Accessed 11/21/2013. Available at:

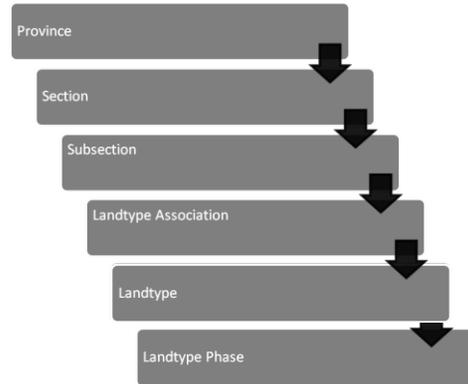
<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/water-nonpoint-source-issues/clean-water-partnership/more-about-the-section-319-program.html>.

- Runkel, A.C, J.R. Steenberg, R.G. Tipping, A.J. Retzler. 2013. “Geologic controls on groundwater and surface water flow in southeastern Minnesota and its impact on nitrate concentrations in streams.” Minnesota Geological Survey.
- Watkins, J., N. Rasmussen, G. Johnson, A. Streitz, K. Ahmad, B. Beyerl, and J. Roebuck. 2013. “Nitrate-Nitrogen in the Springs and Trout Streams of Southeast Minnesota.” Minnesota Pollution Control Agency.
- Streitz, A. Changes to River Baseflow Across Minnesota. Presentation, Midwest Ground Water Conference, October 1, 2012. Minnesota Pollution Control Agency.
- Lenhart, C. and J. Niebert. 2011. “Quantifying differential streamflow response of Minnesota ecoregions to climate change and implications for management.” Report as of FY2010 for 2010MN270B.

### 3.2. Minnesota Ecological Classification System (ECS)

The following excerpt is taken from the MN DNR *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* (MN DNR 2005):

“The Minnesota Department of Natural Resources and the U.S. Forest Service have developed an Ecological Classification System (ECS) for ecological mapping and landscape classification in Minnesota following the [National Hierarchical Framework of Ecological Units](#) (ECOMAP 1993). Ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features. The system uses associations of biotic and environmental factors including climate, geology, topography, soils, hydrology, and vegetation. There are eight levels of ECS units in the United States. Six of these units occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases.”

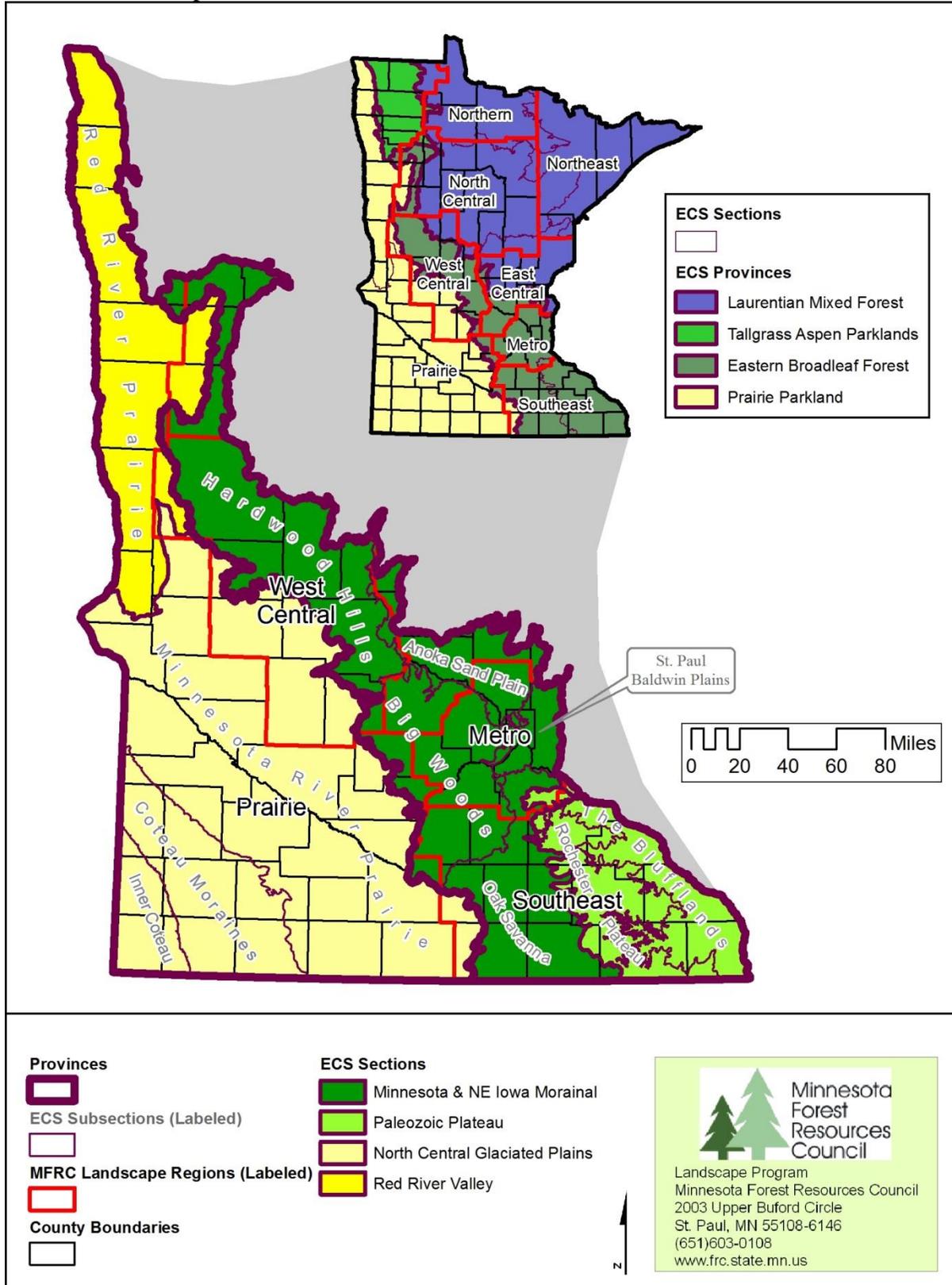


The highest four levels for Minnesota are, according to the following definitions taken from the Field Guide (MN DNR 2005), as follows:

- “**Provinces** are units of land defined using major climate zones, native vegetation, and biomes such as prairies, deciduous forests, or boreal forests. There are four ecological provinces in Minnesota.
- **Sections** are units within Provinces that are defined by origin of glacial deposits, regional elevation, distribution of plants, and regional climate. Minnesota has ten ecological sections.
- **Subsections** are units within Sections that are defined using glacial deposition processes, surface bedrock formations, local climate, topographic relief, and the distribution of plants, especially trees. Minnesota has 26 ecological subsections.
- **Land Type Associations (LTAs)** are divisions within Subsections that are delineated using glacial landforms, bedrock types, topographic roughness, lake and stream distributions, wetland patterns, depths to groundwater table, soil parent material and pre-European settlement vegetation. There are 291 LTAs in the state.”

The MFRC Southeast Landscape exists almost entirely within the Eastern Broadleaf Forest Province, an eco-region that winds throughout 12 states in the east-central United States. A small portion of both Waseca and Freeborn counties are within the neighboring Prairie Parkland Province (Figure 9). The Eastern Broadleaf portion of the Southeast Landscape is divided into two ECS Sections – the Minnesota & NE Iowa Morainal and the Paleozoic Plateau – while the small Prairie Parkland portion is within the North Central Glaciated Plains Section. These three Sections contain five Subsections and 34 Landtype Associations, in regards to the Southeast Landscape region (Table 23, Figure 10).

**Figure 9:** Ecological Classification System (ECS) Provinces and Sections in the MFRC Southeast Landscape.



Source: Minnesota DNR Data Deli

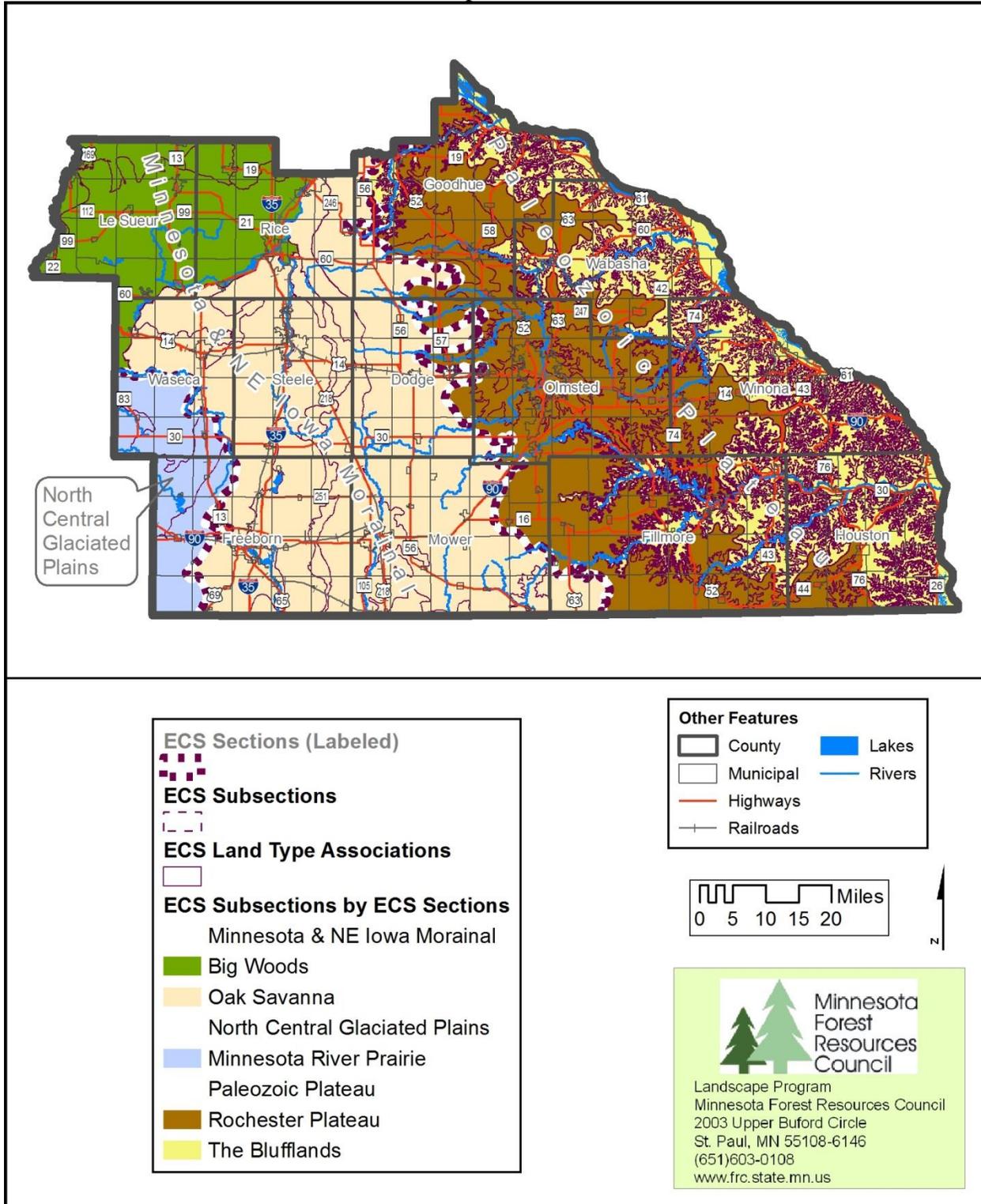
**Table 23:** Ecological Classification System (ECS) Section and Subsection Areas in the Southeast Landscape

| <b>ECS Section</b>                | <b>ECS Subsection</b>      | <b>Acres</b>     | <b>% of Total</b> | <b># of Landtype Associations</b> |
|-----------------------------------|----------------------------|------------------|-------------------|-----------------------------------|
| Minnesota & NE Iowa<br>Morainal   | Big Woods                  | 505,461          | 10.2              | 5                                 |
|                                   | Oak Savanna                | 1,645,020        | 33.0              | 9                                 |
| <b>Subtotal (Section)</b>         |                            | <b>2,150,480</b> | <b>43.2</b>       | <b>14</b>                         |
| North Central Glaciated<br>Plains | Minnesota River<br>Prairie | 251,481          | 5.1               | 4                                 |
| <b>Subtotal (Section)</b>         |                            | <b>251,481</b>   | <b>5.1</b>        | <b>4</b>                          |
| Paleozoic Plateau                 | Rochester Plateau          | 1,298,940        | 26.1              | 5                                 |
|                                   | The Blufflands             | 1,278,527        | 25.7              | 11                                |
| <b>Subtotal (Section)</b>         |                            | <b>2,577,467</b> | <b>51.8</b>       | <b>16</b>                         |
| <b>Total Southeast Region</b>     |                            | <b>4,979,428</b> | <b>100.0</b>      | <b>34</b>                         |

**Source:** Minnesota DNR GIS Data Deli

Note: These data represent Section, Subsections, and Landtype Associations that intersect the Southeast Landscape, but are not necessarily entirely contained within the Landscape.

**Figure 10:** Ecological Classification System (ESC) Subsection areas and Land Type Associations in the MFRC Southeast Landscape.



Source: Minnesota DNR Data Deli

### 3.3. Native Plant Communities (NPC)

The following excerpt is taken from the MN DNR *Field Guide to the Native Plant Communities of Minnesota* (MN DNR 2005):

“A **native plant community** is a group of native plants that interact with each other and with their environment in ways not greatly altered by modern human activity or by introduced organisms. These groups of native plant species form recognizable units, such as oak savannas, pine forests, or marshes, that tend to repeat over space and time. Native plant communities are classified and described by considering 1) vegetation, 2) hydrology, 3) landforms, 4) soils, and 5) natural disturbance regimes. Examples of natural disturbances include: wildfires, severe droughts, windstorms, and floods.

Sometimes referred to as native habitats or natural communities, native plant communities are named for the characteristic plant species within them or for characteristic environmental features. Examples of native plant communities in Minnesota include Dry Barrens Oak Savanna, Red Pine-White Pine Forest, Bulrush Marsh, Sedge Meadow, and Mesic Sandstone Cliff. There are many kinds of vegetated areas that are not native plant communities. These include places where native species have largely been replaced by exotic or invasive species such as smooth brome grass, buckthorn, and purple loosestrife, and planted areas such as orchards, pine plantations, golf courses, and lawns. Other areas not considered to be native plant communities include areas where modern human activities such as farming, overgrazing, non-sustainable logging, and development have destroyed or greatly altered the vegetation.”

More information on NPC Classes for Southeast Minnesota can be found in the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* (MN DNR 2005) or at [www.dnr.state.mn.us/npc/classification.html](http://www.dnr.state.mn.us/npc/classification.html) (MN DNR 2013 (1)).

#### 3.3.1. Native Plant Community Classification

The following excerpt is taken from the MN DNR webpage, “Native Plant Community Classification,” available at [www.dnr.state.mn.us/npc/classification.html](http://www.dnr.state.mn.us/npc/classification.html):

“In 2003, researchers in the Minnesota Department of Natural Resources (DNR) completed a new classification of the native vegetation of Minnesota, Minnesota's Native Plant Community Classification (Version 2.0). The DNR's new classification is intended to provide a framework and common language for improving our ability to manage vegetation, to survey natural areas for biodiversity conservation, to identify research needs, and to promote study and appreciation of native vegetation in Minnesota.

Background: Version 2.0 of the DNR's native plant community classification is based strongly on plant species composition and was developed through analysis of extensive field data collected from [sample plots](#) in forests, prairies, wetlands, and other habitats. The classification is hierarchical, with vegetation units described at levels ranging from broad landscape-level ecological systems to local communities (Table 24). One of the most important features of the new classification is the inclusion of ecological processes as an organizing principle.

Classification Hierarchy: The NPC classification has six levels (Table 24). **System Groups**, the highest level, were created to allow development of manageable field keys for lower levels of the classification. System Groups were formed by combining lower levels of the classification along major physiognomic and hydrologic splits in vegetation. **Ecological Systems** are groups of native plant communities that are unified by strong influence from a major ecological process or set of processes, especially nutrient cycling and natural disturbances. **Floristic Regions** are divisions within Ecological Systems that reflect the distribution of Minnesota's plant species into characteristically northern, northwestern, central, and southern groups, or floras. The important influences on these species distributions appear to be climate and paleohistory. **Native Plant Community Classes** are units of vegetation that generally have uniform soil texture, soil moisture, soil nutrients, topography, and disturbance regimes. For wooded vegetation, Native Plant Community Classes were developed by emphasizing understory vegetation more than canopy trees, under the hypothesis that in much of Minnesota understory plants are often more strongly tied to specific habitat conditions (such as levels of nutrients and moisture) than are canopy trees. **Native Plant Community Types** are defined by dominant canopy trees, variation in substrate, or fine-scale differences in environmental factors such as moisture or nutrients. Type distinctions were also made to describe geographic patterns within a Class. **Native Plant Community Subtypes** are based on finer distinctions in canopy composition, substrates, or other environmental factors. In some instances, Subtypes represent apparent trends within a Type for which more study and collection of data are needed. In other instances Subtypes are well-documented, fine-scale units of vegetation that are useful for work such as rare plant habitat surveys.”

**Table 24:** Native Plant Community (NPC) classification hierarchy.

| Classification Level     | Dominant Factors   | Examples found in SE MN                         |
|--------------------------|--|---|
| <b>System Group</b>      | Vegetation structure & geology   | Upland Forest & Woodland Systems                |
| <b>Ecological System</b> | Ecological processes   | Mesic Hardwood Forest                           |
| <b>Floristic Region</b>  | Climate & paleohistory   | Southern  |
| <b>NPC Class</b>         | Local environmental conditions   | Southern Mesic Maple-Basswood Forest            |
| <b>NPC Type</b>          | Canopy dominants, substrate, or finer environmental conditions                 | Sugar Maple-Basswood-(Bitternut Hickory) Forest |
| <b>NPC Subtype</b>       | Finer distinctions in canopy dominants, substrate, or environmental conditions | [n/a in SE MN forests]                          |

**Source:** Table adapted from the MN DNR *Field Guide to the Native Plant Communities of Minnesota*, [www.dnr.state.mn.us/npc/classification.html](http://www.dnr.state.mn.us/npc/classification.html)

### 3.4. Minnesota County Biological Survey (MCBS)

The Minnesota Biological Survey (MBS) began in 1987 as a systematic survey of rare biological features. The goal of the MBS is to identify significant natural areas and to collect and interpret data on the distribution and ecology of rare plants, rare animals, and natural communities. To accomplish this goal the MBS uses a multi-level procedure, beginning with evaluation of existing inventory data and followed by an assessment of the quality and condition of selected areas using aerial photographs and classified satellite imagery, followed by ground survey of sites that are thought to be “important areas of native vegetation or habitat” (MN DNR 2013 (2)). This is supplemented by specialized field surveys of selected rare species or groups of species. Through this process the MBS “systematically collects, interprets, and delivers baseline data on the distribution and ecology of rare plants, rare animals, native plant communities, and functional landscapes needed to guide decision making” (MN DNR 2013 (2)). The MBS has been completed in 81 out of 87 Minnesota counties, including all counties in the MFRC Southeast Landscape. According to the MN DNR webpage on the “Status and outcomes” of the Minnesota Biological Survey,

“To date MBS has added over 15,000 new records of rare plants and animals to the DNR’s Natural Heritage Information System (NHIS), added over 8,800 vegetation plots to the Relevé Database, recorded 20 native plant species and 3 native amphibians not previously documented in Minnesota, conducted aquatic plant surveys in over 1,500 lakes, produced printed and digital maps of native plant communities and rare species for 38 counties, and digital maps for an additional 18 counties and 3 Ecological subsections.” (MN DNR 2013 (2)).

Out of the 486,726 acres surveyed in the MFRC Southeast Landscape, 162,605 (33.4%) were found to be of “Outstanding” or “High” biodiversity significance (Table 25). Comparing the map of MBS surveyed areas (Figure 11) to the most current map of land cover types (Figure 4) it can be seen that survey plots were concentrated in areas of Upland Forest, as other land types are rare and agriculture dominates much of the remaining landscape. Within these forested areas, riparian areas appear to be the most prevalent location of “Outstanding” or “High” biological significance.

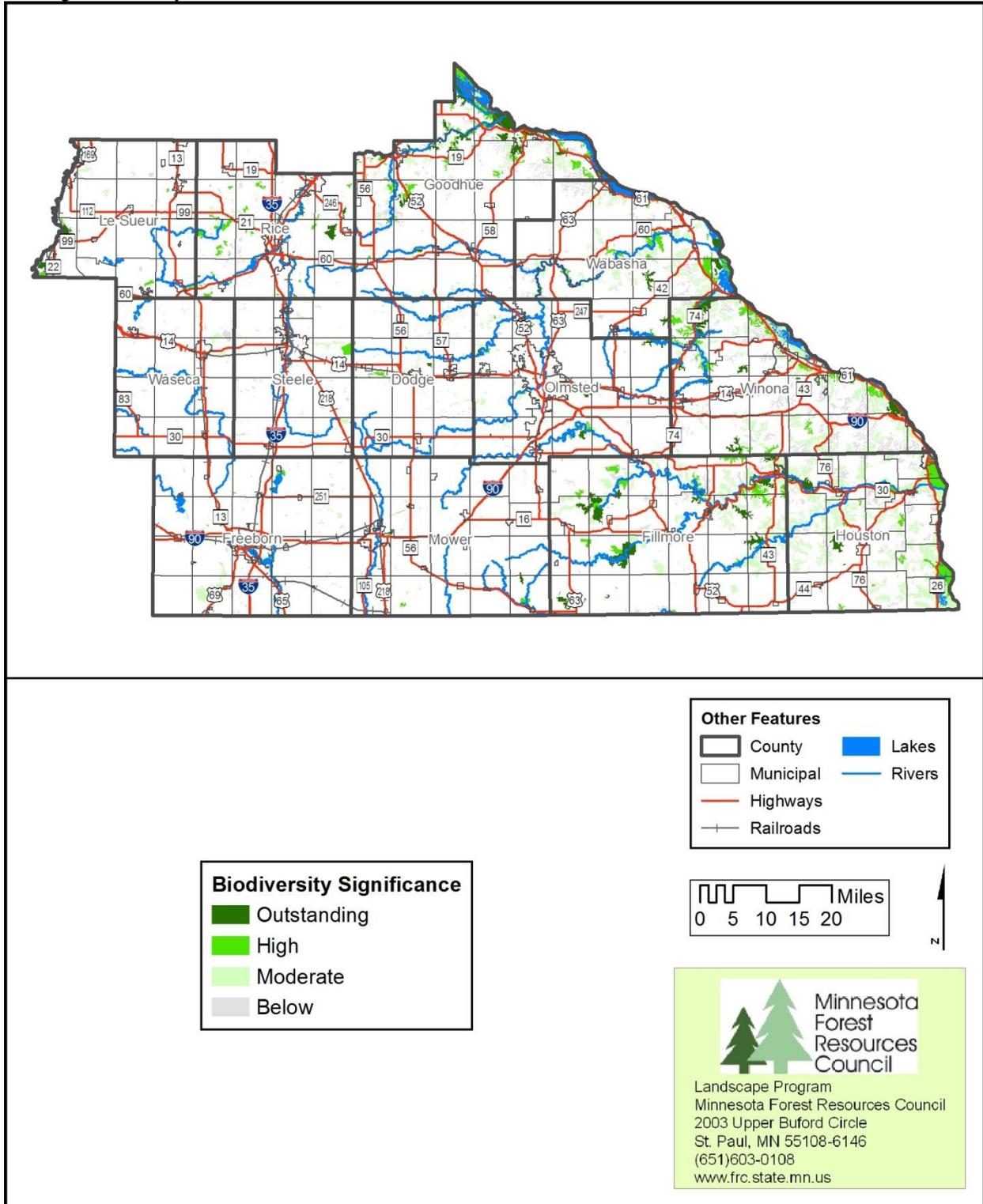
**Table 25:** Areas of biological significance in the Southeast Landscape from the Minnesota Biological Survey.

| <b>Biodiversity Significance</b> | <b>Acres</b>     | <b>% of Total</b> |
|----------------------------------|------------------|-------------------|
| Outstanding                      | 69,921           | 1.40              |
| High                             | 92,684           | 1.86              |
| Moderate                         | 223,778          | 4.49              |
| Below                            | 100,344          | 2.02              |
| <b>Total Surveyed Area</b>       | <b>486,726</b>   | <b>9.77</b>       |
| <b>Total Southeast Area</b>      | <b>4,979,428</b> | <b>-</b>          |

**Source:** Minnesota DNR Data Deli

Note: The Minnesota Biological Survey purposively selected sample plots based on evidence of biological significance, giving higher priority and more detailed investigation to areas that appeared to be the most important biologically. The ratios of the biodiversity significance categories are not intended for projection across the remaining un-surveyed areas. For more information on the plot selection process visit: [http://www.dnr.state.mn.us/eco/mcbs/procedures\\_sites.html](http://www.dnr.state.mn.us/eco/mcbs/procedures_sites.html)

**Figure 11:** Areas of biological significance in the Southeast Landscape from the Minnesota Biological Survey.



Source: Minnesota DNR Data Deli

### 3.5. High conservation value forests (HCVFs)

The Minnesota Department of Natural Resources (MN DNR) states on their webpage about forest certification that:

“The Forest Stewardship Council (FSC) broadly defines high conservation value forests (HCVFs) as *“areas of outstanding biological or cultural significance.”* Certificate holders are required to develop a practical definition and process for implementing the HCVF concept, relative to their scope and scale of operations. [...] All decisions regarding DNR's HCVF approach have been based on the interpretation that most sites managed as HCVFs will remain working forests.” (MN DNR 2013 (9))

The MN DNR has identified 18 HCVFs that intersect with the Southeast Landscape, which they released for public comment in late 2013. Most of these sites are located in the Blufflands subsection (Table 26, Figure 12). Total acreage of the proposed HCVFs that intersect the Southeast Landscape is 20,376 acres; 17,447 of these acres are actually within the boundaries of the Southeast Landscape. The Department intends to complete the HCVF designation process by the end of 2013.

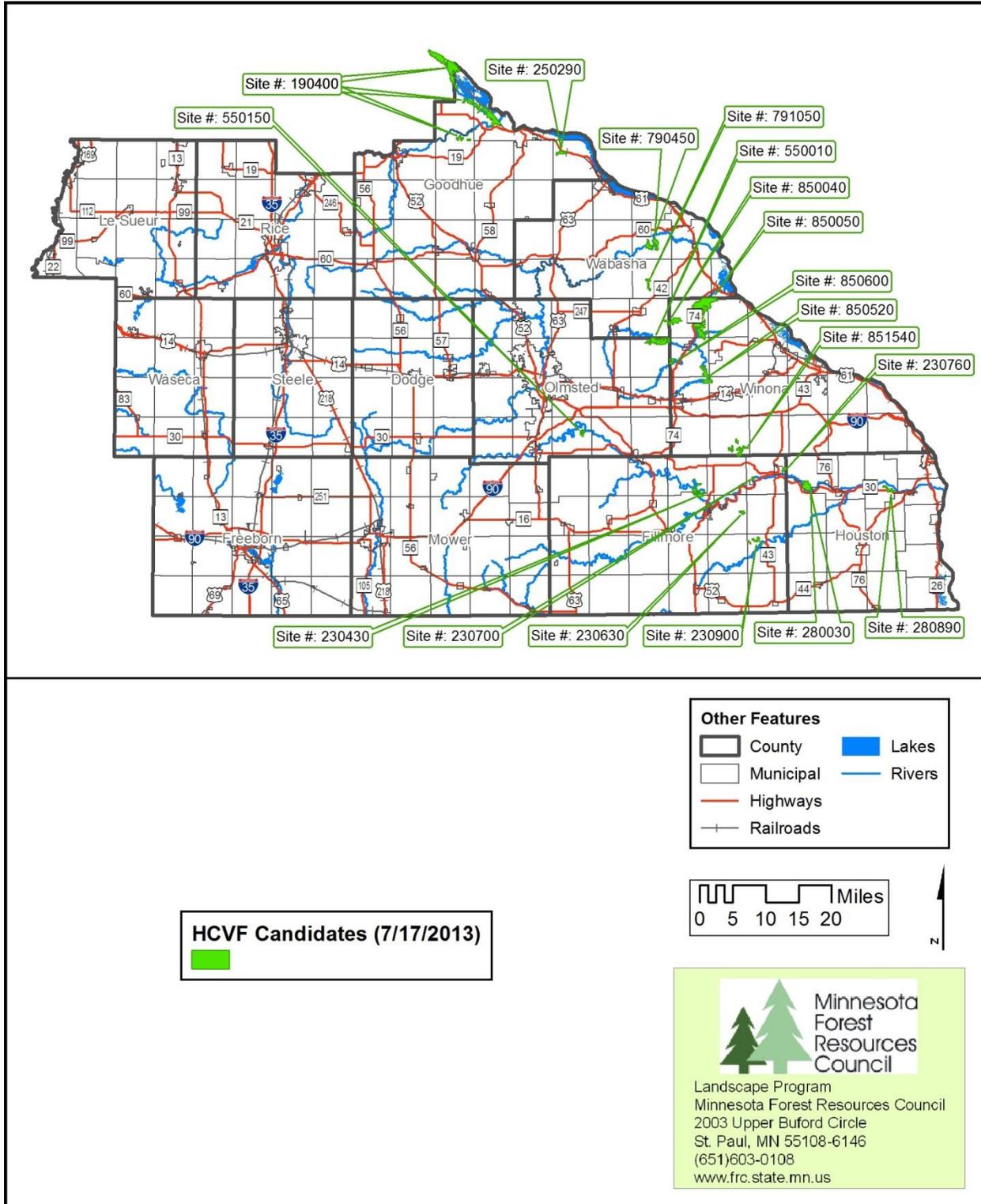
**Table 26:** High Conservation Value Forests (HCVFs) proposed by the MN DNR, 2013.

| Site #                                | Site Name                                    | County*  | ECS Subsection    | Acres | Percent in Region |
|---------------------------------------|--|----------|-------------------|-------|-------------------|
| 190400                                | Vermillion Bottoms & Lower Cannon River Area | Dakota   | The Blufflands    | 5,897 | 50.3              |
| 230430                                | Brightsdale Forestry Unit                    | Fillmore | Rochester Plateau | 782   | 100.0             |
| 230630                                | Diamond Creek Unit                           | Fillmore | The Blufflands    | 153   | 100.0             |
| 230700                                | North Peterson Unit                          | Fillmore | The Blufflands    | 61    | 100.0             |
| 230760                                | Rushford Bluffs                              | Fillmore | The Blufflands    | 119   | 100.0             |
| 230900                                | Shattuck Creek                               | Fillmore | The Blufflands    | 268   | 100.0             |
| 250290                                | Perched Valley                               | Goodhue  | The Blufflands    | 348   | 100.0             |
| 280030                                | Vinegar Ridge                                | Houston  | The Blufflands    | 892   | 100.0             |
| 280890                                | Mound Prairie                                | Houston  | The Blufflands    | 316   | 100.0             |
| 550010                                | North Fork Whitewater WMA                    | Olmsted  | The Blufflands    | 1,353 | 100.0             |
| 550150                                | Partridge Creek                              | Olmsted  | The Blufflands    | 227   | 100.0             |
| 790450                                | Zumbro Bottoms                               | Wabasha  | The Blufflands    | 1,033 | 100.0             |
| 791050                                | West Indian Creek                            | Wabasha  | The Blufflands    | 293   | 100.0             |
| 850040                                | Upper Beaver Creek Valley                    | Winona   | The Blufflands    | 752   | 100.0             |
| 850050                                | Whitewater Sand Savannas                     | Winona   | The Blufflands    | 5,856 | 100.0             |
| 850520                                | South Fork Whitewater WMA                    | Winona   | Rochester Plateau | 989   | 100.0             |
| 850600                                | Callahan Unit--WWMA                          | Winona   | The Blufflands    | 204   | 100.0             |
| 851540                                | Pine Hemingway Creek                         | Winona   | The Blufflands    | 833   | 100.0             |
| <b>Total acres proposed</b>           |  |          |                   |       | <b>20,376</b>     |
| <b>Acres proposed in SE Landscape</b> |  |          |                   |       | <b>17,447</b>     |

**Source:** MN DNR Forestry. High Conservation Value Forests (MN DNR 2013 (9)).

\* May intersect more than one county

**Figure 12:** Location of High Conservation Value Forests (HCVFs) proposed by the MN DNR, 2013.



Source: MN DNR Forestry. High Conservation Value Forests (MN DNR 2013 (9)).

### 3.6 Comparison of pre-settlement vegetation to current vegetation

The Public Land Survey of Minnesota began in 1847 and by 1908 the entire state of Minnesota had been mapped. As an essential part of the survey process, surveyors notched or blazed bearing trees to facilitate the relocation of survey corners. They also noted the species, diameter, and distance and azimuth from the corner for each bearing tree. John Almendinger of the Minnesota Department of Natural Resources Ecological Classification System Program analyzed bearing tree data and compared it to FIA 1990 plot-level data. Tree records were selected from the 1990 FIA plot data to reproduce as nearly as possible the procedure that the surveyors used to select bearing trees. For a more detailed description of the methodology used, see “Minnesota’s Bearing Tree Database” (<http://files.dnr.state.mn.us/eco/nhrp/brgtree.pdf>).

Table 27 shows the results of this analysis for Southeast Minnesota. Box-elder (*Acer negundo*) and eastern redcedar (*Juniperus virginiana*) portrayed the largest positive proportional difference, each with over 400x as much representation in the 1990 FIA sample than in the Public Land Survey data. Black oak (*Quercus nigra*), bur oak (*Quercus macrocarpa*), and jack oak (northern pin oak - *Quercus ellipsoidalis*), however, all portrayed negative proportional differences – i.e., there were fewer in the 1990 FIA sample than in the Public Land Survey data.

**Table 27:** Difference in percentages and proportional difference between relative abundance of tree species estimated from Public Land Survey bearing tree database (late 1800s) and the 1990 Forest Inventory and Analysis (FIA) point data for the Southeast Landscape. Bearing tree names are shown in bold, while un-bolded scientific names are species equivalents found in the FIA database. Proportional Difference represents the factor by which the species increased or decreased between pre-settlement and 1990, based on bearing tree data and selected comparison trees from the 1990 FIA data; e.g. ash was 23x more abundant in the 1990 FIA sample than in the Public Land Survey data.

| <b>Tree Species</b>  | <b>Difference in Relative Abundance (%)</b> | <b>Proportional Difference</b> |
|--|---|--------------------------------|
| <b>Ash</b> — <i>Fraxinus nigra</i> , <i>F. pennsylvanica</i> , <i>F. americana</i>                           | 12.04%                                      | 23.18                          |
| <b>Aspen</b> — <i>Populus tremuloides</i> , <i>P. grandidentata</i> , <i>P. balsamifera</i> (in lesser part) | -1.29%                                      | 2.65                           |
| <b>Birch</b> — <i>Betula papyrifera</i> , <i>B. cordifolia</i>   | 4.21%                                       | 24.89                          |
| <b>Black Birch</b> — <i>Betula nigra</i> , <i>B. alleghaniensis</i> (in part)                                | 0.01%                                       | 1.14                           |
| <b>Black Oak</b> — <i>Quercus nigra</i> , <i>Q. ellipsoidalis</i> (in part)                                  | -24.31%                                     | -49.4                          |
| <b>Black Walnut</b> — <i>Juglans nigra</i>   | 2.92%                                       | 21                             |
| <b>Box-Elder</b> — <i>Acer negundo</i>   | 25.32%                                      | 406.04                         |
| <b>Bur Oak</b> — <i>Quercus macrocarpa</i>   | -167.38%                                    | -12.5                          |
| <b>Butternut</b> — <i>Juglans cinerea</i>  | 2.3%  | 18.26                          |
| <b>Cherry</b> — <i>Prunus serotina</i> , <i>P. pennsylvanica</i>   | 9.62%                                       | 94.9                           |
| <b>Cottonwood</b> — <i>Populus deltoides</i>   | 5.96%                                       | 141.26                         |
| <b>Elm</b> — <i>Ulmus americana</i> , <i>U. rubra</i> , <i>U. thomasi</i>                                    | 15.48%                                      | 14.2                           |
| <b>Hackberry</b> — <i>Celtis occidentalis</i>  | 2.54%                                       | 29.75                          |

|  |        |        |
|--|--------|--------|
| <b>Hawthorn</b> — <i>Crataegus</i> spp.  | 0.74%  | 0      |
| <b>Hickory</b> — <i>Carya cordiformis</i> , <i>C. ovata</i>  | 7.17%  | 18.26  |
| <b>Illegible or Not Recorded</b> —equivalent unknown   | 0.7%   | 38.58  |
| <b>Ironwood</b> — <i>Ostrya virginiana</i>   | -2.26% | 6.77   |
| <b>Jack Oak</b> — <i>Quercus ellipsoidalis</i>   | -4.67% | -11.33 |
| <b>Jack Pine</b> — <i>Pinus banksiana</i>  | 3.05%  | 0      |
| <b>Juniper or Red Cedar</b> — <i>Juniperus virginiana</i>  | 2.76%  | 439.23 |
| <b>Linden or Basswood</b> — <i>Tilia americana</i>   | 19.39% | 20.6   |
| <b>Maple</b> — <i>Acer rubrum</i> , <i>A. saccharum</i> , <i>A. saccharinum</i>  | 4.71%  | 19.71  |
| <b>Oak</b> — <i>Quercus rubra</i> , <i>Q. macrocarpa</i> , <i>Q. ellipsoidalis</i> , <i>Q. velutina</i> , <i>Q. alba</i> , <i>Q. bicolor</i> | -0.53% | 0      |
| <b>Plum</b> —probably <i>Prunus americana</i>  | 0.34%  | 1.89   |
| <b>Red Elm</b> — <i>Ulmus rubra</i>  | 10.65% | 0      |
| <b>Red Oak</b> — <i>Quercus rubra</i> , <i>Q. ellipsoidalis</i> (in part or as hybrid)   | 49.35% | 30.38  |
| <b>Red, Norway, or Yellow Pine</b> — <i>Pinus resinosa</i>   | 0.17%  | 20.81  |
| <b>Sugar Maple</b> — <i>Acer saccharum</i>   | 10.82% | 62.29  |
| <b>Tamarack</b> — <i>Larix laricina</i>  | -0.9%  | 0      |
| <b>White Pine</b> — <i>Pinus strobus</i>   | 0.49%  | 26.42  |
| <b>Willow</b> — <i>Salix</i> spp.  | 7.91%  | 55.97  |

**Source:** (Almendinger 2000); Public Land Survey Bearing Tree Data, late 1800’s and United States Forest Service Forest Inventory and Analysis; this table was taken from the “Southeast Minnesota Landscape Current Conditions and Trends Assessment.”

Note: This table is missing the relative abundances of species, which may make comparison of overall abundance among species difficult.

### 3.7. Age class structure of timberland

The three tables below (Table 28, Table 29, Table 30) show the amount of timberland (in acres) in the MFRC Southeast Landscape by specific forest type and by stand-size class according to Forest Inventory Analysis (FIA) data for 1990, 1999-2003, and 2008-2012. As the Forest Service did not consistently record forest type information prior to the annual surveys beginning in 1999, the 1990 data contains significantly fewer forest types (C. Barnett, personal communication). Because of this, all three tables also show the forest type groups, which better explain change across time.

The oak/hickory group maintains the largest percent of acreage across time, following a similar pattern to overall forest acreage by decreasing slightly by 2003 and increasing again by 2012. The elm/ash/cottonwood group, however, despite making up a lower percentage of total timberland, has increased steadily since 1990. The maple/beech/birch group has shown an overall decrease since 1990, though it increased between 2003 and 2012. Within that latter timeframe the hard maple/basswood type remained relatively consistent, though the sugar maple/beech/yellow birch type increased somewhat. The aspen/birch group also decreased substantially – by over 50% - since 1990, though it makes up a relatively small percentage of the southeast Minnesota forest.

In terms of stand-size class, large diameter stands have consistently made up the vast majority of timberland acreage, dipping somewhat drastically by 2003 but increasing beyond 1990 acreage by 2012. Acres of medium diameter stands have increased slightly since 1990 while acres of small diameter stands have decreased or stayed relatively the same over time (Figure 13).

**Table 28:** Area (in acres) of timberland by forest type group, forest type, and stand-size class for the Southeast landscape, 1990.

|                               |                              |                | Stand-size class |                 |                |
|-------------------------------|------------------------------|----------------|------------------|-----------------|----------------|
| Forest type group             | Forest type                  | Total          | Large diameter   | Medium diameter | Small diameter |
|                               | <b>Total</b>                 | 623,616        | 469,177          | 87,428          | 67,011         |
| White / red / jack pine group | Red pine                     | 806            | -                | 305             | 501            |
| <b>Group Subtotal</b>         |                              | <b>806</b>     | <b>-</b>         | <b>305</b>      | <b>501</b>     |
| Oak / hickory group           | Oak / hickory group          | 369,960        | 315,637          | 39,720          | 14,603         |
| <b>Group Subtotal</b>         |                              | <b>369,960</b> | <b>315,637</b>   | <b>39,720</b>   | <b>14,603</b>  |
| Elm / ash / cottonwood group  | Elm / ash / cottonwood group | 83,203         | 61,801           | 12,801          | 8,601          |
| <b>Group Subtotal</b>         |                              | <b>83,203</b>  | <b>61,801</b>    | <b>12,801</b>   | <b>8,601</b>   |
| Maple / beech / birch group   | Maple / beech / birch group  | 133,540        | 77,438           | 18,001          | 38,101         |
| <b>Group Subtotal</b>         |                              | <b>133,540</b> | <b>77,438</b>    | <b>18,001</b>   | <b>38,101</b>  |
| Aspen / birch group           | Aspen                        | 24,207         | 7,101            | 11,901          | 5,205          |
|                               | Paper birch                  | 11,900         | 7,200            | 4,700           | -              |
| <b>Group Subtotal</b>         |                              | <b>36,107</b>  | <b>14,301</b>    | <b>16,601</b>   | <b>5,205</b>   |

Source: Forest Inventory and Analysis estimate, 1990

Note: Area estimates are based on FIA samples and affected by stratification of the sample into categories and by non-sampled rates leading to some artificial variability in area estimates from survey to survey.

**Table 29:** Area (in acres) of timberland by forest type group, forest type, and stand-size class for the Southeast landscape, 2003.

|                               |                               |               | Stand-size class |                 |                |             |
|-------------------------------|-------------------------------|---------------|------------------|-----------------|----------------|-------------|
| Forest type group             | Forest type                   | Total         | Large diameter   | Medium diameter | Small diameter | Non-stocked |
|                               | <b>Total</b>                  | 539,199       | 338,870          | 153,388         | 40,423         | 6,517       |
| White / red / jack pine group | Red pine                      | 3,957         | 1,518            | 2,439           | -              | -           |
|                               | Eastern white pine            | 6,652         | 3,617            | 3,035           | -              | -           |
| <b>Group Subtotal</b>         |                               | <b>10,609</b> | <b>5,135</b>     | <b>5,474</b>    | <b>-</b>       | <b>-</b>    |
| Other eastern softwoods group | Eastern redcedar              | 8,977         | 2,715            | -               | 6,262          | -           |
| <b>Group Subtotal</b>         |                               | <b>8,977</b>  | <b>2,715</b>     | <b>-</b>        | <b>6,262</b>   | <b>-</b>    |
| Oak / hickory group           | Oak / hickory group           | 646           | 160              | 486             | -              | -           |
|                               | White oak / red oak / hickory | 183,124       | 113,505          | 65,094          | 4,525          | -           |
|                               | White oak                     | 5,751         | 5,751            | -               | -              | -           |
|                               | Northern red oak              | 45,853        | 45,853           | -               | -              | -           |

|                              |  |                |                |               |               |              |
|------------------------------|--|----------------|----------------|---------------|---------------|--------------|
|                              | Bur oak                                  | 25,595         | 22,019         | 3,577         | -             | -            |
|                              | Black walnut                             | 3,716          | 2,811          | 905           | -             | -            |
|                              | Elm / ash / black locust                 | 13,542         | 2,455          | 8,811         | 2,276         | -            |
|                              | Mixed upland hardwoods                   | 34,025         | 25,005         | 9,020         | -             | -            |
| <b>Group Subtotal</b>        |  | <b>312,252</b> | <b>217,559</b> | <b>87,893</b> | <b>6,801</b>  | <b>-</b>     |
| Elm / ash / cottonwood group | Elm / ash / cottonwood group             | 570            | 82             | 488           | -             | -            |
|                              | Black ash / American elm / red maple     | 2,871          | -              | 416           | 2,455         | -            |
|                              | Cottonwood                               | 9,520          | 9,520          | -             | -             | -            |
|                              | Willow                                   | 2,398          | -              | -             | 2,398         | -            |
|                              | Sycamore / pecan / American elm          | 848            | 848            | -             | -             | -            |
|                              | Sugarberry / hackberry / elm / green ash | 73,190         | 23,996         | 32,959        | 16,235        | -            |
|                              | Silver maple / American elm              | 7,788          | 6,190          | 1,599         | -             | -            |
|                              | Cottonwood / willow                      | 5,759          | 5,759          | -             | -             | -            |
| <b>Group Subtotal</b>        |  | <b>102,944</b> | <b>46,395</b>  | <b>35,462</b> | <b>21,088</b> | <b>-</b>     |
| Maple / beech / birch group  | Sugar maple / beech / yellow birch       | 34,782         | 23,094         | 7,646         | 4,043         | -            |
|                              | Hard maple / basswood                    | 45,210         | 40,581         | 4,629         | -             | -            |
| <b>Group Subtotal</b>        |  | <b>79,992</b>  | <b>63,675</b>  | <b>12,275</b> | <b>4,043</b>  | <b>-</b>     |
| Aspen / birch group          | Aspen                                    | 11,356         | -              | 9,126         | 2,230         | -            |
|                              | Paper birch                              | 6,551          | 3,393          | 3,159         | -             | -            |
| <b>Group Subtotal</b>        |  | <b>17,907</b>  | <b>3,393</b>   | <b>12,285</b> | <b>2,230</b>  | <b>-</b>     |
| Nonstocked                   | Nonstocked                               | 6,517          | -              | -             | -             | 6,517        |
| <b>Group Subtotal</b>        |  | <b>6,517</b>   | <b>-</b>       | <b>-</b>      | <b>-</b>      | <b>6,517</b> |

Source: Forest Inventory and Analysis estimate, 1999-2003

Note: Area estimates are based on FIA samples and affected by stratification of the sample into categories and by non-sampled rates leading to some artificial variability in area estimates from survey to survey.

**Table 30:** Area (in acres) of timberland by forest type group, forest type, and stand-size class for the Southeast landscape, 2012.

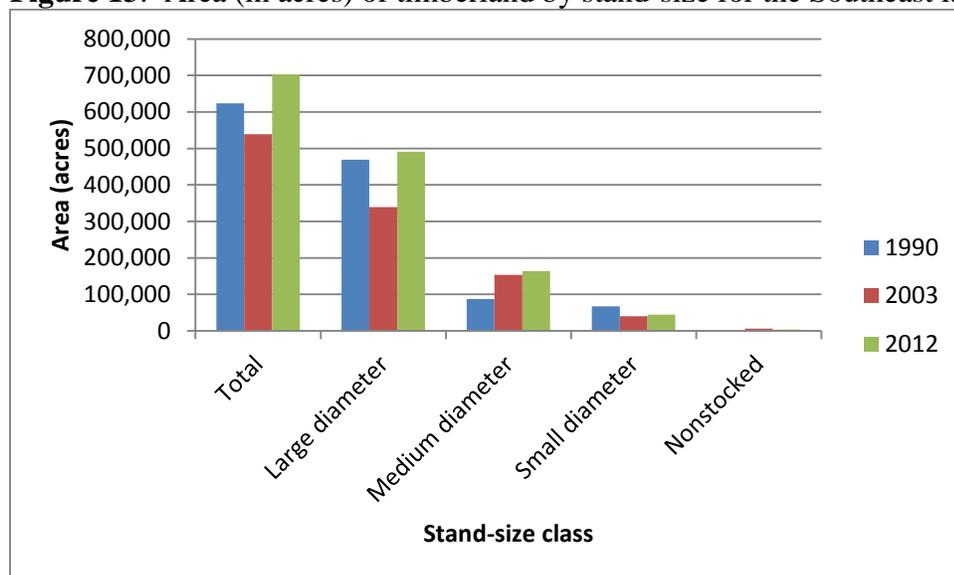
|                               |                    | Stand-size class |                |                 |                |             |
|-------------------------------|--------------------|------------------|----------------|-----------------|----------------|-------------|
| Forest type group             | Forest type        | Total            | Large diameter | Medium diameter | Small diameter | Non-stocked |
|                               | <b>Total</b>       | 702,547          | 490,724        | 163,878         | 44,527         | 3,418       |
| White / red / jack pine group | Red pine           | 3,150            | 1,468          | 1,682           | -              | -           |
|                               | Eastern white pine | 8,895            | 5,888          | 2,202           | 805            | -           |
| <b>Group Subtotal</b>         |                    | <b>12,045</b>    | <b>7,356</b>   | <b>3,884</b>    | <b>805</b>     | <b>-</b>    |
| Spruce / fir group            | White spruce       | 5,493            | 547            | 4,946           | -              | -           |
| <b>Group Subtotal</b>         |                    | <b>5,493</b>     | <b>547</b>     | <b>4,946</b>    | <b>-</b>       | <b>-</b>    |
| Other eastern softwoods group | Eastern redcedar   | 6,616            | 5,676          | 940             | -              | -           |
| <b>Group Subtotal</b>         |                    | <b>6,616</b>     | <b>5,676</b>   | <b>940</b>      | <b>-</b>       | <b>-</b>    |
| Oak / pine group              | Eastern redcedar / | 6,728            | 3,364          | 3,364           | -              | -           |

|                              |  |                |                |               |               |              |
|------------------------------|--|----------------|----------------|---------------|---------------|--------------|
|                              | hardwood                                 |                |                |               |               |              |
| <b>Group Subtotal</b>        |  | <b>6,728</b>   | <b>3,364</b>   | <b>3,364</b>  | <b>-</b>      | <b>-</b>     |
| Oak / hickory group          | White oak / red oak / hickory            | 211,787        | 156,473        | 55,313        | -             | -            |
|                              | White oak                                | 7,675          | 7,675          | -             | -             | -            |
|                              | Northern red oak                         | 66,458         | 61,089         | 144           | 5,225         | -            |
|                              | Bur oak                                  | 37,521         | 37,521         | -             | -             | -            |
|                              | Black walnut                             | 11,649         | 6,665          | 3,360         | 1,624         | -            |
|                              | Elm / ash / black locust                 | 18,947         | 4,841          | 3,683         | 10,423        | -            |
|                              | Mixed upland hardwoods                   | 63,256         | 41,821         | 16,142        | 5,293         | -            |
| <b>Group Subtotal</b>        |  | <b>417,293</b> | <b>316,085</b> | <b>78,642</b> | <b>22,565</b> | <b>-</b>     |
| Elm / ash / cottonwood group | Black ash / American elm / red maple     | 12,951         | 11,226         | 1,724         | -             | -            |
|                              | Cottonwood                               | 18,992         | 18,992         | -             | -             | -            |
|                              | Willow                                   | 733            | 733            | -             | -             | -            |
|                              | Sugarberry / hackberry / elm / green ash | 73,178         | 29,195         | 36,286        | 7,697         | -            |
|                              | Silver maple / American elm              | 19,965         | 13,219         | 4,173         | 2,573         | -            |
|                              | Cottonwood / willow                      | 3,273          | 3,273          | -             | -             | -            |
| <b>Group Subtotal</b>        |  | <b>129,092</b> | <b>76,638</b>  | <b>42,183</b> | <b>10,270</b> | <b>-</b>     |
| Maple / beech / birch group  | Sugar maple / beech / yellow birch       | 58,885         | 38,942         | 14,187        | 5,756         | -            |
|                              | Hard maple / basswood                    | 41,159         | 35,353         | 3,200         | 2,606         | -            |
| <b>Group Subtotal</b>        |  | <b>100,044</b> | <b>74,295</b>  | <b>17,387</b> | <b>8,362</b>  | <b>-</b>     |
| Aspen / birch group          | Aspen                                    | 11,017         | 4,240          | 5,068         | 1,708         | -            |
|                              | Paper birch                              | 6,621          | 2,523          | 4,098         | -             | -            |
| <b>Group Subtotal</b>        |  | <b>17,638</b>  | <b>6,763</b>   | <b>9,166</b>  | <b>1,708</b>  | <b>-</b>     |
| Other hardwoods group        | Other hardwoods                          | 4,182          | -              | 3,364         | 818           | -            |
| <b>Group Subtotal</b>        |  | <b>4,182</b>   | <b>-</b>       | <b>3,364</b>  | <b>818</b>    | <b>-</b>     |
| Nonstocked                   | Nonstocked                               | 3,418          | -              | -             | -             | 3,418        |
| <b>Group Subtotal</b>        |  | <b>3,418</b>   | <b>-</b>       | <b>-</b>      | <b>-</b>      | <b>3,418</b> |

Source: Forest Inventory and Analysis estimate, 2008-2012.

Note: Area estimates are based on FIA samples and affected by stratification of the sample into categories and by non-sampled rates leading to some artificial variability in area estimates from survey to survey.

**Figure 13:** Area (in acres) of timberland by stand-size for the Southeast landscape, 1990-2012.



**Source:** Forest Inventory and Analysis estimate 1990, 2003, 2012

Note: Area estimates are based on FIA samples and affected by stratification of the sample into categories and by non-sampled rates leading to some artificial variability in area estimates from survey to survey.

### 3.8. Annual growth, mortality, and removals of growing stock on timberland

According to Forest Inventory and Analysis (FIA) 2008-2012 estimates (as of October 2013) of growing stock on timberland, there are nearly 900 million cubic feet of growing stock timber in southeast Minnesota (Table 31). The species groups that experienced the greatest quantity of net growth (in board feet, NOT by percent of total) were “other eastern soft hardwoods,” followed by hard maple, then basswood, then select red oaks. By a large margin, the species group with the greatest quantity of mortality was “other eastern soft hardwoods” by a similar quantity to total net growth after mortality, followed by select red oaks, cottonwood and aspen, and select white oaks. Species groups that experienced the highest removal quantities (in cubic feet) were cottonwood and aspen, select red oaks, and ash.

Estimates of sawtimber volumes were greater. By 2012, the MFRC Southeast Landscape had an estimated over 3.1 billion board feet (International ¼-inch rule) of sawtimber (Table 32). Select red oaks had the greatest net volume by a large margin, followed by select white oaks, cottonwood and aspen, and other eastern soft hardwoods. In terms of growth, however, other eastern soft hardwoods experienced the greatest overall quantity of net growth, followed by select red oaks, hard maple, and basswood. Mortality and removal numbers were not available for all species; however, “other eastern hard hardwoods” and “other” species experienced negative net growth, possibly due to high mortality rates.

U.S. Forest Service definitions for FIA terms are listed below.

Forest Inventory and Analysis Definitions (USFS):

- Growing stock. All live trees of commercial species that meet minimum merchantability standards (at least 5 inches d.b.h.). In general, these trees have at least one solid 8-foot section, are reasonably free from defect on the merchantable bole, and at least 34% or more of the volume is merchantable. Excludes rough or rotten cull trees.
- Sawtimber. A tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches d.b.h.
- Net cubic-foot volume. For timber species, this is the net volume of wood in the central stem of a sample tree  $\geq 5.0$  inches in diameter, from a 1-foot stump to a minimum 4-inch top diameter, or to where the central stem breaks into limbs all of which are  $<4.0$  inches in diameter. For woodland species (trees where the diameter is measured at root collar [DRC]), this is the net volume of wood and bark from the DRC measurement point(s) to a 1-1/2 inch top diameter; includes branches that are at least 1-1/2 inches in diameter along the length of the branch.
- Average annual net growth. The average annual change in the volume of trees during the period between inventories. Components include the change in volume of trees that have met the minimum size requirements over the inventory period, plus the volume of trees reaching the minimum size during the period (ingrowth), minus the volume of trees that died during the period, minus the volume of cull during the period. Mortality removals (trees killed in the harvesting process and left on site) and diversion removals (trees removed from the forest-land base due to a change from forest to non-forest land) are not included.
- Average annual removals of growing stock. Trees that were growing-stock trees on timberland at the time of the previous inventory and were removed from timberland by the time of the current inventory. Removals are cut and utilized trees, trees killed as a result of harvest operations but not utilized and live trees associated with land-use reclassifications.
- Average annual mortality of growing stock. Volume of growing stock trees that were alive at the time of the previous inventory and are dead in the current inventory. Tree death associated with insects, disease, fire, animals, weather, and other factors are included.
- Average annual sawtimber board-foot removals on timberland. Growing-stock trees that were or achieved sawtimber-size by the midpoint between inventory periods and were removed from timberland by the time of the current inventory. Removals are cut and utilized trees, trees killed as a result of harvest operations but not utilized, and live trees associated with land-use reclassifications.
- Sampling error percent. Equals 100 multiplied by the square root of the variance divided by the sample estimate.
- Timberland. Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. Areas qualifying as timberland are capable of producing at least 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.

**Table 31:** Estimated current net volume, and average net annual growth, mortality and removals of growing stock (in cubic feet) on timberland by species group for the MFRC Southeast Landscape, 2012.

| Species group                    | Total volume |                | Net growth |                | Mortality  |                | Removals   |                |
|----------------------------------|--------------|----------------|------------|----------------|------------|----------------|------------|----------------|
|                                  | cubic feet   | sampling error | cubic feet | sampling error | cubic feet | sampling error | cubic feet | sampling error |
| <b>Total</b>                     | 873,980,019  | 7.33           | 25,778,326 | 10.44          | 9,459,981  | 11.93          | 7,863,503  | 34.79          |
| Eastern white and red pine       | 24,082,888   | 48.28          | 1,601,511  | 44.04          | 71,908     | 98.07          | -          | -              |
| Spruce and balsam fir            | 4,905,185    | 59.39          | 853,899    | 58.93          | n/a        | -              | -          | -              |
| Other eastern softwoods          | 7,071,731    | 33.25          | 492,092    | 39.64          | n/a        | -              | -          | -              |
| Select white oaks                | 100,231,168  | 15.17          | 1,518,211  | 29.01          | 598,812    | 36             | 432,607    | 60.88          |
| Select red oaks                  | 155,764,447  | 13.52          | 2,474,251  | 39.57          | 1,175,550  | 45.27          | 1,718,502  | 62.48          |
| Other red oaks                   | 25,741,919   | 31.64          | 1,371,262  | 61.97          | 7,621      | 92.28          | 344,345    | 73.42          |
| Hickory                          | 31,699,240   | 15.28          | 989,689    | 22.72          | 241,223    | 47.1           | -          | -              |
| Hard maple                       | 56,346,328   | 21.82          | 3,068,069  | 36.49          | n/a        | -              | 71,871     | 92.28          |
| Soft maple                       | 60,515,956   | 38.6           | 1,085,486  | 36.76          | 155,999    | 56.61          | 170,334    | 67.78          |
| Ash                              | 29,539,730   | 18.95          | 1,316,647  | 35.73          | 235,874    | 83.55          | 1,707,211  | 75.97          |
| Cottonwood and aspen             | 86,900,124   | 22.91          | 2,492,347  | 28.99          | 870,127    | 36.53          | 1,911,147  | 68.65          |
| Basswood                         | 81,461,361   | 14.86          | 2,713,336  | 25.3           | 484,814    | 67.54          | 340,009    | 97.84          |
| Black walnut                     | 36,630,987   | 18.11          | 2,146,283  | 24.57          | 139,615    | 61.1           | 585,798    | 62.02          |
| Other eastern soft hardwoods     | 168,874,955  | 8.57           | 5,919,095  | 15.85          | 5,450,394  | 13.11          | 566,824    | 43.16          |
| Other eastern hard hardwoods     | 4,214,001    | 40.8           | -19,029    | -1,295.42      | 28,045     | 66.6           | 14,856     | 93.37          |
| Eastern non-commercial hardwoods | n/a          | n/a            | -21,966    | -92.28         | n/a        | -              | -          | -              |
| Other                            | n/a          | n/a            | -2,222,856 | -27.71         | n/a        | -              | -          | -              |

**Source:** Forest Inventory and Analysis estimates. Miles, P.D. Tue Oct 22 2013. Forest Inventory EVALIDator web-application version 1.5.1.05. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.fed.us/Evalidator/tmattribute.jsp>]

**Table 32:** Estimated current net volume, and average net annual growth, mortality and removals of sawtimber (in board feet, international 1/4" rule) on timberland by species group for the Southeast landscape, 2012.

| Species Group                | Net Volume    |                | Growth      |                | Mortality  |                | Removals   |                |
|------------------------------|---------------|----------------|-------------|----------------|------------|----------------|------------|----------------|
|                              | board feet    | sampling error | board feet  | sampling error | board feet | sampling error | board feet | sampling error |
| <b>Total</b>                 | 3,146,057,661 | 8.76           | 101,474,605 | 11.18          | 24,863,557 | 17.13          | 36,043,565 | 37.89          |
| Eastern white and red pine   | 94,686,457    | 53.62          | 7,229,751   | 52.71          | 328,915    | 98.07          | -          | -              |
| Spruce and balsam fir        | 8,796,972     | 57.87          | 1,682,095   | 57.93          | -          | -              | -          | -              |
| Other eastern softwoods      | 15,247,388    | 43.88          | 388,624     | 43.69          | -          | -              | -          | -              |
| Select white oaks            | 411,615,711   | 16.76          | 8,444,502   | 23.59          | 1,358,283  | 56.12          | 1,902,572  | 65.64          |
| Select red oaks              | 725,197,567   | 14.64          | 13,341,211  | 36.24          | 4,876,495  | 54.11          | 8,422,975  | 62.55          |
| Other red oaks               | 117,868,805   | 32.87          | 6,557,330   | 63.63          | -          | -              | 1,681,316  | 74.91          |
| Hickory                      | 68,047,665    | 20.66          | 3,081,289   | 27.78          | 411,787    | 92.28          | -          | -              |
| Hard maple                   | 203,672,966   | 25.61          | 11,590,651  | 41.24          | -          | -              | 304,191    | 92.28          |
| Soft maple                   | 287,131,538   | 40.98          | 6,569,544   | 34.74          | 486,895    | 70.88          | 468,631    | 92.28          |
| Ash                          | 100,581,898   | 24.79          | 4,731,692   | 41.05          | 852,115    | 92.28          | 7,961,937  | 82.22          |
| Cottonwood and aspen         | 355,045,140   | 27.54          | 9,842,099   | 27.11          | 2,789,108  | 44.43          | 9,783,407  | 73.3           |
| Basswood                     | 286,742,247   | 19.96          | 10,479,040  | 31.49          | 2,336,804  | 69.54          | 825,357    | 102.35         |
| Black walnut                 | 124,974,933   | 22.67          | 6,332,252   | 30.19          | 339,586    | 92.28          | 2,899,714  | 64.42          |
| Other eastern soft hardwoods | 335,801,499   | 12.97          | 18,464,069  | 19.96          | 11,083,569 | 18.43          | 1,793,464  | 57.34          |
| Other eastern hard hardwoods | 10,646,877    | 50.8           | -59,589     | -1,380.46      | -          | -              | -          | -              |
| Other                        | n/a           | n/a            | -7,199,955  | -33.54         | -          | -              | -          | -              |

**Source:** Forest Inventory and Analysis estimates. Miles, P.D. Tue Oct 22 2013. Forest Inventory EVALIDator web-application version 1.5.1.05. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station. [Available only on internet: <http://apps.fs.fed.us/Evalidator/tmattribute.jsp>]

### 3.9. Southeast vascular plant

The Minnesota DNR maintains a list of vascular plant species that reflect vouchered specimens present in herbarium collections at the University of Minnesota Herbarium, a division of the Bell Museum of Natural History on the St. Paul campus, and select plant families (Cyperaceae, Orchidaceae, and ferns) from the Olga Lakela Herbarium at University of Minnesota Duluth. This database, called MNTaxa, provides the species “full scientific name, including family, genus, species, and variety or subspecies (when applicable). Other attributes available include: whether the species is introduced to Minnesota; current status according to Minnesota's Endangered Species Statute and associated Rules; physiognomy; and the counties and subcounties in which the species has been documented,” according to the MNTaxa website. For further information on this database visit: [www.dnr.state.mn.us/eco/mcbs/plant\\_lists.html](http://www.dnr.state.mn.us/eco/mcbs/plant_lists.html)

According to this dataset total vascular plant species richness in Minnesota is 2,250 with 1,376 documented in the Southeast Landscape (Table 33). Of these 1,376 species, 1179 are native, 193 are introduced, and there are four for which the native or non-native status is unknown. There are 75 vascular plant species in the Southeast Landscape Region that are found nowhere else in the state, according to herbarium records; 11 of those species have recorded Minnesota occurrences only in Houston County (Table 34).

**Table 33:** Vascular plant species richness in the Southeast Landscape

|                      | <b>Dodge</b>    | <b>Fillmore</b> | <b>Freeborn</b> | <b>Goodhue</b> | <b>Houston</b> | <b>Le Sueur</b> | <b>Mower</b>               |
|----------------------|-----------------|-----------------|-----------------|----------------|----------------|-----------------|----------------------------|
| Native               | 427             | 743             | 418             | 811            | 854            | 514             | 562                        |
| Introduced           | 52              | 107             | 62              | 134            | 139            | 73              | 79                         |
| Unknown              | 2               | 2               | 1               | 2              | 3              | 1               | 1                          |
| <b>Total Species</b> | 481             | 852             | 481             | 947            | 996            | 588             | 642                        |
| %Native              | 88.8%           | 87.2%           | 86.9%           | 85.6%          | 85.7%          | 87.4%           | 87.5%                      |
|                      | <b>Olmstead</b> | <b>Rice</b>     | <b>Steele</b>   | <b>Wabasha</b> | <b>Waseca</b>  | <b>Winona</b>   | <b>Southeast Landscape</b> |
| Native               | 568             | 566             | 457             | 790            | 409            | 831             | <b>1179</b>                |
| Introduced           | 72              | 86              | 65              | 108            | 69             | 127             | <b>193</b>                 |
| Unknown              | 2               | 1               | 2               | 1              | 1              | 2               | <b>4</b>                   |
| <b>Total Species</b> | 642             | 653             | 524             | 899            | 479            | 960             | <b>1376</b>                |
| %Native              | 88.5%           | 86.7%           | 87.2%           | 87.9%          | 85.4%          | 86.6%           | <b>85.7%</b>               |

**Source:** Minnesota DNR, MNTaxa

Note: The number of species with recorded occurrences in a given landscape reflect herbarium records and not necessarily the richness of the landscape.

**Table 34:** Number of vascular plants in Minnesota with recorded occurrence limited to the MFRC Southeast Landscape; number of these vascular plants with recorded occurrence limited to single counties within the Southeast region.

|                            |           |
|----------------------------|-----------|
| <b>Southeast Landscape</b> | <b>75</b> |
| Dodge                      | 0         |
| Fillmore                   | 4         |
| Freeborn                   | 0         |

|          |    |
|----------|----|
| Goodhue  | 3  |
| Houston  | 11 |
| Le Sueur | 0  |
| Mower    | 4  |
| Olmstead | 0  |
| Rice     | 0  |
| Steele   | 0  |
| Wabasha  | 2  |
| Waseca   | 0  |
| Winona   | 5  |

**Source:** Minnesota DNR, MNTaxa

Note: The number of species with recorded occurrences in a given landscape reflect herbarium records and not necessarily the richness of the landscape.

### 3.10. Species richness of mammals, amphibians and reptiles, and birds in the MFRC’s Southeast Landscape.

According to vertebrate surveys performed during the Minnesota Biological Survey, there are at least 71 small and incidental mammals, 21 (29.6%) of which are in southeast Minnesota (note: recorded observations of larger mammals on an “incidental” basis do not necessarily represent all large mammals in the state) (Table 35). Fifty-two amphibians and reptiles were observed state-wide during the surveys, 44 (84.6%) of which were found in southeast Minnesota, and 247 breeding birds were observed statewide, 156 (%) of which were found in southeast Minnesota.

**Table 35:** Total species richness and richness of small and incidental mammals\*, amphibians and reptiles, and breeding birds in Minnesota and the MFRC Southeast Landscape.

|                            | Small/incidental mammals <sup>a</sup> | Amphibians and reptiles <sup>b</sup> | Breeding Birds <sup>a</sup> |
|----------------------------|---------------------------------------|--------------------------------------|-----------------------------|
| <b>Minnesota</b>           | 71                                    | 52                                   | 247                         |
| <b>Southeast Landscape</b> | 21                                    | 44                                   | 156                         |
| Dodge                      | 6                                     | 20                                   | 94                          |
| Fillmore                   | 9                                     | 29                                   | 91                          |
| Freeborn                   | 8                                     | 15                                   | 118                         |
| Goodhue                    | 9                                     | 32                                   | 84                          |
| Houston                    | 9                                     | 38                                   | 106                         |
| Le Sueur                   | 7                                     | 22                                   | 97                          |
| Mower                      | 7                                     | 25                                   | 101                         |
| Olmstead                   | 8                                     | 28                                   | 83                          |
| Rice                       | 15                                    | 22                                   | 79                          |
| Steele                     | 7                                     | 16                                   | 98                          |
| Wabasha                    | 7                                     | 32                                   | 97                          |
| Waseca                     | 6                                     | 13                                   | 108                         |
| Winona                     | 12                                    | 38                                   | 110                         |

\*These data are still preliminary at this time. “Incidental” mammals are larger mammals whose presence was observed during grid trapping sessions for small mammals.

<sup>a</sup>Karen Cieminski and Steve Stucker, Minnesota Biological Survey, MN DNR Division of Ecological and Water Resources, 2013.

<sup>b</sup> (Hall 2013); (MN DNR 2013 (3)). For distribution maps:

[http://files.dnr.state.mn.us/eco/mcbs/herp\\_maps/reptile\\_and\\_amphibian\\_maps\\_2ecs.pdf](http://files.dnr.state.mn.us/eco/mcbs/herp_maps/reptile_and_amphibian_maps_2ecs.pdf). Note: the following types of recordings were included for amphibians/reptiles : *vouchered record, post-1960*, specimen or photo collected after 1960; *vouchered record, pre-1960*, specimen or photo collected prior to 1960; *sighting or literature record*, description of species lacking a photo or specimen. Massasagua was not included as according to Hall the species is likely extirpated from the state.

### 3.11. Species at risk

As stated by the Minnesota Department of Natural Resources (MN DNR) webpage on endangered, threatened, and special concern species:

“Minnesota law requires the Department of Natural Resources to maintain a list of species that are at risk of disappearing from the state. Listed species are placed into one of three categories: endangered, threatened and special concern (ETSC). The list is based on scientific field studies, such as those conducted by the Minnesota Biological Survey.” (MN DNR 2013 (4))

The state’s List of Endangered, Threatened and Special Concern Species was first established in 1984; it was updated once in 1996 and again in 2013 (Table 36).

As stated in “Minnesota’s list of endangered, threatened, and special concern species,” Minnesota designates species as:

- Endangered, if the species is threatened with extinction throughout all or a significant portion of its range;
- Threatened, if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range;
- Species of Special Concern, if although the species is not endangered or threatened, it is extremely uncommon in this state, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.” (MN DNR 2013 (2))

#### *Section 3.11.1: Endangered, Threatened, and Special Concern Species in the Southeast Landscape*

In the MFRC Southeast Landscape, there are a combined 4 endangered, 5 threatened, and 27 special concern vertebrate species (excluding fish). Of the 31 species of forest-associated ETSC species, 17 are found in southeast Minnesota; examples include the least weasel (*Mustela nivalis*), red-shouldered hawk (*Buteo lineatus*), timber rattlesnake (*Crotalus horridus*), and Blanding’s turtle (*Emys blandingii*) (Table 37). [Note: These numbers need to be verified by the update to the online Rare Species Guide tool (appears to not be updated as of 8/18/2014). The 7 mammals, 5 birds, 3 reptiles or amphibians added in August are not in the RSG and location/habitat type had to be extrapolated from descriptive summaries created for the revision of the ETSC list, and at times these delineations were not clear.]

**Table 36:** Numbers of endangered, threatened, and special concern species for Minnesota, 2013.

|                         | <b>Endangered</b> | <b>Threatened</b> | <b>Special Concern</b> | <b>Total</b> |
|-------------------------|-------------------|-------------------|------------------------|--------------|
| Mammals                 | 0                 | 2                 | 19                     | 21           |
| Birds                   | 9                 | 2                 | 21                     | 32           |
| Amphibians and Reptiles | 2                 | 4                 | 10                     | 16           |
| Fish                    | 4                 | 5                 | 25                     | 34           |
| Mollusks                | 13                | 11                | 9                      | 33           |
| Jumping Spiders         | 0                 | 1                 | 9                      | 10           |
| Leafhoppers             | 0                 | 0                 | 3                      | 3            |
| Dragonflies             | 0                 | 1                 | 7                      | 8            |
| Butterflies and Moths   | 8                 | 1                 | 10                     | 19           |
| Caddisflies             | 5                 | 11                | 8                      | 24           |
| Tiger Beetles           | 3                 | 2                 | 4                      | 9            |
| Vascular Plants         | 86                | 93                | 130                    | 309          |
| Fungi                   | 3                 | 0                 | 5                      | 8            |
| Lichens                 | 7                 | 9                 | 21                     | 37           |
| Mosses and Liverworts   | 3                 | 7                 | 17                     | 27           |
| <b>Total</b>            | <b>143</b>        | <b>149</b>        | <b>298</b>             | <b>590</b>   |

**Source:** Minnesota’s List of Endangered, Threatened, and Special Concern Species, 2013. MN DNR Division of Ecological and Water Resources.

**Table 37:** Complete list of endangered, threatened, and special concern species of mammals, breeding birds, and amphibians and reptiles in Minnesota, 2013. Forest-associated species are designated with (F); species present in Southeast Minnesota are in bolded print.

|                | <b>Endangered</b> | <b>Threatened</b>   | <b>Special Concern</b>   |
|----------------|-------------------|---|--|
| <b>Mammals</b> | --                | <ul style="list-style-type: none"> <li>• eastern spotted skunk (F)</li> <li>• northern pocket gopher</li> </ul> | <ul style="list-style-type: none"> <li>• moose (F)</li> <li>• elk (F)</li> <li>• North American least shrew</li> <li>• <b>big brown bat (F?)</b></li> <li>• Canada lynx (F) (Fed. Status: T)</li> <li>• <b>prairie vole</b></li> <li>• <b>woodland vole (F)</b></li> <li>• <b>least weasel (F)</b></li> <li>• <b>little brown myotis (F?)</b></li> <li>• <b>northern myotis (F)</b></li> <li>• northern grasshopper mouse</li> <li>• <b>tri-colored bat (F)</b></li> <li>• <b>plains pocket mouse</b></li> <li>• eastern heather vole (F)</li> <li>• mountain lion (F)</li> <li>• <b>western harvest mouse</b></li> <li>• smoky shrew (F)</li> <li>• northern bog lemming (F)</li> <li>• Richardson’s ground squirrel</li> </ul> |

|                                       |  |  |  |
|---------------------------------------|--|--|--|
| <p><b>Breeding Birds</b></p>          | <ul style="list-style-type: none"> <li>• Baird's sparrow</li> <li>• <b>Henslow's sparrow</b></li> <li>• Sprague's pipit (Fed. Status: C)</li> <li>• burrowing owl</li> <li>• chestnut-collared longspur</li> <li>• piping plover (Fed. Status: E/T)</li> <li>• <b>loggerhead shrike</b></li> <li>• horned grebe</li> <li>• <b>king rail</b></li> </ul> | <ul style="list-style-type: none"> <li>• <b>Wilson's phalarope</b></li> <li>• common tern</li> </ul>   | <ul style="list-style-type: none"> <li>• northern goshawk (F)</li> <li>• boreal owl (F)</li> <li>• Nelson's sparrow</li> <li>• <b>short-eared owl</b></li> <li>• <b>red-shouldered hawk (F)</b></li> <li>• <b>lark sparrow</b></li> <li>• yellow rail</li> <li>• <b>trumpeter swan</b></li> <li>• <b>Acadian flycatcher (F)</b></li> <li>• <b>peregrine falcon</b></li> <li>• <b>common gallinule</b></li> <li>• Franklin's gull</li> <li>• marbled godwit</li> <li>• <b>Louisiana waterthrush (F)</b></li> <li>• American white pelican</li> <li>• <b>purple martin</b></li> <li>• <b>cerulean warbler (F)</b></li> <li>• <b>hooded warbler (F)</b></li> <li>• <b>Forster's tern</b></li> <li>• greater prairie-chicken</li> <li>• <b>Bell's vireo</b></li> </ul> |
| <p><b>Reptiles and Amphibians</b></p> | <ul style="list-style-type: none"> <li>• <b>northern cricket frog (F)</b></li> <li>• massasauga<sup>a</sup> (F) (Fed. Status: C)</li> </ul>  | <ul style="list-style-type: none"> <li>• <b>timber rattlesnake (F)</b></li> <li>• <b>Blanding's turtle (F)</b></li> <li>• <b>wood turtle (F)</b></li> <li>• <b>western ratsnake (F)</b></li> </ul> | <ul style="list-style-type: none"> <li>• spotted salamander (F)</li> <li>• Great Plains toad</li> <li>• <b>smooth softshell</b></li> <li>• <b>North American racer (F)</b></li> <li>• four-toed salamander (F)</li> <li>• <b>plains hog-nosed snake</b></li> <li>• mudpuppy (F?)</li> <li>• <b>gopher snake</b></li> <li>• <b>common five-lined skink</b></li> <li>• lined snake</li> </ul>  |

**Source:** Minnesota's List of Endangered, Threatened, and Special Concern Species, 2013 (5), MN DNR Division of Ecological and Water Resources; Rare Species Guide, MN DNR 2013 (6).

<sup>a</sup>Massasauga is not shown as present in southeast MN as according to Carol Hall of the Minnesota Biological Survey staff, the species is likely extirpated from the state.

*Section 3.11.2: SCGN Species by Subsection for the three main Subsections in the Southeast Landscape*

When examined by the three most dominate Subsections, the Blufflands also contains the highest number of Species of Greatest Conservation Need (SGCN) in the region. The Blufflands contains 156 SGCN, which is approximately two-thirds more than either the Rochester Plateau (94) or the Oak Savanna Subsections (93) (Table 38-Table 40).

Table 38: SGCN in the Blufflands Subsection

|            | # of SGCN | Percentage of SGCN Set by Taxon | Examples of SGCN      |
|------------|-----------|---------------------------------|-----------------------|
| Amphibians | 3         | 50                              | Pickerel frog         |
| Birds      | 53        | 54.6                            | Blue-winged warbler   |
| Fishes     | 26        | 55.3                            | Crystal darter        |
| Insects    | 14        | 25                              | Karner blue butterfly |
| Mammals    | 9         | 40.9                            | Northern myotis       |
| Mollusks   | 32        | 82.1                            | Hubricht's vertigo    |
| Reptiles   | 16        | 94.1                            | Timber rattlesnake    |
| Spiders    | 3         | 37.5                            | <i>P. apacheanus</i>  |
| TOTAL SGCN | 156       |                                 |                       |

Table 39: SGCN in the Rochester Plateau Subsection

|            | # of SGCN | Percentage of SGCN Set by Taxon | Examples of SGCN                  |
|------------|-----------|---------------------------------|-----------------------------------|
| Amphibians | 3         | 50                              | Pickerel frog                     |
| Birds      | 46        | 47.4                            | Loggerhead shrike                 |
| Fishes     | 11        | 23.4                            | Gravel chub                       |
| Insects    | 7         | 12.5                            | <i>None documented since 1990</i> |
| Mammals    | 6         | 27.3                            | Eastern pipistrelle               |
| Mollusks   | 9         | 23.1                            | Ellipse                           |
| Reptiles   | 12        | 70.6                            | Six-lined racerunner              |
| Spiders    | 0         | 0                               | NA                                |
| TOTAL SGCN | 94        |                                 |                                   |

Table 40: SGCN in the Oak Savanna Subsection

|            | # of SGCN | Percentage of SGCN Set by Taxon | Examples of SGCN                  |
|------------|-----------|---------------------------------|-----------------------------------|
| Amphibians | 2         | 33.3                            | Common Mudpuppy                   |
| Birds      | 48        | 49.5                            | Bobolink                          |
| Fishes     | 12        | 25.5                            | Slender madtom                    |
| Insects    | 7         | 12.5                            | <i>None documented since 1990</i> |
| Mammals    | 7         | 31.8                            | Western harvest mouse             |
| Mollusks   | 9         | 23.1                            | Spike                             |
| Reptiles   | 8         | 47.1                            | Eastern fox snake                 |
| Spiders    | 0         | 0                               | NA                                |
| TOTAL SGCN | 93        |                                 |                                   |

### 3.12. Invasive Species

Non-native invasive species pose a significant threat to Minnesota’s forests, lakes, and associated economies. Figure 14 through Figure 16 show the distribution of invasive plants listed on Minnesota’s Prohibited Noxious Weeds List. The Minnesota Department of Agriculture (MDA) is responsible for maintaining and updating this list which includes, according to the MDA’s website, “annual, biennial, or perennial plants that the commissioner designates as having the potential or are known to be detrimental to human or animal health, the environment, public roads, crops, livestock or other property” (MDA 2013). Plants on this list are designated as:

1. **Eradicate List:** plants that are not currently known to be present in Minnesota or are not widely established. These species must be eradicated, meaning all of the above and below ground parts of the plant must be destroyed, as required by Minnesota Statutes, Section 18.78. Additionally, no transportation, propagation, or sale of these plants is allowed. Measures must also be taken to prevent and exclude these species from being introduced into Minnesota.
2. **Control List:** plants established throughout Minnesota or regions of the state. Species on this list must be controlled, meaning efforts must be made to prevent the spread, maturation and dispersal of any propagating parts, thereby reducing established populations and preventing reproduction and spread as required by Minnesota Statutes, Section 18.78. Additionally, transportation, propagation, or sale of these plants is prohibited.
3. **Restricted Noxious Weeds:** plants that are widely distributed in Minnesota and are detrimental to human or animal health, the environment, public roads, crops, livestock or other property, but whose only feasible means of control is to prevent their spread by prohibiting the importation, sale, and transportation of their propagating parts in the state except as allowed by Minnesota Statutes, Section 18.82. Plants designated as Restricted Noxious Weeds may be reclassified if effective means of control are developed.” (MDA 2013)

Table 41 summarizes the total number of observations of terrestrial plant invasive species present on both the Noxious Weeds list and in the Southeast Landscape that were made by the Minnesota Department of Natural Resources (MN DNR) Division of Ecological and Water Resources, as well as the Minnesota Department of Agriculture’s (MDA) Early Detection and Distribution Mapping System (EDD MapS). Reed canary grass (*Phalaris arundinacea*) is not listed on the Noxious Weeds List, but is included because of its abundance in the region. The most frequently observed species included reed canary grass, wild parsnip (*Pastinaca sativa*), and common buckthorn (*Rhamnus cathartica*). As seen in Figure 14, Figure 15, and Figure 16, the largest observed concentrations of these terrestrial invasive plant species are along waterways and highways, such as portions of the Mississippi and Root rivers, and along Hwy 60/the Cannon River in Le Sueur and Rice counties. It should be noted, however, that these data contain heavy sampling bias, as roadways and public lands were the only accessible sample sites. It is therefore possible that many more observations of these terrestrial invasive species could be made on private land in southeast Minnesota. It should also be noted that the species presented are only those found on the MDA’s “Noxious Weeds” list (MDA 2013 (1)) and does not include all terrestrial invasive plants that may be present in the region, such as Japanese barberry (*Berberis thunbergii*).

Figure 14 shows species on the MDA “Eradicate List,” indicating that they are not yet widely distributed in the state. However, while not yet widely distributed it is possible that some of these species have existed within the state for a while, undetected. According to the MDA, the first Minnesota reported outbreak and control of oriental bittersweet occurred in 2010 in the Twin Cities metro area, where it had been mistaken with American bittersweet (*Celastrus scandens*) and planted; however, estimates show that some outbreaks may be 30 years old, indicating that the species has been in the state and gone unnoticed for quite some time (A. Gupta, personal communication). There are currently reported outbreaks of this destructive plant in both Goodhue and Winona counties (MDA 2013 (2)).

More information on terrestrial invasive plants in Minnesota can be found at:

[www.mda.state.mn.us/plants/badplants/noxiouslist.aspx](http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx) or  
[www.dnr.state.mn.us/invasives/terrestrial/index.html](http://www.dnr.state.mn.us/invasives/terrestrial/index.html)  
<http://www.dnr.state.mn.us/invasives/terrestrialanimals/eab/index.html>

Another terrestrial invasive species of major concern in Southeast Minnesota in recent years is the emerald ash borer (*Agrilus planipennis*). According to the Minnesota Department of Natural Resources webpage on emerald ash borer:

“Emerald ash borer (EAB) is a nonnative invasive insect that destroys ash trees. EAB has currently been identified in the Metro and Southeastern regions of the state and quarantine has been placed on Ramsey, Hennepin, Houston, and Winona counties to help slow the spread of EAB to other areas.” (MN DNR 2013 (7))

Areas of highest risk of EAB introduction were inferred based on the presence of campgrounds, firewood dealers, sawmills, urban areas and other potential sources of EAB introduction due to human movement of the insect (MDA 2006). Areas of highest introduction risk in the Southeast Landscape include the city of Rochester and areas surrounding the lakes along the Cannon River in Le Sueur County (Figure 17). Presence of EAB has been confirmed for several sites in Winona and Houston counties (Table 42, Figure 17).

The following EAB definitions for Table 42 are from the Minnesota Dept. of Agriculture:

- **Emerald Ash Borer Introduction Risk:** “The purpose of the risk model and map is to optimize the placement of emerald ash borer detection (trap) trees in Minnesota.” (MDA 2006, p. 1)

**EAB Biological Control Sites:** “Biological control is the only management option that can be applied at the forest landscape level. The goal of EAB biological control is to use natural enemies to bring EAB populations into balance and reduce damage. There are three species of parasitoid wasps that are approved for release. These species were selected by the US Department of Agriculture’s Animal and Plant Health Inspection Service (APHIS) and Forest Service. These three species were tested to ensure that they will not negatively impact other species or the environment. APHIS rears these biological control agents at a specialized facility and provides them to states with EAB infestations. Biological control implementation is a collaborative effort by local governments and state and federal agencies. The Minnesota Department of Agriculture coordinates the statewide EAB biological control program.” (MDA

2011, p.2) Figure 21 shows waters designated by the MN DNR as being infested with aquatic invasive plants. Major areas of impact, as seen in the figure, include the Mississippi and Zumbro rivers, and in lakes along the Cannon river such as Cannon and Tetonka lakes in Steele and Rice counties.

Gypsy moth trapping results from 2002 to 2013 indicate somewhat irregular results from 2002 to 2007, with a sudden peak in 2008 (Table 43). Concentrations of trapped moths were highest in Houston County that year. A treatment was imposed in some locations in 2009 (Figure 19). Trapped moth numbers dropped again in 2009 through 2013, though it is unclear whether lower moth numbers were a direct result of that treatment or if other factors were involved, considering the irregular numbers in pre-2008 years. Eight of 13 counties in the region had evidence of moth presence in 2013 (Table 46).

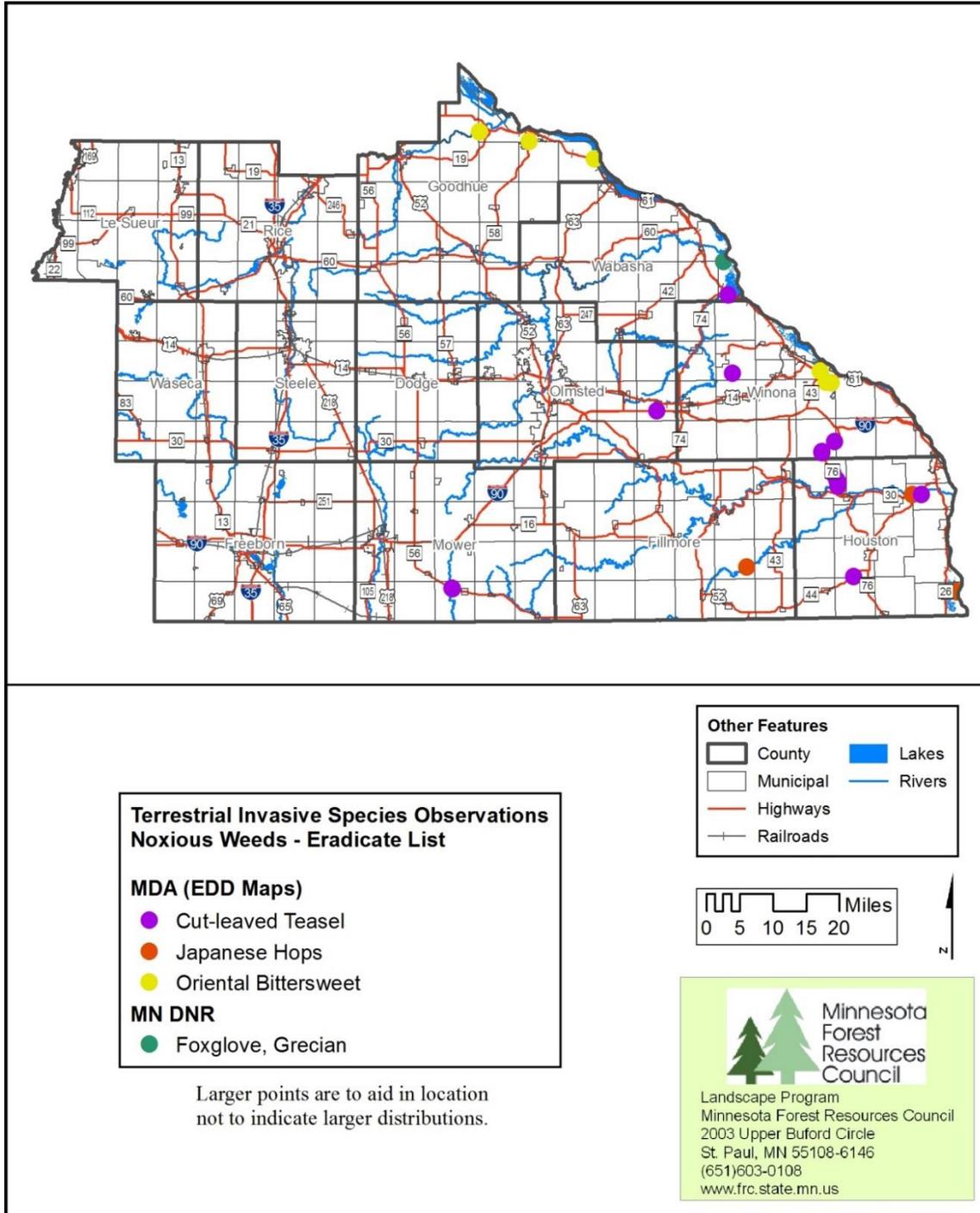
**Table 41:** Terrestrial invasive plant species observations in the Southeast Landscape, 2004 to 2012.

| Noxious Weed List Status | Source   | Scientific name       | Common name          | Number of Observations |
|--------------------------|----------|-----------------------|----------------------|------------------------|
| Eradicate                | EDD MapS | Dipsacus laciniatus   | cutleaf teasel       | 16                     |
|                          | EDD MapS | Humulus japonicas     | Japanese hops        | 4                      |
|                          | EDD MapS | Celastrus orbiculatus | oriental bittersweet | 6                      |
|                          | MN DNR   | Digitalis lanata      | Grecian foxglove     | 1                      |
| Control                  | MN DNR   | Centaurea stoebe      | spotted knapweed     | 25                     |
|                          | MN DNR   | Lythrum salicaria     | purple loosestrife   | 111                    |
|                          | MN DNR   | Alliaria petiolata    | garlic mustard       | 371                    |
|                          | MN DNR   | Pastinaca sativa      | wild parsnip         | 4124                   |
|                          | MN DNR   | Euphorbia esula       | leafy spurge         | 77                     |
|                          | MN DNR   | Tanacetum vulgare     | common tansy         | 962                    |
|                          | MN DNR   | Cirsium arvense       | Canada thistle       | 254                    |
|                          | MN DNR   | Carduus nutans        | musk/nodding thistle | 8                      |
| Restricted               | MN DNR   | Rhamnus cathartica    | common buckthorn     | 2921                   |
|                          | MN DNR   | Frangula alnus        | glossy buckthorn     | 33                     |
| Not listed               | MN DNR   | Phalaris arundinacea  | reed canary grass    | 4778                   |

**Source:** Minnesota Department of Natural Resources Division of Ecological and Water Resources, MN DNR Data Deli (MN DNR 2013 (8)); Minnesota Dept. of Agriculture Early Detection and Distribution Mapping System (EDD MapS)

Note: Observations were made between 6/17/2004 and 10/8/2013. Each observation may vary for the number of plants observed, distribution of plants, and acres infected. Separate observations may represent the same location, therefore the count of observations may over-represent the distribution of a species. Some current distribution records in EDD MapS have not been verified.

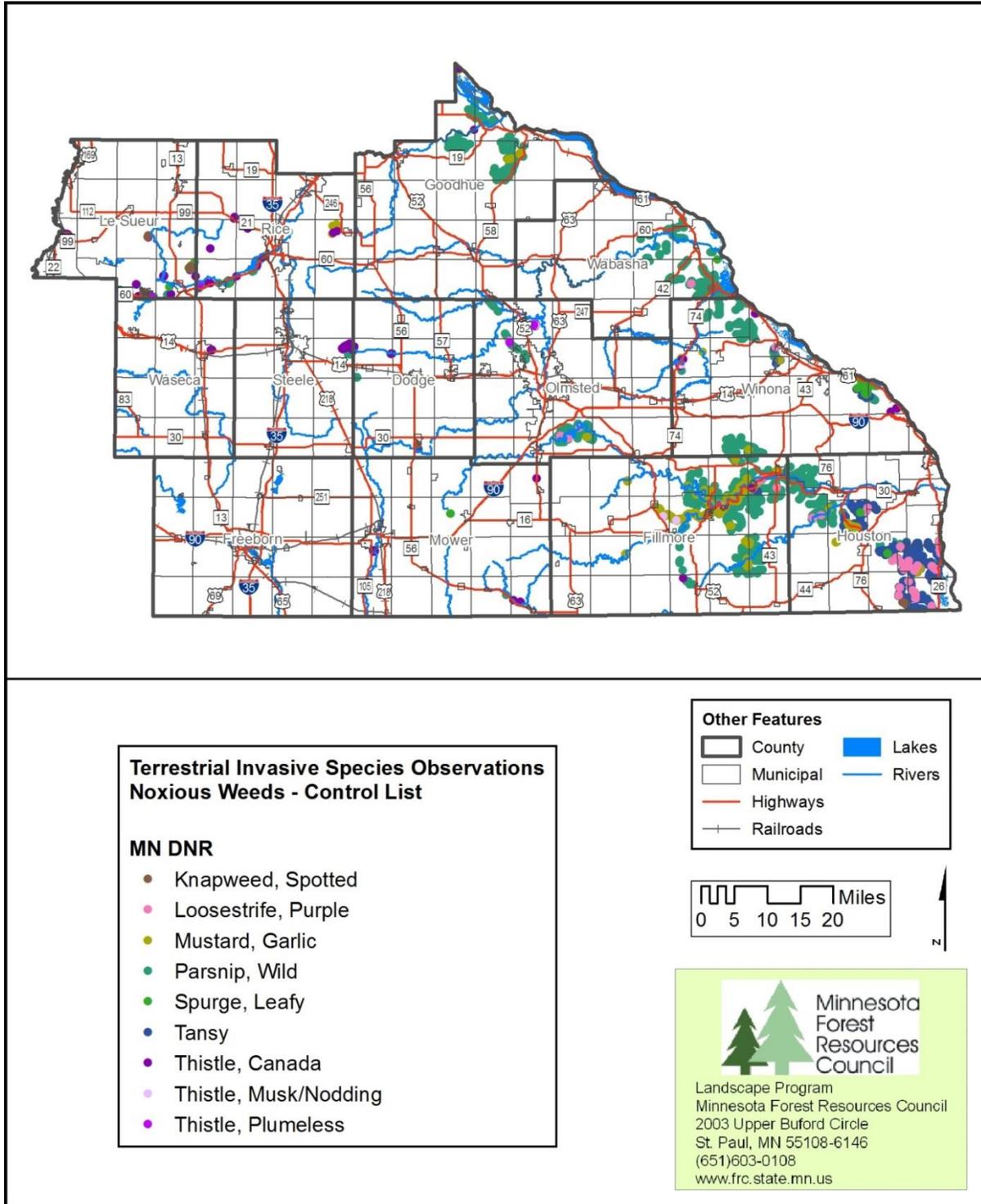
**Figure 14:** Terrestrial invasive plant species observations in the Southeast Landscape, 2004 to 2012, MDA Eradicate List.



**Source:** Minnesota DNR Data Deli; Minnesota Dept. of Agriculture Early Detection and Distribution Mapping System

Notes: The species represented in this figure are designated by the MN Department of Agriculture as ‘Noxious Weeds’ (Eradicate List) and therefore falling under the Noxious Weed Law ([www.mda.state.mn.us/plants/badplants/noxiouslist.aspx](http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx)). Colored dots are overlapping (least common species are in the top layers) and thus some dots may not be visible. Some current distribution records in EDD MapS have not been verified.

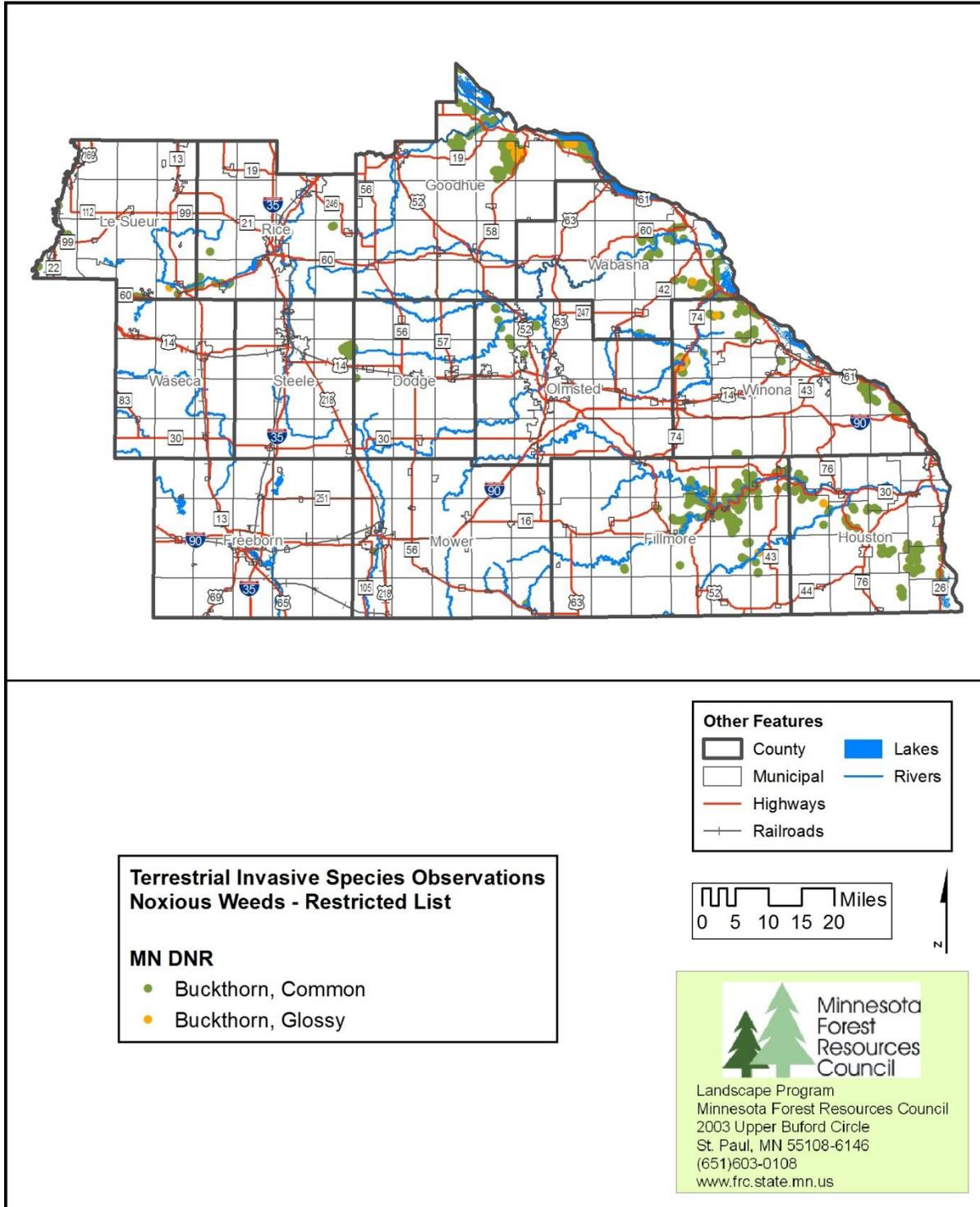
**Figure 15:** Terrestrial invasive plant species observations in the Southeast Landscape, 2004 to 2012, MDA Control List.



**Source:** Minnesota DNR Data Deli

Notes: With the exception of reed canary grass, the species represented in this figure are designated by the MN Department of Agriculture as ‘Noxious Weeds’ (Control List) and therefore falling under the Noxious Weed Law ([www.mda.state.mn.us/plants/badplants/noxiouslist.aspx](http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx)). Colored dots are overlapping (least common species are in the top layers) and thus some dots are not visible.

**Figure 16:** Terrestrial invasive plant species observations in the Southeast Landscape, 2004 to 2012, MDA Restricted List.



**Source:** Minnesota DNR Data Deli

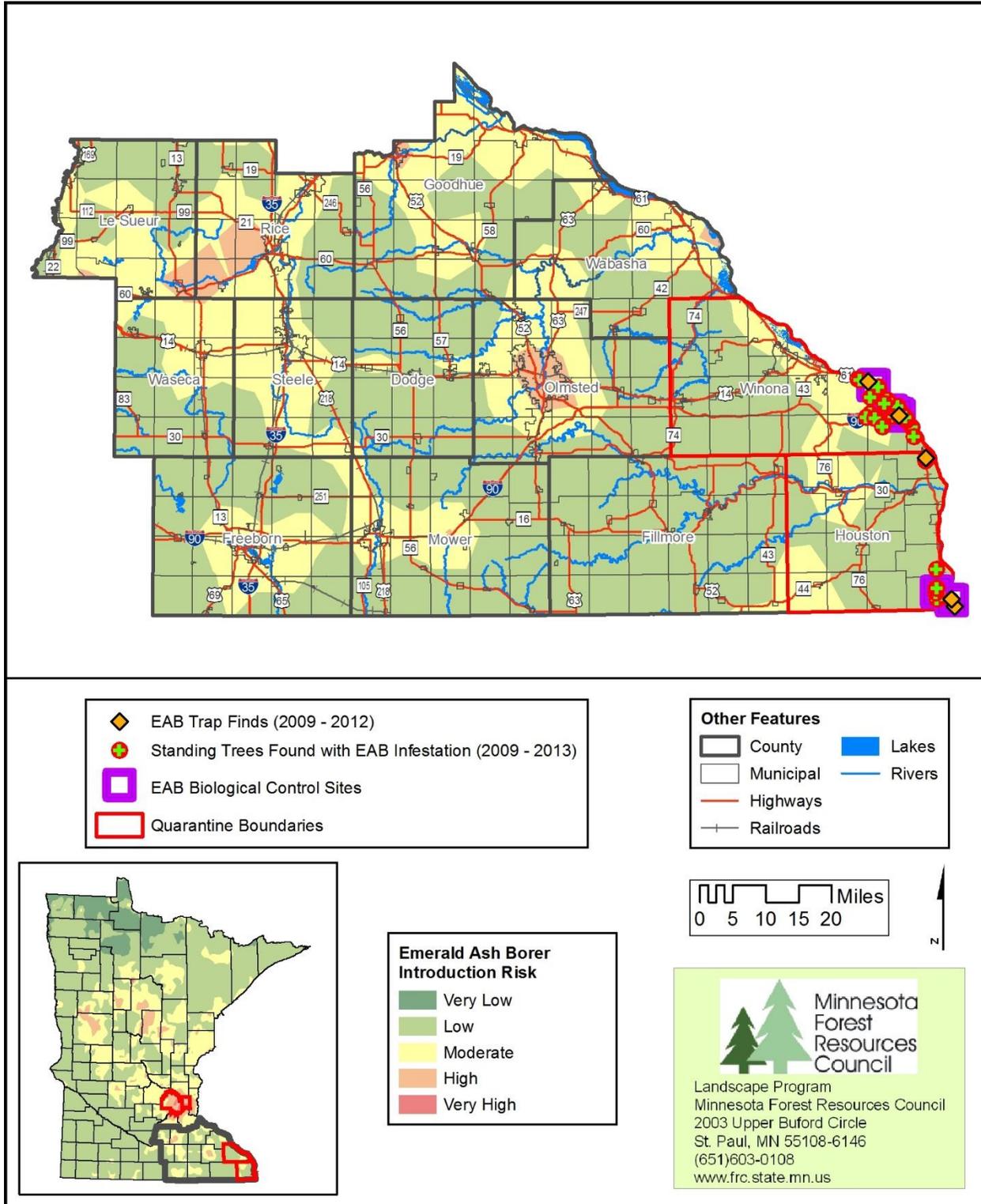
Notes: The species represented in this figure are designated by the MN Department of Agriculture as ‘Noxious Weeds’ (Restricted List) and therefore falling under the Noxious Weed Law ([www.mda.state.mn.us/plants/badplants/noxiouslist.aspx](http://www.mda.state.mn.us/plants/badplants/noxiouslist.aspx)). Colored dots are overlapping (least common species are in the top layers) and thus some dots are not visible.

**Table 42:** Evidence of emerald ash borer (EAB) in the Southeast Landscape and number of biological control sites in affected counties, 2009-2013.

| County  | Item  | Count |
|---------|---|-------|
| Winona  | EAB Trap Finds (2009 - 2012)                            | 2     |
|         | Standing Trees Found with EAB Infestation (2009 - 2013) | 71    |
|         | EAB Biological Control Sites                            | 4     |
| Houston | EAB Trap Finds (2009 - 2012)                            | 3     |
|         | Standing Trees Found with EAB Infestation (2009 - 2013) | 19    |
|         | EAB Biological Control Sites                            | 2     |

Source: Minnesota MDA, Emerald Ash Borer Status Map, <http://gis.mda.state.mn.us/eab/>

**Figure 17:** Emerald ash borer introduction and introduction risk in the Southeast Landscape, 2009-2013.



Source: Minnesota MDA, Emerald Ash Borer Status Map, <http://gis.mda.state.mn.us/eab/>

Table 43: Gypsy Moth Trap results in the Southeast Landscape, 2002-2013.

| <b>Year</b> | <b>Southeast Region Trap Catch Results</b> |
|-------------|--|
| 2002        | 21   |
| 2003        | 213  |
| 2004        | 34   |
| 2005        | 7  |
| 2006        | 10   |
| 2007        | 321  |
| 2008        | 2,872                                      |
| 2009        | 166  |
| 2010        | 248  |
| 2011        | 122  |
| 2012        | 34   |
| 2013        | 184  |

Table 44: Gypsy Moth trap results, by county in the Southeast Landscape, 2008.

| <b>County</b>                 | <b>Trap Catch Results (2008)</b> |
|-------------------------------|----------------------------------|
| Dodge                         | 2                                |
| Fillmore                      | 196                              |
| Freeborn                      | 0                                |
| Goodhue                       | 42                               |
| Houston                       | 1,374                            |
| Le Sueur                      | 2                                |
| Mower                         | 0                                |
| Olmsted                       | 148                              |
| Rice                          | 1                                |
| Steele                        | 0                                |
| Wabasha                       | 153                              |
| Waseca                        | 0                                |
| Winona                        | 954                              |
| <b>Total Southeast Region</b> | <b>2,872</b>                     |

Figure 18: Gypsy Moth trap results, by county in the Southeast Landscape, 2008.

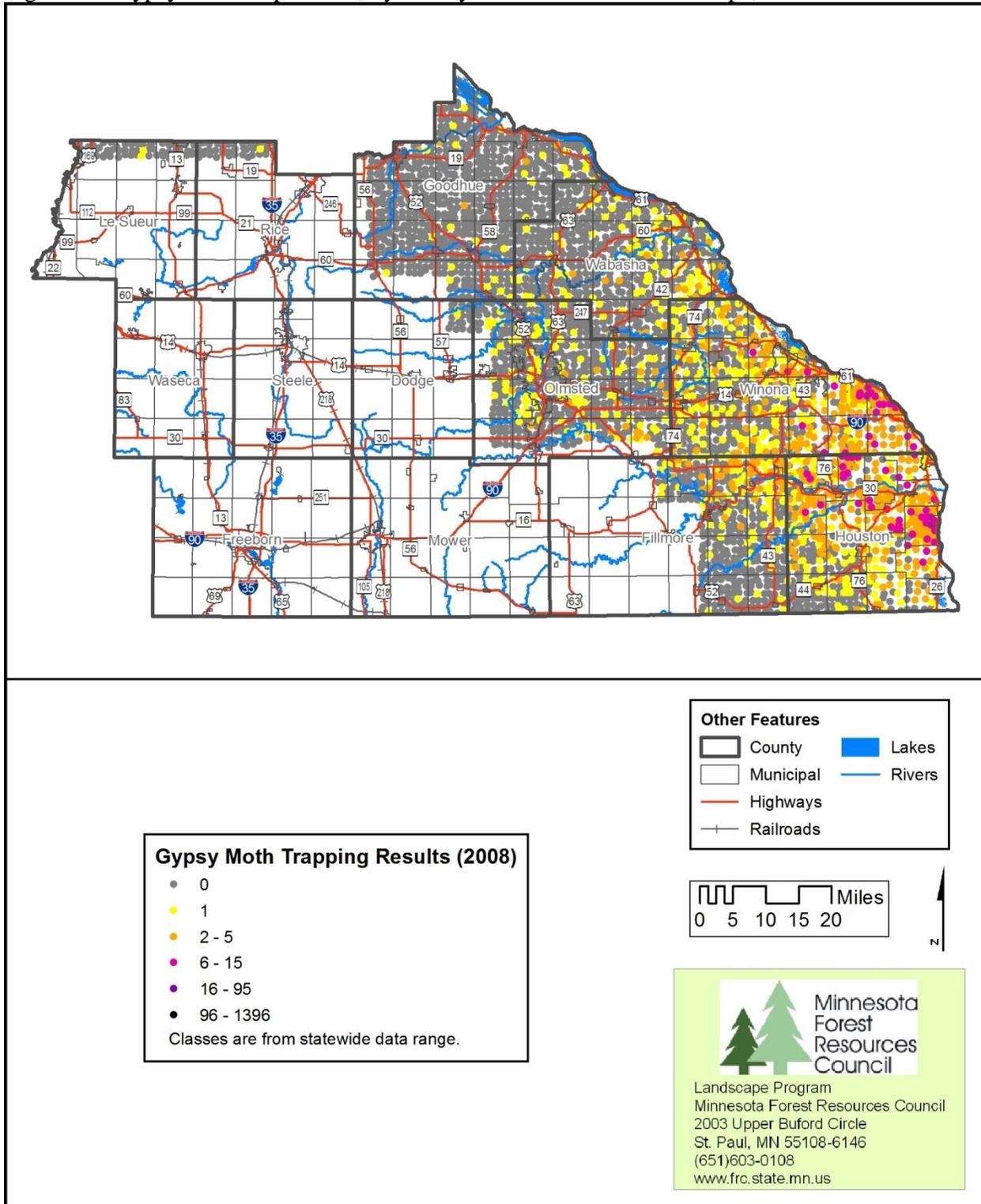


Table 45: Gypsy Moth trap results, by county in the Southeast Landscape, 2009.

| <b>County</b>                 | <b>Trap Catch Results (2009)</b> |
|-------------------------------|----------------------------------|
| Dodge                         | 0                                |
| Fillmore                      | 13                               |
| Freeborn                      | 0                                |
| Goodhue                       | 1                                |
| Houston                       | 75                               |
| Le Sueur                      | 0                                |
| Mower                         | 0                                |
| Olmsted                       | 28                               |
| Rice                          | 1                                |
| Steele                        | 0                                |
| Wabasha                       | 9                                |
| Waseca                        | 0                                |
| Winona                        | 39                               |
| <b>Total Southeast Region</b> | <b>166</b>                       |

Figure 19: Gypsy Moth trap results, by county in the Southeast Landscape, 2009.

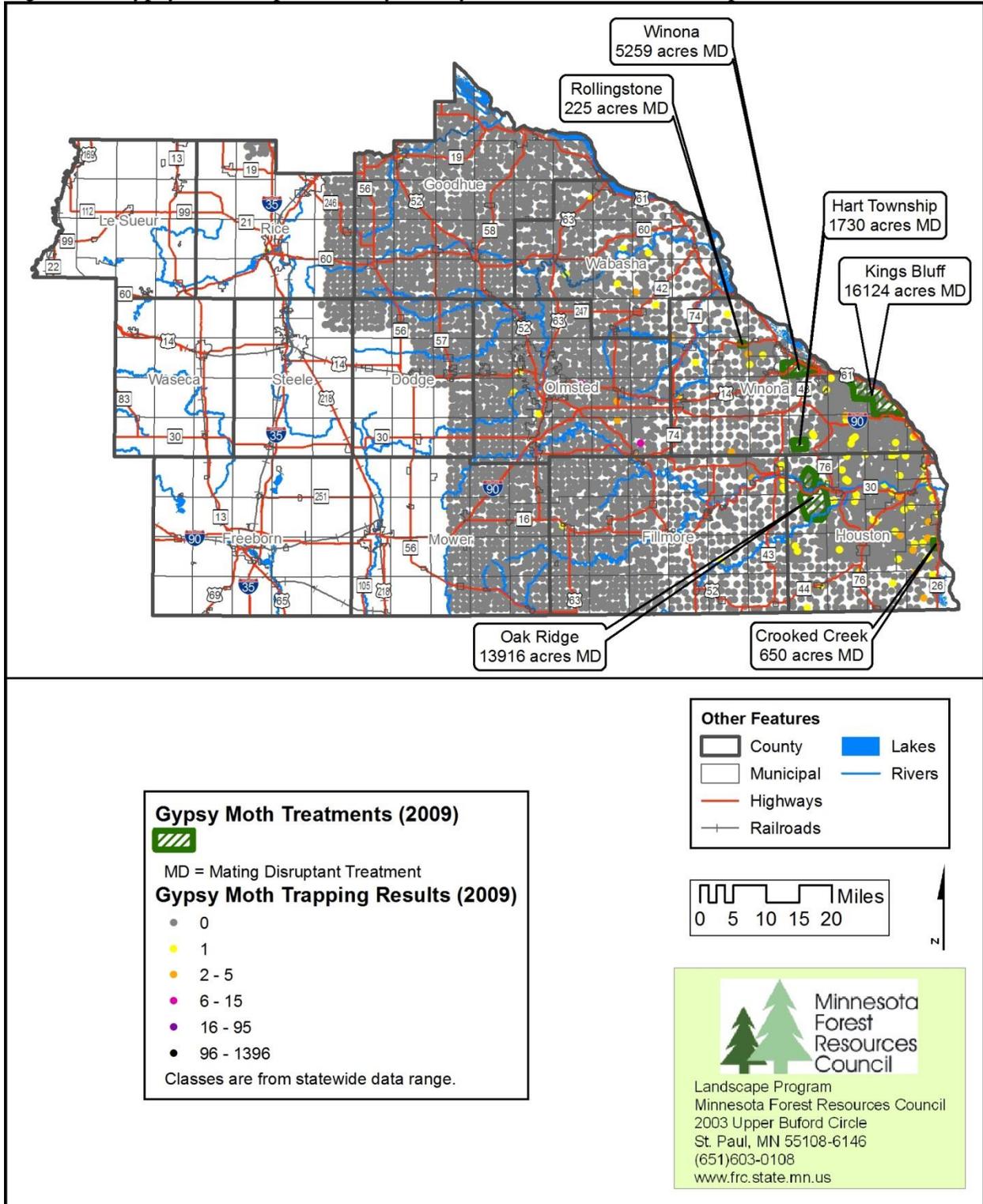
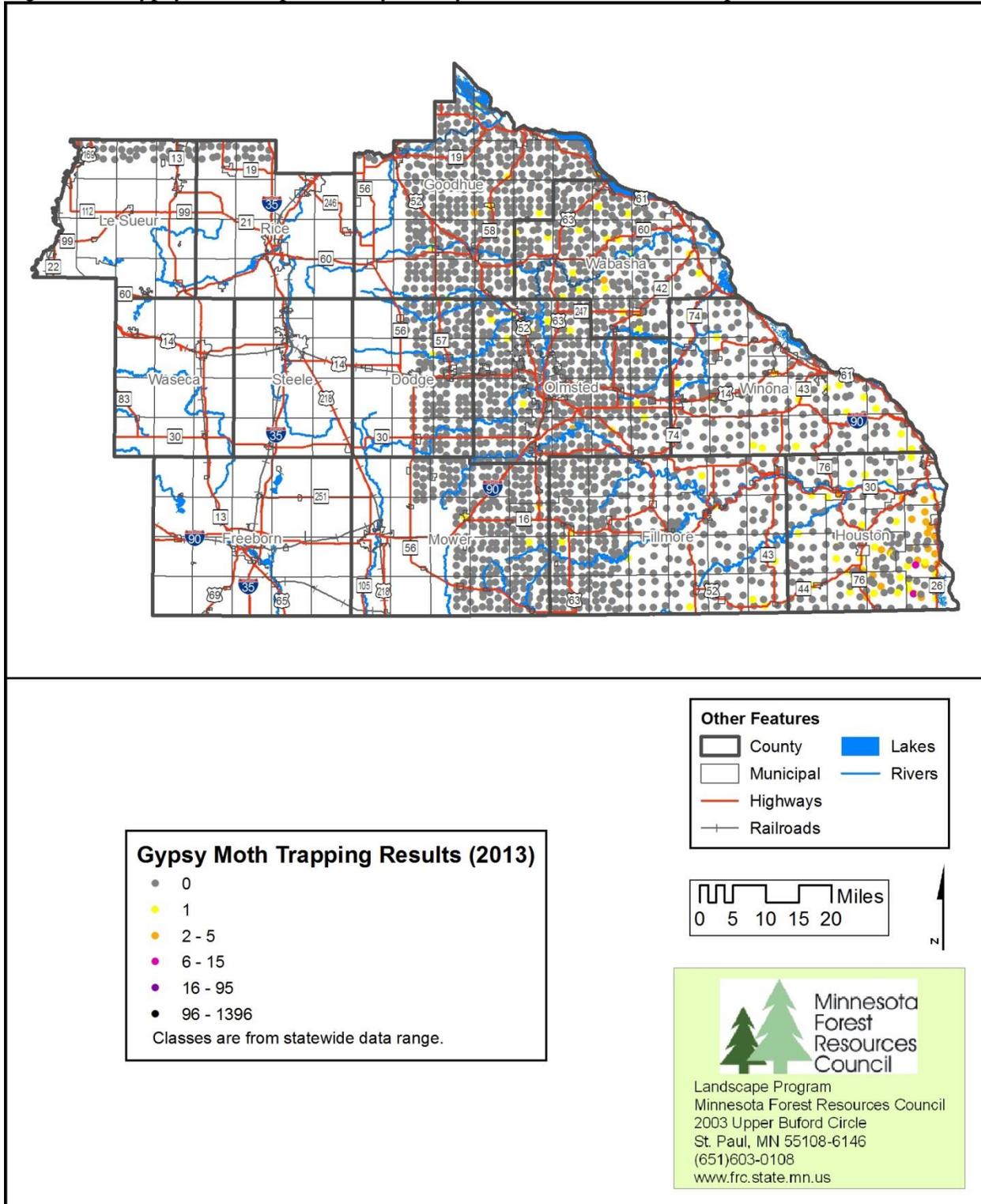


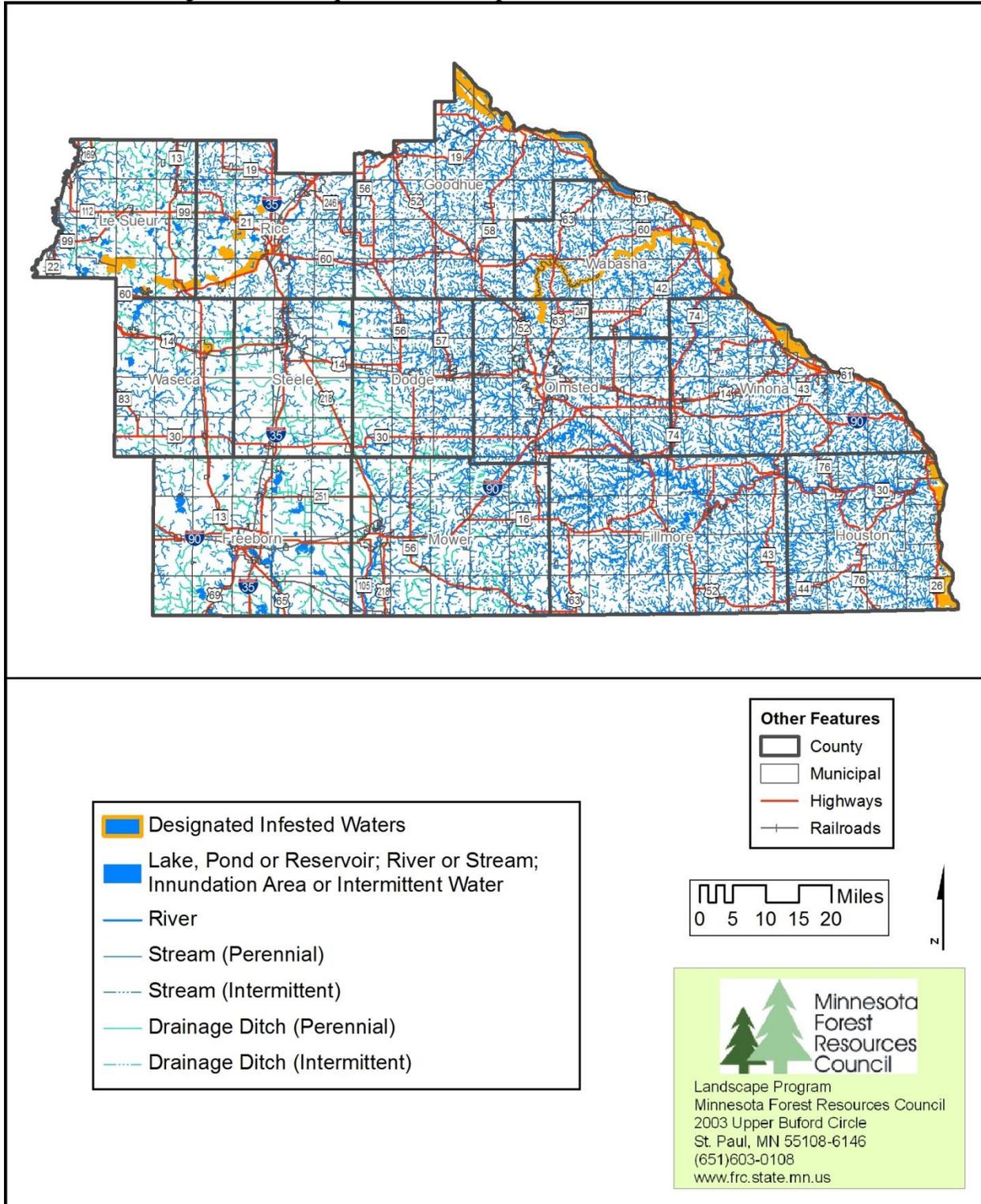
Table 46: Gypsy Moth trap results, by county in the Southeast Landscape, 2013.

| <b>County</b>                 | <b>Trap Catch Results (2013)</b> |
|-------------------------------|----------------------------------|
| Dodge                         | 1                                |
| Fillmore                      | 9                                |
| Freeborn                      | 0                                |
| Goodhue                       | 12                               |
| Houston                       | 102                              |
| Le Sueur                      | 0                                |
| Mower                         | 3                                |
| Olmsted                       | 13                               |
| Rice                          | 0                                |
| Steele                        | 0                                |
| Wabasha                       | 22                               |
| Waseca                        | 0                                |
| Winona                        | 22                               |
| <b>Total Southeast Region</b> | <b>184</b>                       |

Figure 20: Gypsy Moth trap result, by county in the Southeast Landscape, 2013.



**Figure 21:** Lakes and streams in the MFRC Southeast Landscape designated by the Minnesota DNR as containing non-native aquatic invasive species, 2013.



**Source:** Minnesota DNR Division of Ecological and Water Resources.

### 3.13. Water quality in lakes and streams

The United States Geological Survey uses the HUC system to hierarchically subdivide the nation's watersheds in a series of four levels (USGS 2013). There are 16 watersheds in the MFRC Southeast Landscape that are categorized as hydrologic unit code (HUC) level 8 (Figure 22).

The Minnesota Pollution Control Agency (MPCA) is the state agency responsible for protecting Minnesota's water quality:

“Water quality standards are fundamental tools that help protect Minnesota's abundant and valuable water resources from pollution. “*Beneficial uses*” are the uses that water resources and their associated aquatic communities provide. Under the federal Clean Water Act, states are required to monitor and assess their waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired. States are then required to develop a list of impaired waters that require Total Maximum Daily Loads (TMDL) studies, and to submit an updated list to the U.S. Environmental Protection Agency every even-numbered year for approval.” (MPCA 2013 (1))

TMDL studies are used to identify both point and nonpoint sources of each pollutant that fails to meet water quality standards and to “define how much of the pollutant can be in the surface and/or ground water while still allowing the waterbody to meet its designated uses, such as drinking water, fishing, swimming, irrigation or industrial purposes” (MPCA 2013 (2)). Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant.

More information about impaired waters in Minnesota can be found at:

[www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/minnesotas-impaired-waters-and-total-maximum-daily-loads-tmdls.html](http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/minnesotas-impaired-waters-and-total-maximum-daily-loads-tmdls.html).

and: <http://www.pca.state.mn.us/index.php/water/water-types-and-programs/water-nonpoint-source-issues/clean-water-partnership/more-about-the-section-319-program.html>

There are over 42,000 acres of lakes impaired by either mercury or high nutrient load (or both) in southeast Minnesota and over 1500 miles of streams contaminated by a wide variety of impairments, including mercury, PCBs, E. coli, fecal coliform, and nitrates (Table 48, Table 49, Figure 23). The overall health of the watersheds in southeast Minnesota can be seen in Figure 24. On a 1-100 point scale, all watersheds fall in the mid-range of health; however the healthiest area is located in a small part of Winona and Houston counties along the Blufflands, with health scores decreasing in a westwardly direction, likely due to the prominence of agriculture.

Healthy forests maintain high quality aquatic systems such as cold water trout streams through shading and water temperature maintenance, erosion and nutrient loading reduction, and providing coarse woody debris and structural cover. In southeast Minnesota, there are over 800 miles of designated trout streams and over 1000 miles of protected tributaries to trout streams located in Goodhue, Wabasha, Winona, Houston, Fillmore and small part of Olmstead counties (Table 50, Figure 25).

According to 2013 data from the Minnesota Pollution Control Agency’s (MPCA) Milestone Project, most water pollutants have shown decreasing trend or no trend over time in the region’s watersheds (Table 51). The exception is nitrites/nitrates, which have shown an increasing trend in eight of the 13 Milestone testing sites within the Southeast Landscape. In a study by the Minnesota Geological Survey of southeastern Minnesota streams, Runkel et al. (2013) note that “Nitrate contamination of surface water and groundwater is a long-standing issue in the region. Impacts to municipal and private drinking water supplies by nitrate are widespread and well-documented.” (p. 4). This study identified a relationship between sedimentary cover and nitrate contamination, noting that consistent sedimentary cover of 50 feet or more is needed to ensure water quality protection from nitrite/nitrate contamination in an area:

“In this analysis, 11.8% of wells where sedimentary cover is less than 50 feet thick had a nitrate concentration greater than 2 ppm whereas 8.1% of wells where the cover is more than 50 feet had values greater than 2 ppm. This relationship is much more pronounced in a comparison of shallow bedrock groundwater from wells within the *interior* of the drift dominated landscape, to all other areas. The results indicate that 12.5% of wells outside of the interior of the drift dominated landscape have nitrate concentrations greater than 2 ppm and only 1.77% wells within the interior of the drift dominated landscape, nearly an order of magnitude less, have nitrate concentrations that exceed 2 ppm. The marked contrast between the two analyses indicates that a relatively continuous cover of unconsolidated sediment greater than 50 ft thick is required to generally protect underlying bedrock aquifers from nitrate contamination. In areas of less continuous cover, individual wells located where unconsolidated sediment is greater than 50 ft thick have nearly the same probability of having nitrate concentrations greater than 2 ppm as do wells elsewhere in the bedrock dominated landscape where the cover is thinner. This reflects the three dimensional character of the flow system in the bedrock dominated landscape: An individual well located on an isolated patch of thick sedimentary cover is drawing water that likely in part includes a source of nitrate-enriched water from nearby areas lacking a thick cover of unconsolidated sediment, and transported laterally to the well site.” (Runkel et al. 2013, p. 39-40)

The ability for contaminated water to flow laterally below the surface and mix with nearby water sources is due to the karst geology of the region (Figure 26). Runkel et al. (2013) also note that as water moves further from sites of intensive agriculture, nitrite/nitrate concentrations decrease, likely due to dilution from deeper, nitrate-poor water sources:

“Progressively greater contribution from more deeply sourced, nitrate-poor groundwater likely accounts for this trend of downstream-decreasing stream water nitrate concentrations relative to row crop production.” (p. 53 Runkel et al. 2013)

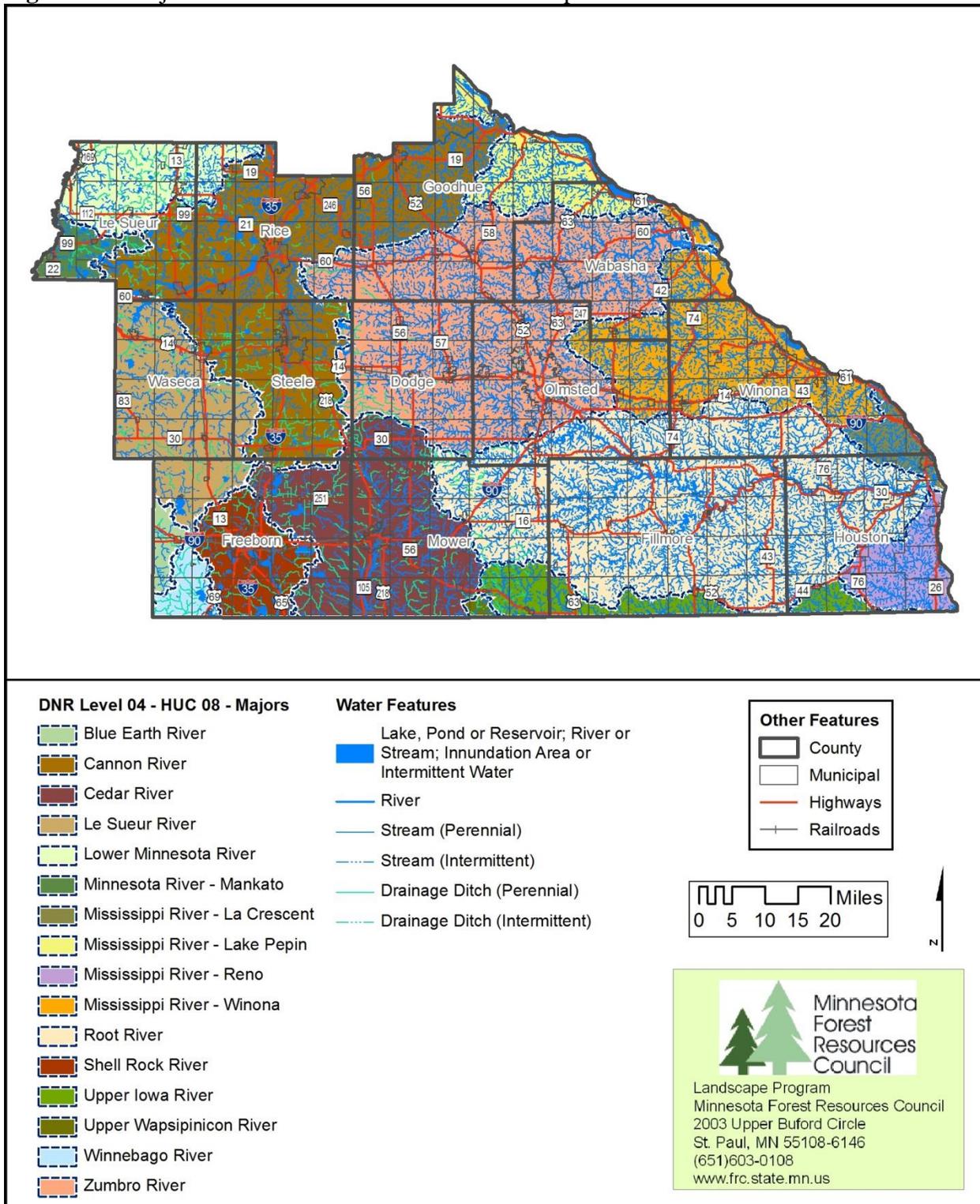
Further, Watkins et al. (2013) found a direct, positive relationship between the baseflow concentrations of nitrates in trout streams of southeast Minnesota and the percentage of surrounding land in corn and soybean row-cropping (Figure 27). Further supporting the findings of Runkel et al. (2013), Watkins et al. (2013) also found a steady increase in nitrate concentrations in the Peterson Hatchery spring water between 1988 and 2012 (Figure 28). As row cropping has actually decreased in the region during recent years (Table 8), this suggests a

lag in the impact of surface-level agricultural practices on subsurface groundwater nitrate concentrations (J. Watkins, personal communication).

Pressure on groundwater *quantity* is also a growing issue in Minnesota. According to Streit (2012), river summer baseflow (the component of flow based primarily on groundwater discharge rather than precipitation and runoff) state-wide have been showing a decline, despite steady precipitation since 1990. Streit indicates increases in groundwater consumption – nearly doubled since 1990 – and surface water consumption, as well as increased underground tiling, as contributing factors (Streit 2012). However, Lenhart and Niebert (2011) found that unlike baseflow, annual streamflow as a result of runoff was increasing in the agricultural areas of southern Minnesota due primarily to land use changes.

Watershed health scores can be seen to be highest in the Blufflands, decreasing in the Rochester Plateau (higher in the southern portion, lower in the northern for both of these subsections), and decreasing further still in the Oak Savanna (Figure 29).

**Figure 22:** Major watersheds in the Southeast Landscape.



Source: Minnesota DNR Data Deli

**Table 47:** Impairment abbreviations.

| Abbreviation | Impairment                           | Abbreviation | Affected Use        |
|--------------|--------------------------------------|--------------|---------------------|
| Cl-          | Chloride                             | AQC          | Aquatic consumption |
| DO           | Dissolved oxygen                     | AQL          | Aquatic life        |
| E.coli       | Escherichia coli                     | AQR          | Aquatic recreation  |
| FC           | Fecal coliform                       | DW           | Drinking water      |
| F-IBI        | Fish - Index of Biological Integrity |              |                     |
| HgF          | Mercury in fish tissue               |              |                     |
| HgW          | Mercury in water column              |              |                     |
| LCWA         | Lack of a coldwater assemblage       |              |                     |
| NO3          | Nitrates                             |              |                     |
| PCBF         | PCB in fish tissue                   |              |                     |
| PCBW         | PCB in water column                  |              |                     |
| PFOS         | Perfluorooctane Sulfate              |              |                     |
| T            | Turbidity                            |              |                     |
| TM           | Temperature                          |              |                     |

Source: Minnesota Pollution Control Agency

**Table 48:** Area of impaired lakes in the Southeast Landscape by affected use and impairment, 2010.

| Impairment        | Affected Use | Area (Acres)  |
|-------------------|--------------|---------------|
| HgF               | AQC          | 181           |
| HgF, Nutrients    | AQC, AQR     | 11,138        |
| Nutrients         | AQR          | 30,763        |
| <b>Total Area</b> |              | <b>42,083</b> |

Source: Minnesota Pollution Control Agency

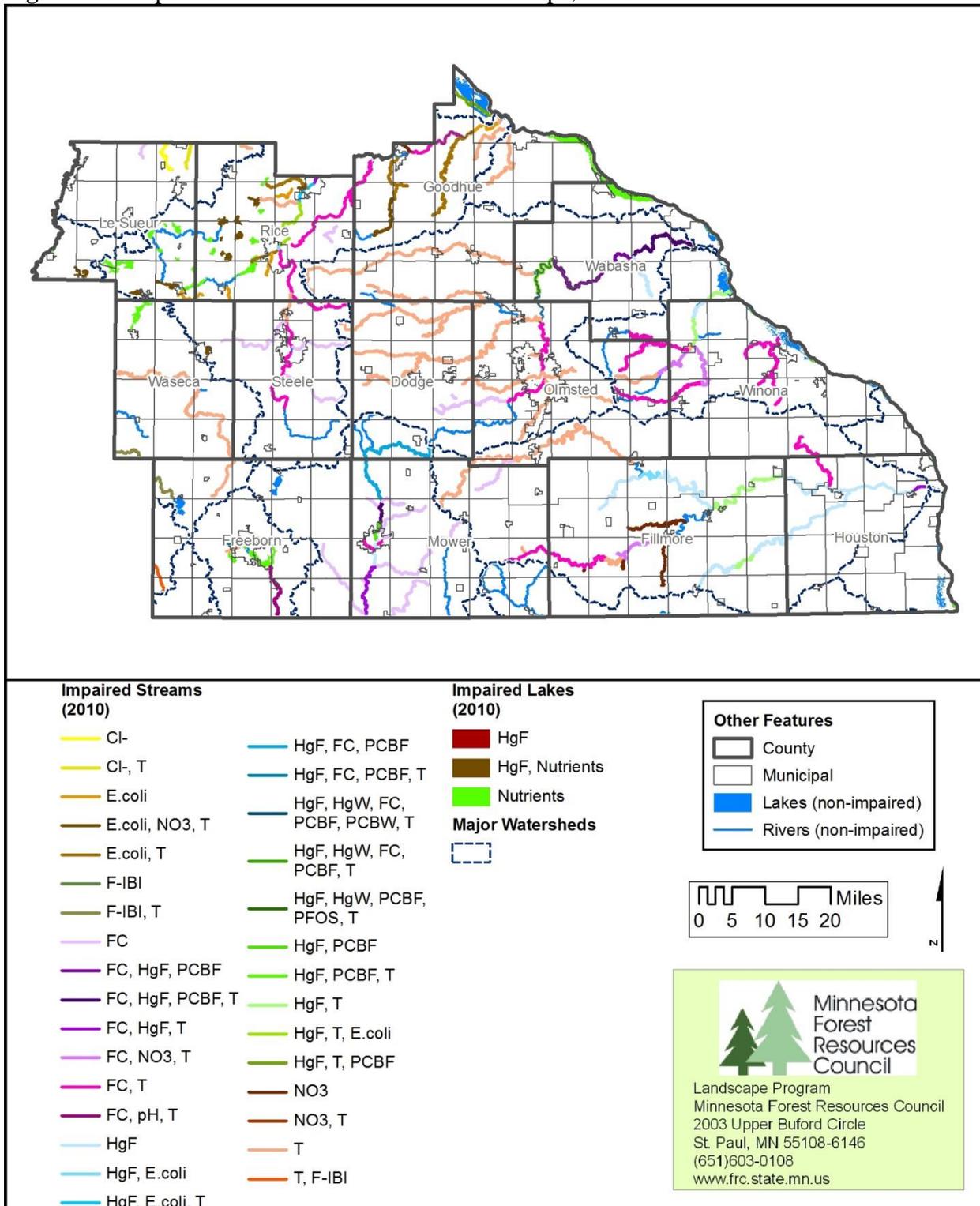
**Table 49:** Length of impaired rivers and streams in the Southeast Landscape by affected use and impairment, 2010.

| Impairment     | Affected Use | Length (Miles) |
|----------------|--------------|----------------|
| Cl-            | AQL          | 7.3            |
| Cl-, T         | AQL          | 5.7            |
| E.coli         | AQR          | 26.1           |
| E.coli, NO3, T | AQL, AQR, DW | 12.4           |
| E.coli, T      | AQL, AQR     | 53.3           |
| F-IBI          | AQL          | 0.8            |
| F-IBI, T       | AQL          | 15.4           |
| FC             | AQR          | 166.1          |

|                             |               |               |
|-----------------------------|---------------|---------------|
| FC, HgF, PCBF               | AQC, AQR      | 24.6          |
| FC, HgF, PCBF, T            | AQC, AQL, AQR | 29.4          |
| FC, HgF, T                  | AQC, AQL, AQR | 18.1          |
| FC, NO3, T                  | AQL, AQR, DW  | 37.5          |
| FC, pH, T                   | AQL, AQR      | 12.1          |
| FC, T                       | AQL, AQR      | 246.4         |
| HgF                         | AQC           | 127.4         |
| HgF, E.coli                 | AQC, AQR      | 6.9           |
| HgF, E.coli, T              | AQC, AQL, AQR | 4.9           |
| HgF, FC, PCBF               | AQC, AQR      | 28.6          |
| HgF, FC, PCBF, T            | AQC, AQL, AQR | 6.2           |
| HgF, HgW, FC, PCBF, PCBW, T | AQC, AQL, AQR | 3.0           |
| HgF, HgW, FC, PCBF, T       | AQC, AQL, AQR | 2.6           |
| HgF, HgW, PCBF, PFOS, T     | AQC, AQL      | 30.9          |
| HgF, PCBF                   | AQC           | 77.2          |
| HgF, PCBF, T                | AQC, AQL      | 4.1           |
| HgF, T                      | AQC, AQL      | 38.7          |
| HgF, T, E.coli              | AQC, AQL, AQR | 11.1          |
| HgF, T, PCBF                | AQC, AQL      | 10.3          |
| NO3                         | DW            | 30.2          |
| NO3, T                      | AQL, DW       | 0.1           |
| T                           | AQL           | 471.1         |
| T, F-IBI                    | AQL           | 5.6           |
| <b>Total Length</b>         |               | <b>1514.2</b> |

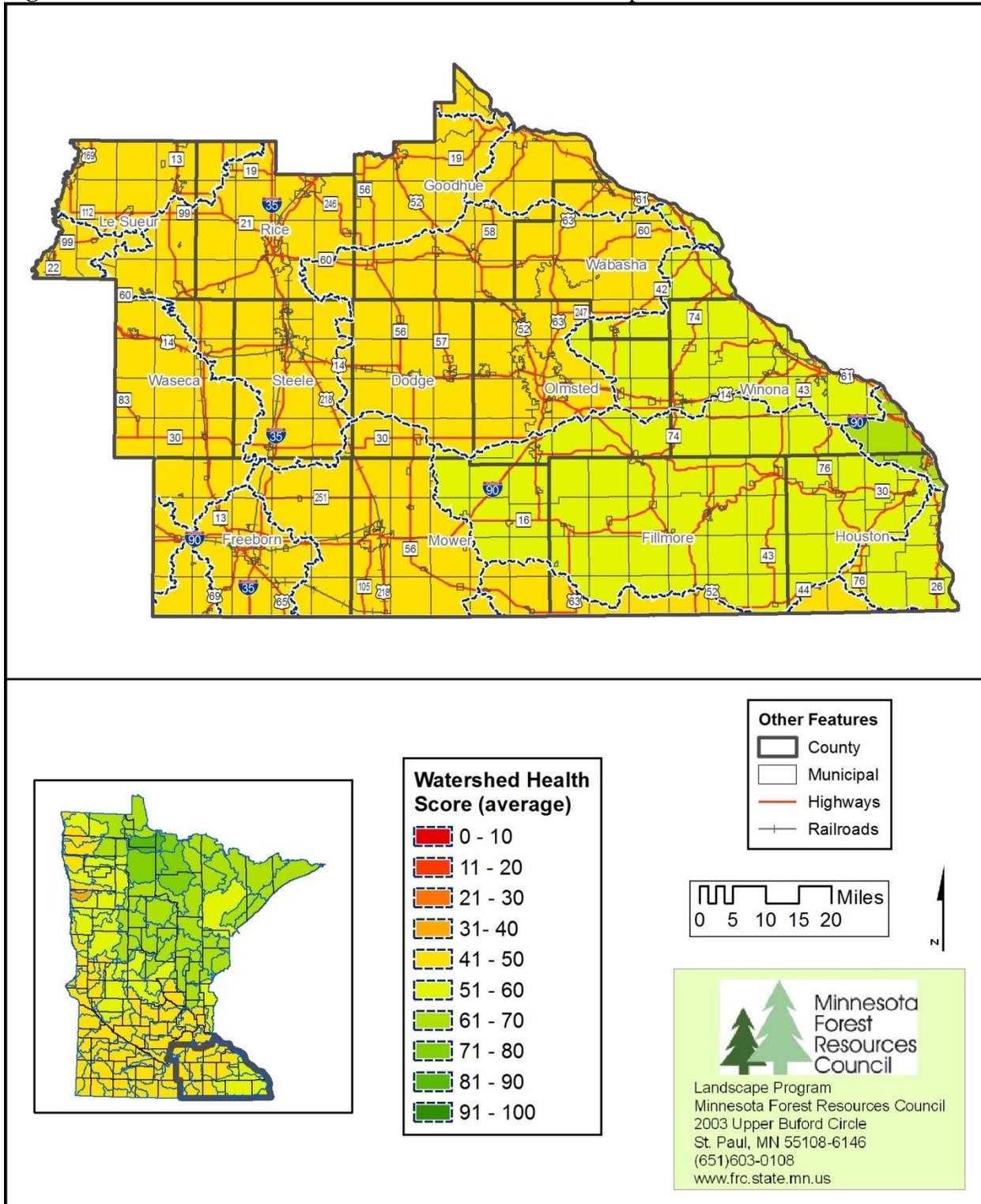
Source: Minnesota Pollution Control Agency

**Figure 23: Impaired waters in the Southeast Landscape, 2010.**



Source: Minnesota Pollution Control Agency

**Figure 24:** Watershed health scores in the Southeast Landscape.



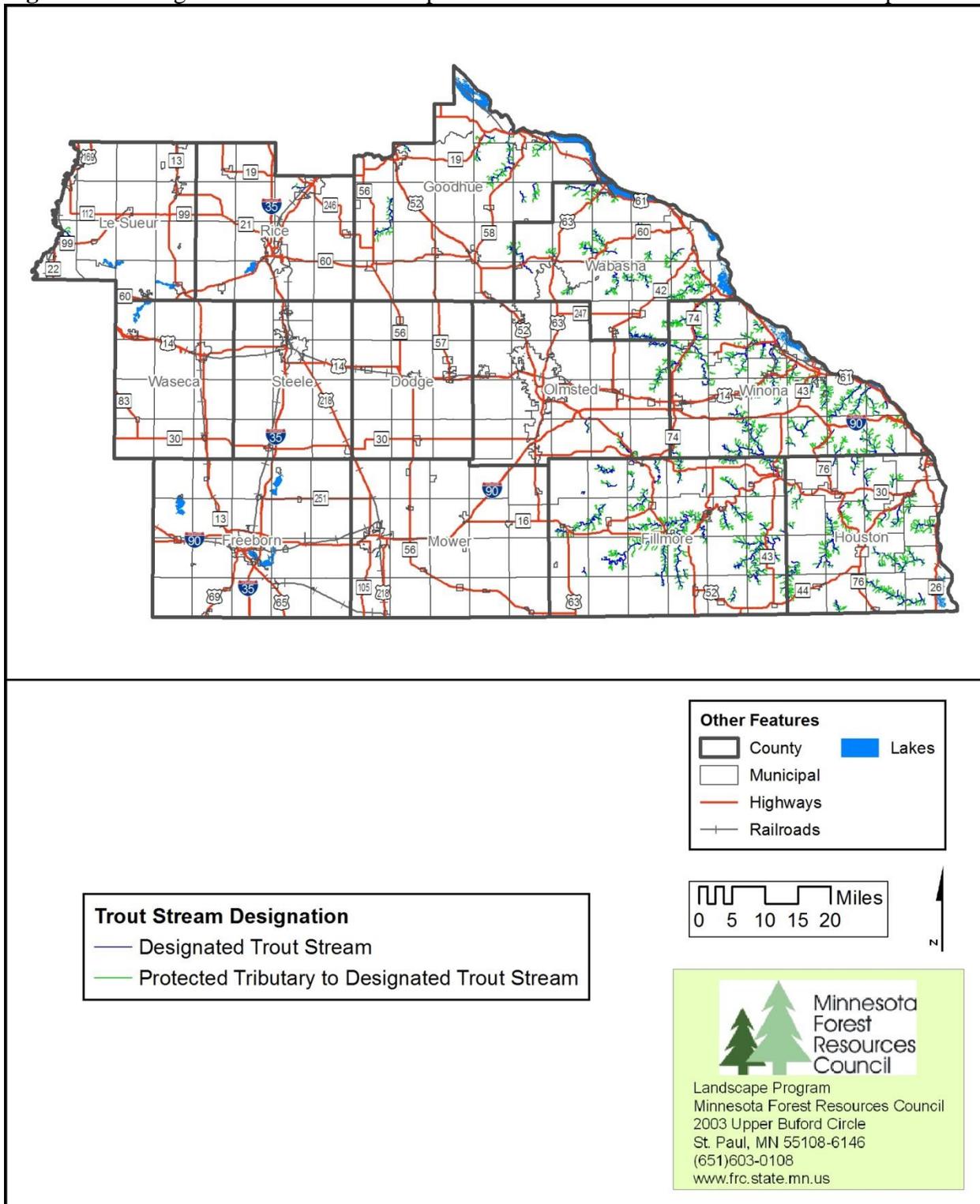
Source: Minnesota DNR Watershed Health Assessment Framework <http://www.dnr.state.mn.us/whaf/index.html>.

**Table 50:** Designated trout streams and protected tributaries in the Southeast Landscape.

| <b>Trout Stream Designation</b>                | <b>Length<br/>(Miles)</b> |
|--|---------------------------|
| Designated Trout Stream                        | 803                       |
| Protected Tributary to Designated Trout Stream | 1,064                     |
| <b>Total Length</b>                            | <b>1,867</b>              |

**Source:** Minnesota DNR Data Deli

**Figure 25:** Designated trout streams and protected tributaries in the Southeast Landscape.



Source: Minnesota DNR Data Deli

Table 51: Pollution Trends at MPCA Milestone Sites in the Southeast Landscape:  
**Upper Mississippi River Basin -- Lower Portion**

| Contaminant                       | Unit                    | Cannon River |       |       |        |        |               | Garvin Brook   |       |       |        |        |               |
|-----------------------------------|-------------------------|--------------|-------|-------|--------|--------|---------------|----------------|-------|-------|--------|--------|---------------|
|                                   |                         | 1950s        | 1960s | 1970s | 1980s  | 1990s  | overall trend | 1950s          | 1960s | 1970s | 1980s  | 1990s  | overall trend |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | 3.3          | ---   | ---   | 2.5    | 2.5    | decrease      | ---            | ---   | ---   | 1.6    | 1.4    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---          | ---   | ---   | 22.8   | 15.1   | decrease      | ---            | ---   | ---   | 85.8   | 35.5   | no trend      |
| Total Phosphorus                  | (geomean in mg/l)       | ---          | ---   | ---   | 0.26   | 0.18   | decrease      | ---            | ---   | ---   | 0.25   | 0.13   | no trend      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---          | ---   | ---   | 3.00   | 3.90   | no trend      | ---            | ---   | ---   | 1.30   | 1.70   | increase      |
| Un-ionized Ammonia                | (median in mg/l)        | ---          | ---   | ---   | 0.0060 | 0.0040 | decrease      | ---            | ---   | ---   | 0.0050 | 0.0040 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---          | ---   | ---   | 139    | 52     | decrease      | ---            | ---   | ---   | 670    | 851    | no trend      |
| Contaminant                       | Unit                    | Root River   |       |       |        |        |               | Straight River |       |       |        |        |               |
|                                   |                         | 1950s        | 1960s | 1970s | 1980s  | 1990s  | overall trend | 1950s          | 1960s | 1970s | 1980s  | 1990s  | overall trend |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | ---          | 5.5   | 2.4   | 1.8    | 1.5    | decrease      | 6.4            | 4.6   | ---   | 2.4    | 1.8    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---          | 58.5  | 92.6  | 81.3   | 99.1   | no trend      | ---            | 25.8  | ---   | 22.5   | 21.0   | no trend      |
| Total Phosphorus                  | (geomean in mg/l)       | ---          | 0.16  | 0.26  | 0.18   | 0.17   | decrease      | ---            | ---   | ---   | 0.33   | 0.24   | decrease      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---          | ---   | 1.90  | 2.65   | 3.90   | increase      | ---            | ---   | ---   | 4.90   | 6.20   | no trend      |
| Un-ionized Ammonia                | (median in mg/l)        | ---          | ---   | ---   | 0.0025 | 0.0020 | decrease      | ---            | ---   | ---   | 0.0095 | 0.0030 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---          | 1,276 | 703   | 322    | 615    | decrease      | ---            | 3,433 | ---   | 353    | 537    | decrease      |

|                                   |                         | Mississippi River (at La Crosse)   |       |       |        |        |               | Mississippi River (at Trempealeau, WI) |       |       |        |        |               |
|-----------------------------------|-------------------------|------------------------------------|-------|-------|--------|--------|---------------|--|-------|-------|--------|--------|---------------|
| Contaminant                       | Unit                    | 1950s                              | 1960s | 1970s | 1980s  | 1990s  | overall trend | 1950s                                  | 1960s | 1970s | 1980s  | 1990s  | overall trend |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | ---                                | ---   | 3.4   | 2.5    | 2.6    | decrease      | ---                                    | 4.1   | 3.4   | 2.3    | 2.5    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---                                | ---   | 19.1  | 20.9   | 27.8   | no trend      | ---                                    | 27.6  | 27.5  | 19.1   | 25.5   | decrease      |
| Total Phosphorus                  | (geomean in mg/l)       | ---                                | ---   | 0.21  | 0.18   | 0.18   | decrease      | ---                                    | 0.21  | 0.24  | 0.18   | 0.20   | decrease      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---                                | ---   | 0.85  | 0.78   | 1.30   | increase      | ---                                    | ---   | ---   | 0.97   | 1.60   | no trend      |
| Un-ionized Ammonia                | (median in mg/l)        | ---                                | ---   | ---   | 0.0055 | 0.0030 | decrease      | ---                                    | ---   | ---   | 0.0060 | 0.0030 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---                                | ---   | 50    | 68     | 101    | no trend      | ---                                    | 188   | 174   | 46     | 120    | decrease      |
|                                   |                         | Mississippi River (near Minneiska) |       |       |        |        |               | Zumbro River South Fork                |       |       |        |        |               |
| Contaminant                       | Unit                    | 1950s                              | 1960s | 1970s | 1980s  | 1990s  | overall trend | 1950s                                  | 1960s | 1970s | 1980s  | 1990s  | overall trend |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | ---                                | ---   | 3.4   | 2.3    | 2.6    | decrease      | ---                                    | ---   | 5.0   | 2.8    | 2.1    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---                                | ---   | 20.9  | 18.1   | 25.0   | no trend      | ---                                    | ---   | 30.5  | 25.6   | 36.8   | no trend      |
| Total Phosphorus                  | (geomean in mg/l)       | ---                                | ---   | 0.21  | 0.18   | 0.18   | decrease      | ---                                    | ---   | 0.95  | 0.35   | 0.22   | decrease      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---                                | ---   | 0.90  | 1.16   | 2.00   | increase      | ---                                    | ---   | 3.30  | 5.20   | 5.95   | increase      |
| Un-ionized Ammonia                | (median in mg/l)        | ---                                | ---   | ---   | 0.0070 | 0.0040 | decrease      | ---                                    | ---   | ---   | 0.0085 | 0.0020 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---                                | ---   | 66    | 28     | 63     | no trend      | ---                                    | ---   | 132   | 115    | 409    | no trend      |
|                                   |                         | Whitewater River South Fork        |       |       |        |        |               |  |       |       |        |        |               |

| Contaminant                       | Unit                    | 1950s | 1960s | 1970s | 1980s  | 1990s  | overall trend |
|-----------------------------------|-------------------------|-------|-------|-------|--------|--------|---------------|
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | ---   | ---   | 2.5   | 1.6    | 1.7    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---   | ---   | 19.0  | 19.3   | 41.7   | no trend      |
| Total Phosphorus                  | (geomean in mg/l)       | ---   | ---   | 0.47  | 0.45   | 0.52   | no trend      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---   | ---   | 6.00  | 7.10   | 8.90   | increase      |
| Un-ionized Ammonia                | (median in mg/l)        | ---   | ---   | ---   | 0.0050 | 0.0020 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---   | ---   | 487   | 373    | 1,157  | no trend      |

**Minnesota River Basin**

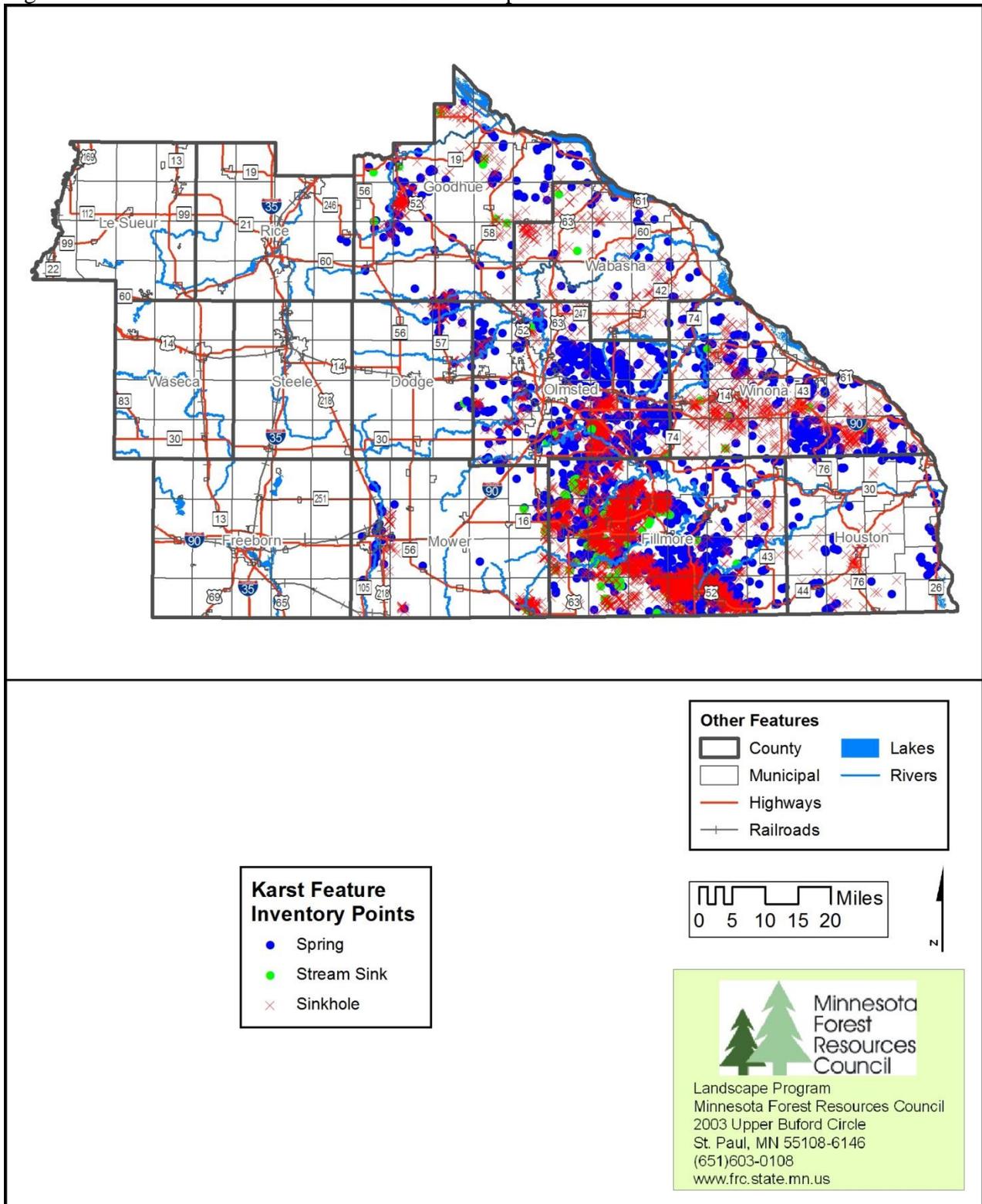
|                                   |                         | Minnesota River |       |       |        |        |               |
|-----------------------------------|-------------------------|-----------------|-------|-------|--------|--------|---------------|
|                                   |                         | 1950s           | 1960s | 1970s | 1980s  | 1990s  | overall trend |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | 5.8             | ---   | 4.7   | 3.2    | 2.8    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---             | ---   | 79.4  | 76.4   | 103.7  | no trend      |
| Total Phosphorus                  | (geomean in mg/l)       | ---             | ---   | 0.37  | 0.28   | 0.27   | decrease      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---             | ---   | 3.20  | 4.30   | 5.65   | no trend      |
| Un-ionized Ammonia                | (median in mg/l)        | ---             | ---   | ---   | 0.0080 | 0.0030 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---             | ---   | 230   | 132    | 153    | decrease      |

**Cedar - Des Moines Rivers Basin**

|                                   |                         | Cedar River (near Austin) |       |       |        |        |               | Cedar River (near Lansing) |       |       |        |        |               |
|-----------------------------------|-------------------------|---------------------------|-------|-------|--------|--------|---------------|----------------------------|-------|-------|--------|--------|---------------|
|                                   |                         | 1950s                     | 1960s | 1970s | 1980s  | 1990s  | overall trend | 1950s                      | 1960s | 1970s | 1980s  | 1990s  | overall trend |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | ---                       | 5.2   | 5.8   | 3.1    | 2.4    | decrease      | ---                        | 3.3   | 3.0   | 1.9    | 1.4    | decrease      |
| Total Suspended Solids            | (geomean in mg/l)       | ---                       | 31.0  | 30.5  | 23.4   | 28.8   | no trend      | ---                        | 23.0  | 25.5  | 18.9   | 21.1   | no trend      |
| Total Phosphorus                  | (geomean in mg/l)       | ---                       | 0.64  | 0.72  | 0.43   | 0.36   | decrease      | ---                        | 0.18  | 0.28  | 0.19   | 0.16   | decrease      |
| Nitrite/Nitrate                   | (median in mg/l)        | ---                       | ---   | 3.20  | 3.90   | 5.45   | increase      | ---                        | ---   | ---   | 4.40   | 6.55   | no trend      |
| Un-ionized Ammonia                | (median in mg/l)        | ---                       | ---   | ---   | 0.0135 | 0.0070 | decrease      | ---                        | ---   | ---   | 0.0060 | 0.0030 | decrease      |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---                       | 2,307 | 697   | 199    | 280    | decrease      | ---                        | 409   | 589   | 302    | 374    | no trend      |
|                                   |                         | Shell Rock River          |       |       |        |        |               |                            |       |       |        |        |               |
|                                   |                         | 1950s                     | 1960s | 1970s | 1980s  | 1990s  | overall trend |                            |       |       |        |        |               |
| Biochemical Oxygen Demand (5-day) | (geomean in mg/l)       | ---                       | 13.4  | 11.2  | 8.1    | 6.4    | decrease      |                            |       |       |        |        |               |
| Total Suspended Solids            | (geomean in mg/l)       | ---                       | 77.5  | 35.1  | 44.4   | 41.8   | decrease      |                            |       |       |        |        |               |
| Total Phosphorus                  | (geomean in mg/l)       | ---                       | 0.52  | 0.73  | 0.91   | 0.41   | no trend      |                            |       |       |        |        |               |
| Nitrite/Nitrate                   | (median in mg/l)        | ---                       | ---   | 0.33  | 3.95   | 1.95   | increase      |                            |       |       |        |        |               |
| Un-ionized Ammonia                | (median in mg/l)        | ---                       | ---   | ---   | 0.0160 | 0.0045 | decrease      |                            |       |       |        |        |               |
| Fecal Coliform Organisms          | (geomean in col/100 ml) | ---                       | 140   | 158   | 175    | 150    | no trend      |                            |       |       |        |        |               |

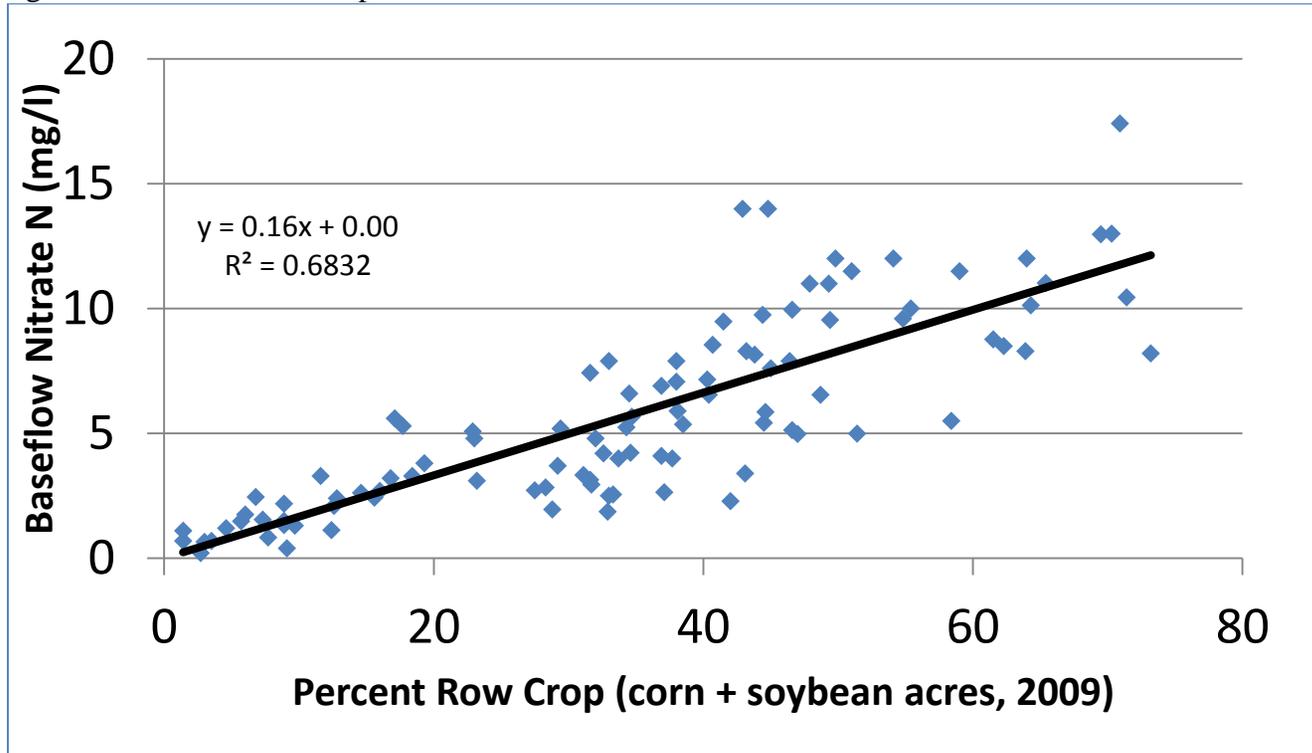
**Source:** Minnesota Pollution Control Agency, 2013. “Milestone Trends by Decade.” Available at: <http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/streams-and-rivers/minnesota-milestone-river-monitoring-program.html>.

Figure 26: Karst features in the Southeast Landscape.



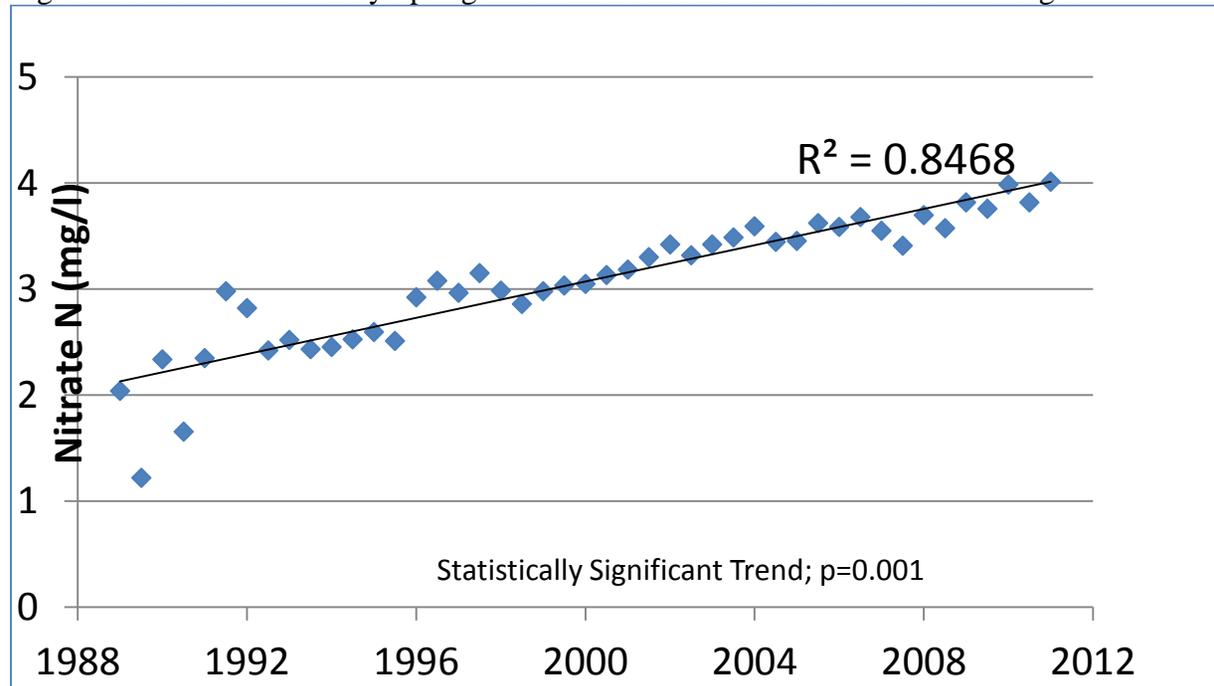
Source: Karst Feature Inventory Points and Other Features: MN DNR Data Deli

Figure 27: Percent Row Crop vs. Baseflow Nitrate-N Concentration in Trout Stream Watersheds of SE MN; n = 100



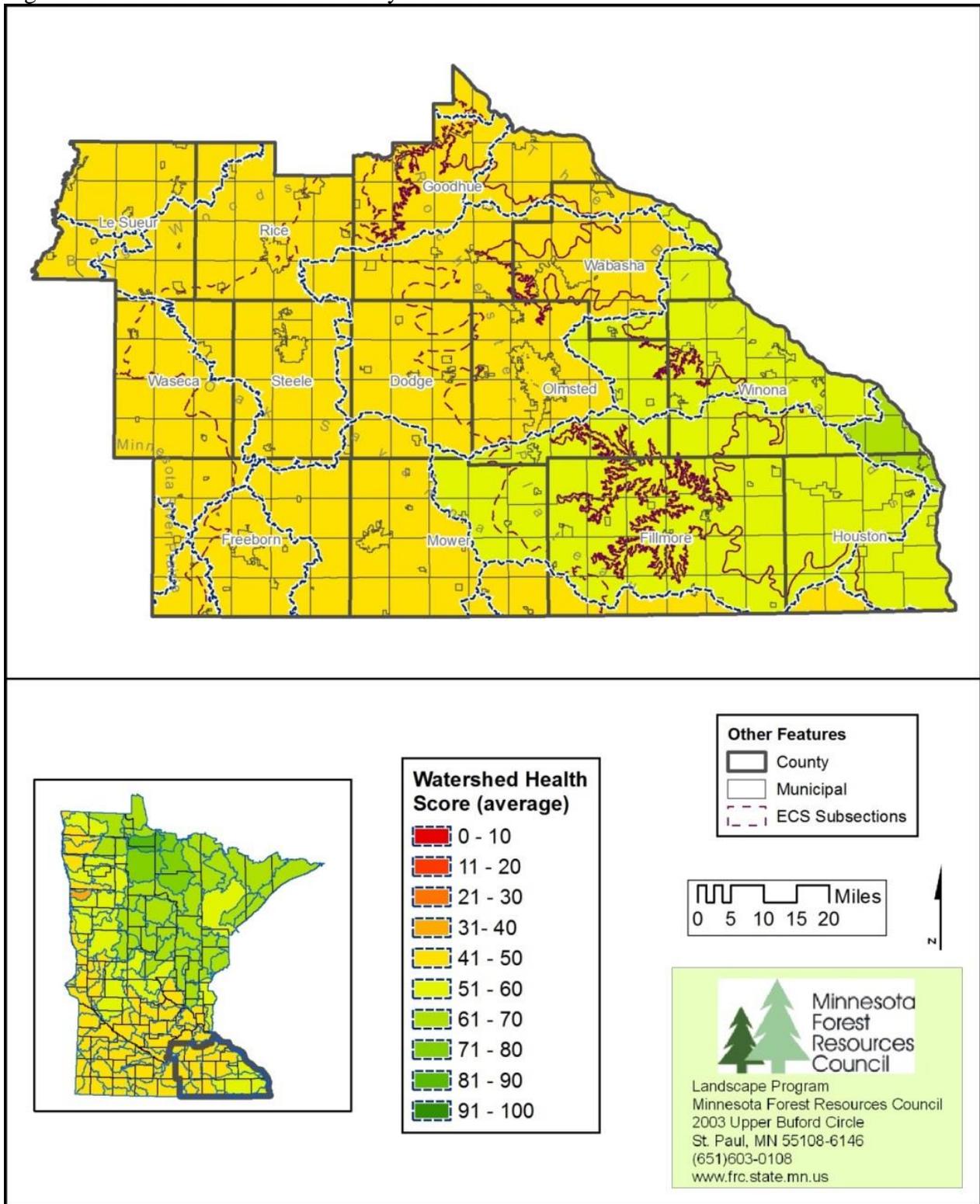
Source: Watkins, J., N. Rasmussen, G. Johnson, A. Streitz, K. Ahmad, B. Beyerl, and J. Roebuck. 2013. "Nitrate-Nitrogen in the Springs and Trout Streams of Southeast Minnesota." Minnesota Pollution Control Agency.

Figure 28: Peterson Hatchery Spring Nitrate-N Concentrations Six-Month Averages



Source: Watkins, J., N. Rasmussen, G. Johnson, A. Streitz, K. Ahmad, B. Beyerl, and J. Roebuck. 2013. “Nitrate-Nitrogen in the Springs and Trout Streams of Southeast Minnesota.” Minnesota Pollution Control Agency.

Figure 29: Watershed Health Scores by Subsection

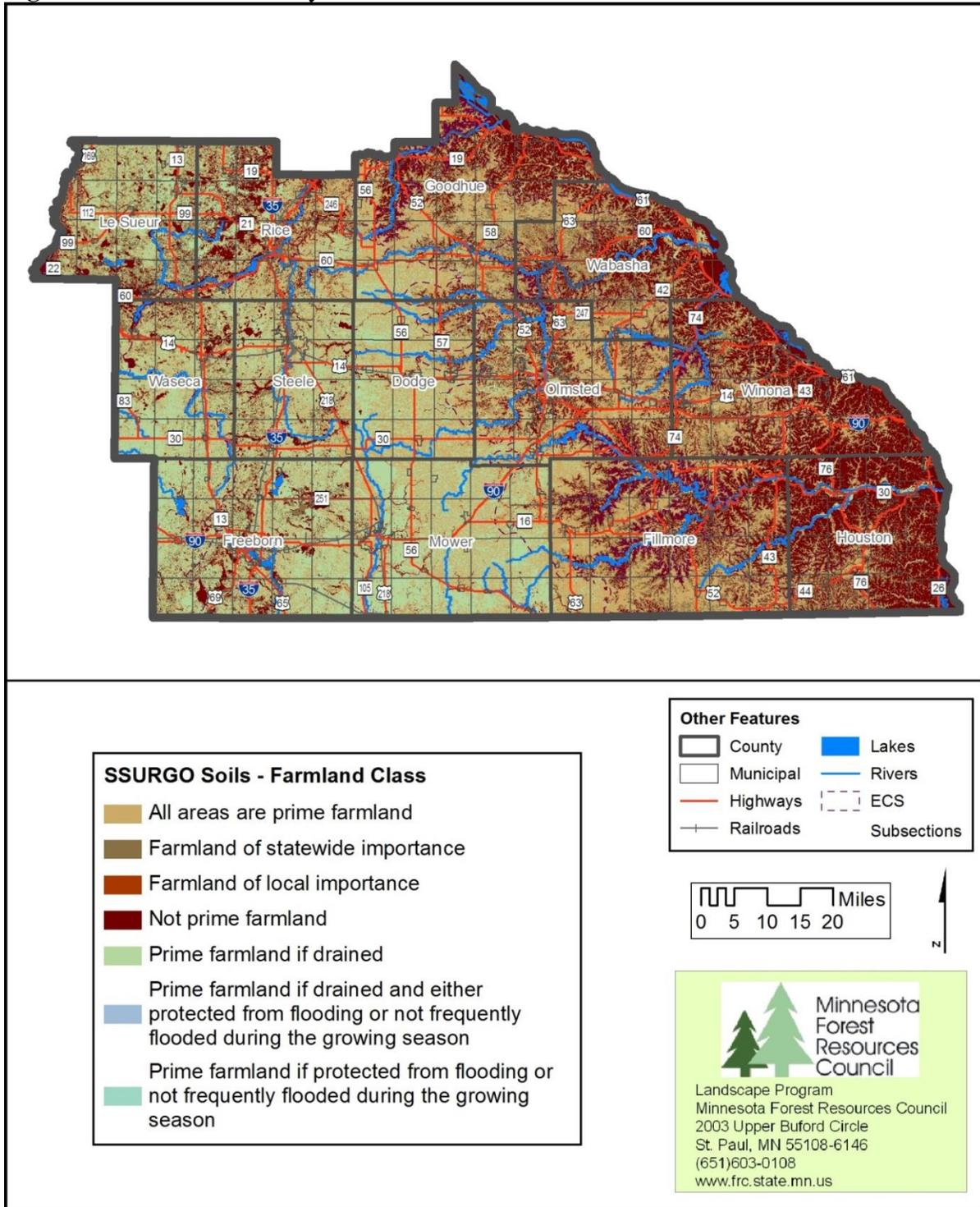


Source: MN DNR Watershed Health Assessment Framework; MN DNR Data Deli

### 3.14. Soils

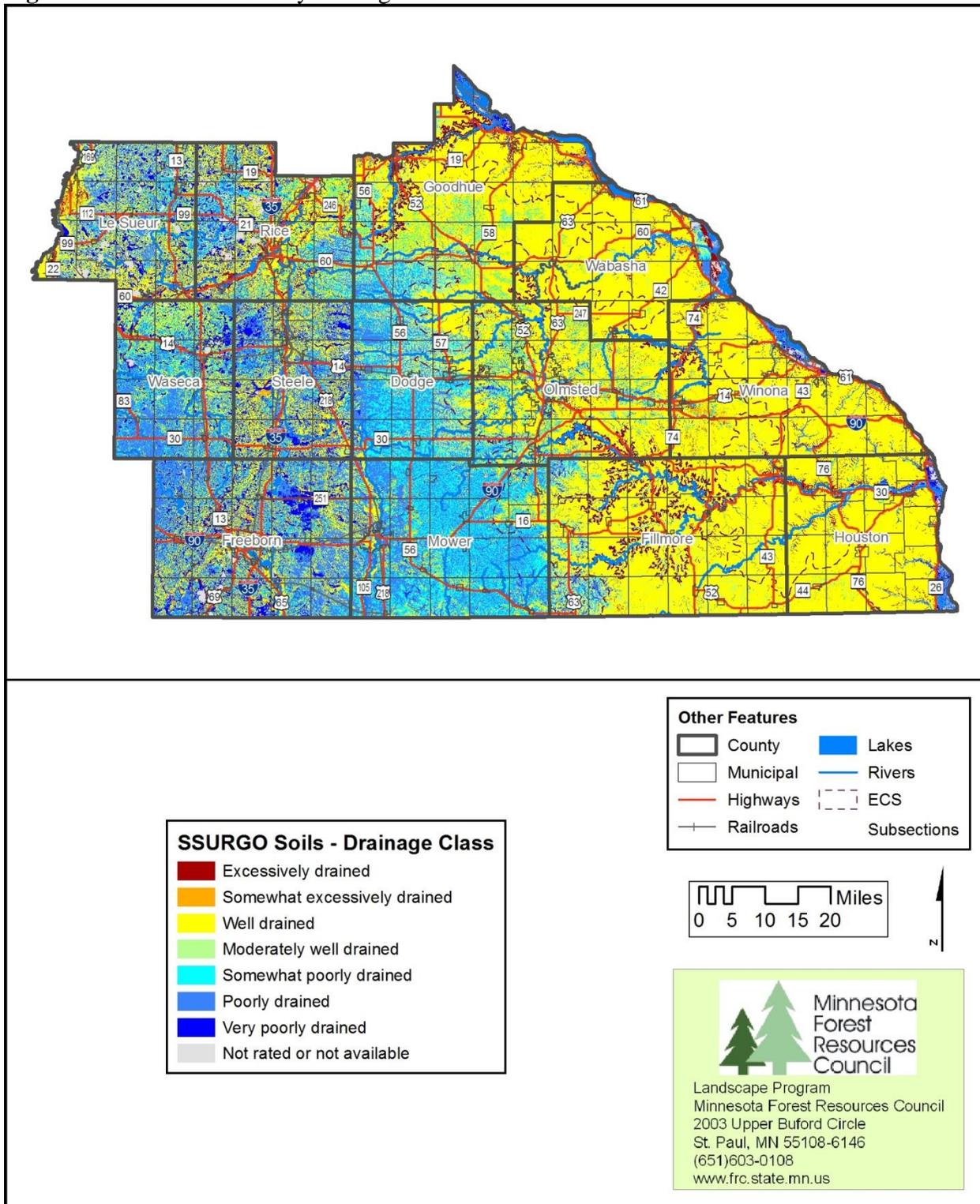
Figures display various soil attributes in the MFRC Southeast Landscape, including farmland classification (Figure 30), drainage classification (Figure 31), and hydric rating (Figure 32).

**Figure 30: SSURGO soils by farmland classification**



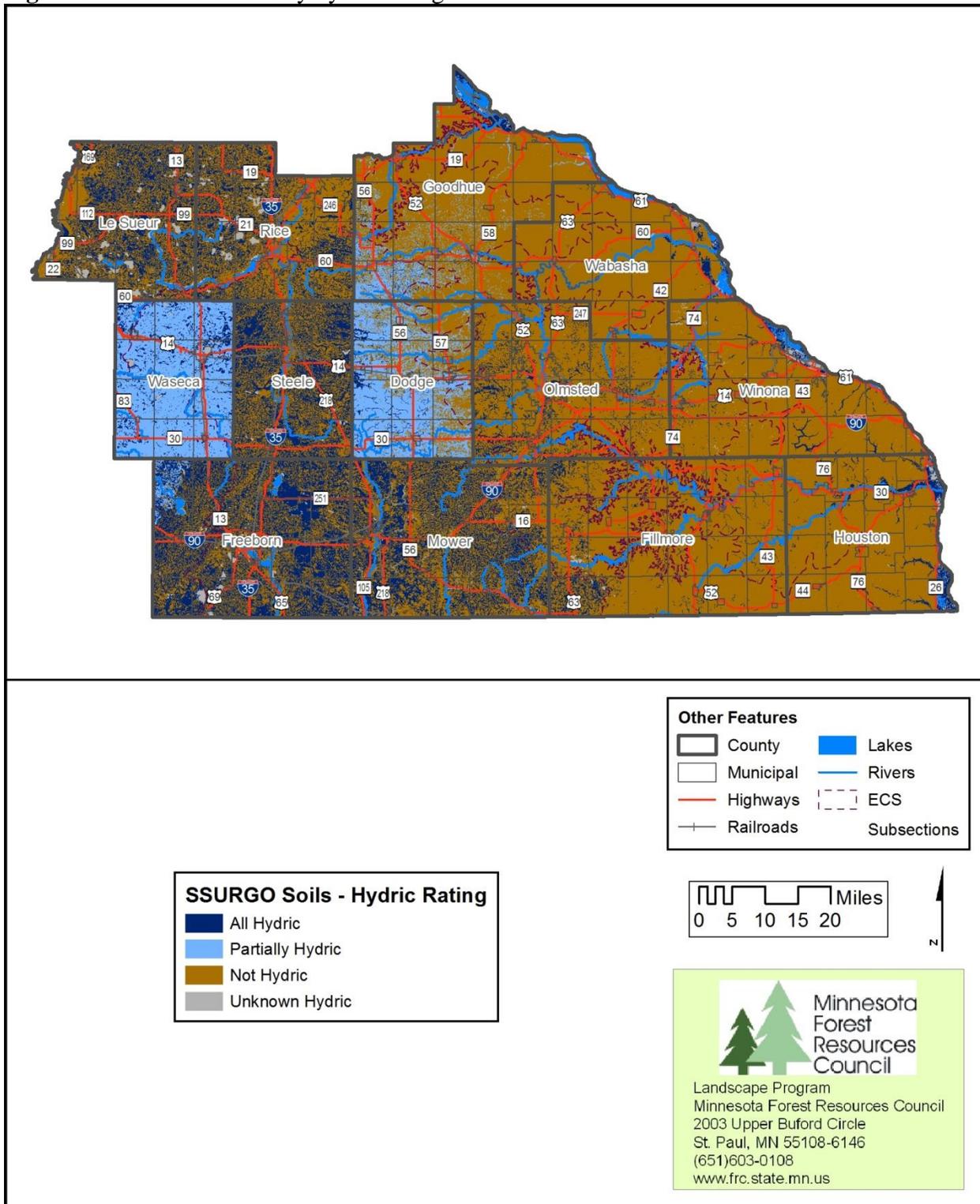
Source: NRCS Web Soil Survey. <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.

**Figure 31: SSURGO soils by drainage classification**



Source: NRCS Web Soil Survey. <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.

**Figure 32: SSURGO soils by hydric rating**



Source: NRCS Web Soil Survey. <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.

### **3.15. Additional data needs**

- CRP, 2c, SFIA land enrollment - change over time
- Wetland data – drainage and restoration, change over time
- Native Plant Community systems in Southeast Minnesota
- Missing relative abundance data from Table 27, pre-settlement vs. FIA 1990 tree species data
- 2013 updates to the Rare Species Guide online tool
- GIS data on all MDA-listed Noxious Weeds in Minnesota and specifically the Southeast Landscape.
- Climate change data
- Forestland carbon stock



## Goal 4 – Economic and Social Values

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**MFRC Goal 4: Economic and Social Values.** Forests within a region’s landscape will be providing a full range of products, services, and values, including timber products, wildlife, and tourism that are major contributors to economic stability, environmental quality, social satisfaction, and community well-being.

Note: Population and economic data for the Southeast Landscape that is related to Goal 4 can be found in the Demographic Data Report for the 2<sup>nd</sup> generation Forest Resource Management Plan for the Southeast Region.

### 4.1 Data Sources

#### Hydraulic sand fracturing

- Minnesota Department of Transportation.

#### Roads:

- Minnesota Department of Transportation.
- Minnesota House of Representatives Research Department.

#### Trails:

- Table: Lawton, John. 2013. MN DNR Division of Parks and Trails.
- Map: MN DNR Data Deli

### 4.2. Forest products industry

#### *Section 4.2.1: Forest Products Industry – Southeast Minnesota*

According to data from MN DEED’s Quarterly Census of Employment and Wages, there were nearly 323 forest-related payroll jobs in the Southeast Landscape in 2013 (Table 52). This was slightly up from 2010, which had the decade-low number of forest-related payroll jobs (271), but well below 2005 when forest-related payroll jobs peaked for the decade (604). Freeborn County had the most forest-related payroll jobs in 2013 (137), followed by Wabasha (91), Houston (70), and Mower (25); no other counties reported forest-related jobs in 2013.

8,425 cord equivalents (1000 boardfeet ~ 2 cords) of timber were harvested in the region in 2011, the majority of which came from Fillmore (3,361) and Houston (1,868) Counties (Table 53). Comparatively, over 21,000 cord equivalents of timber were processed in the region in 2009, indicating that the region imports timber from other parts of the state or other states for processing (Table 54).

Table 55 and Figure 33 show the locations of 26 sawmills in the Southeast Landscape in 2007. Most of these facilities are located in the Rochester Plateau and Blufflands Subsections.

Table 52: Forest-related payroll employment in the Southeast Landscape, 2004-2013.

| County                    | 2004       | 2005       | 2006       | 2007       | 2008       | 2009       | 2010       | 2011       | 2012       | 2013       |
|---------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Dodge                     | n/a        |
| Fillmore                  |            |            |            |            |            |            |            | 36         | 58         |            |
| Freeborn                  | 140        | 141        | 143        | 144        | 145        | 114        | 99         | 122        | 139        | 137        |
| Goodhue                   |            | 104        | 104        | 68         | 47         | 30         |            |            |            |            |
| Houston                   | 179        | 188        | 157        | 115        | 97         | 75         | 65         | 63         | 64         | 70         |
| Le Sueur                  | 20         |            | 13         | 11         |            |            |            |            |            |            |
| Mower                     | 36         | 34         | 29         | 30         | 29         | 26         | 25         | 25         | 24         | 25         |
| Olmsted                   |            |            |            |            | 6          | 5          | 7          | 7          |            |            |
| Rice                      | n/a        |
| Steele                    | 16         | 21         |            |            |            |            |            |            |            |            |
| Wabasha                   | 128        | 116        | 91         | 79         | 78         | 81         | 75         | 56         | 52         | 91         |
| Waseca                    | n/a        |
| Winona                    | n/a        |
| <b>TOTAL SE Landscape</b> | <b>519</b> | <b>604</b> | <b>537</b> | <b>447</b> | <b>402</b> | <b>331</b> | <b>271</b> | <b>309</b> | <b>337</b> | <b>323</b> |

Note: Table updated Aug. 2014.

Source: Deckard, Don. MN DNR Forest Economist. Data queried from MNDEED QCEW (Quarterly Census of Employment and Wages) 8-19-2014.

Table 53: Timber harvest by Minnesota county in the Southeast Landscape, 2011.

| County                    | Harvest (cords) |
|---------------------------|-----------------|
| Dodge                     | 179             |
| Fillmore                  | 3,361           |
| Freeborn                  | 153             |
| Goodhue                   | 595             |
| Houston                   | 1,868           |
| Le Sueur                  | 209             |
| Mower                     | 117             |
| Olmsted                   | 807             |
| Rice                      | 48              |
| Steele                    | 78              |
| Wabasha                   | 191             |
| Waseca                    | 57              |
| Winona                    | 763             |
| <b>TOTAL SE Landscape</b> | <b>8,425</b>    |

Note: Table updated Aug. 2014.

Source: Deckard, Don. MN DNR Forest Economist. Compiled from: MNDNR 2010 Sawmill Survey and USFS 2011 Pulpwood Survey, 8-19-2014.

Table 54: Timber Processed in the Southeast Landscape, 2009.

| County                                  | Harvest (thousand boardfeet) |
|---|------------------------------|
| Dodge                                   | 0                            |
| Fillmore                                | 4,357                        |
| Freeborn                                | 270                          |
| Goodhue                                 | 181                          |
| Houston                                 | 5,349                        |
| Le Sueur                                | 0                            |
| Mower                                   | 20                           |
| Olmsted                                 | 120                          |
| Rice                                    | 48                           |
| Steele                                  | 84                           |
| Wabasha                                 | 43                           |
| Waseca                                  | 0                            |
| Winona                                  | 61                           |
| TOTAL SE Landscape (thousand boardfeet) | 10,533                       |
| TOTAL SE Landscape (cord equivalents)   | 21,066                       |

Notes: Mill Type: Portable sawmill - Post/Pole/Piling operation - Stationary sawmill - Veneer mill; Production Volume Range: (ALL). Table updated Aug. 2014.

Source: Deckard, Don. MN DNR Forest Economist. 2009. Compiled from: Minnesota Forest Products Primary Processors Database, 8-19-2014.

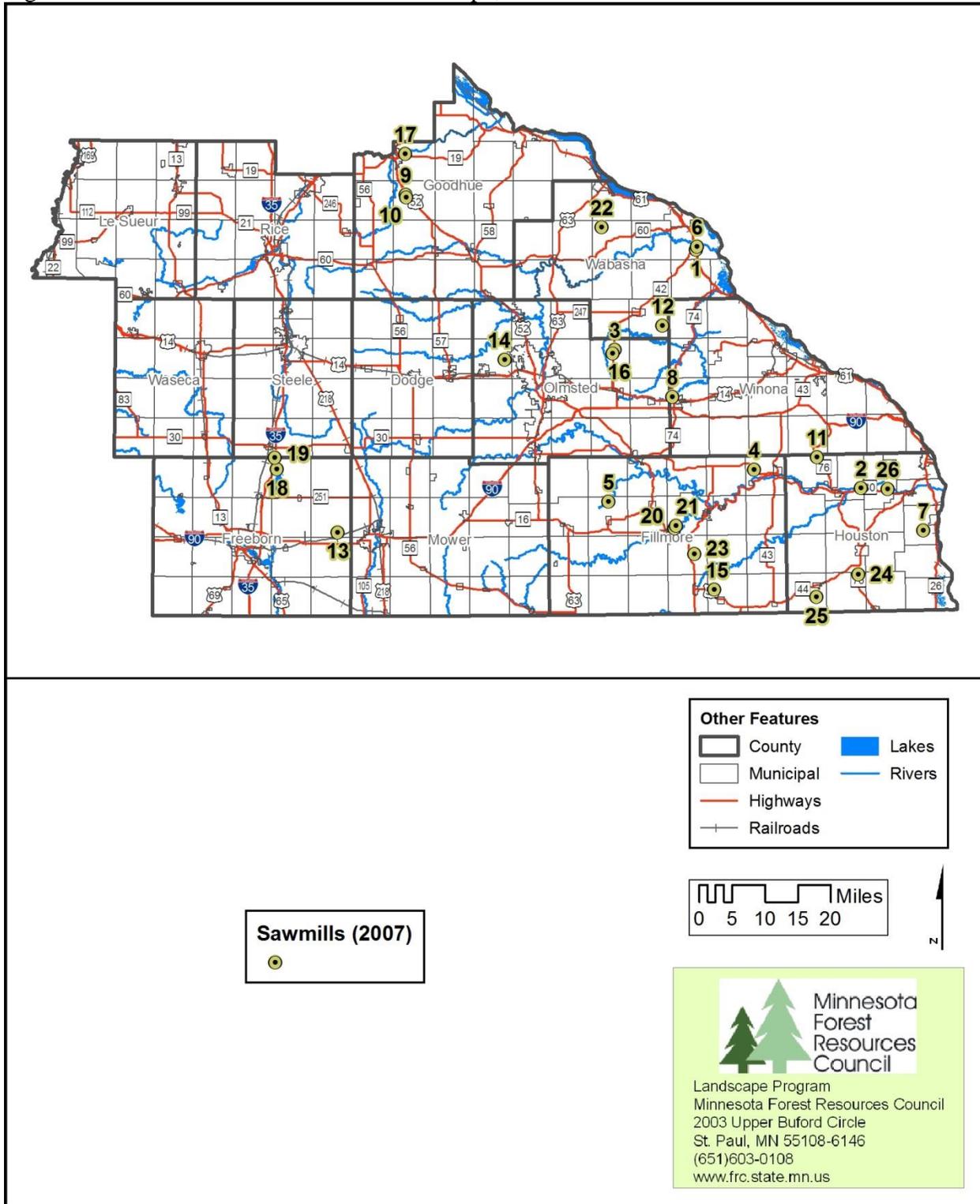
Table 55: Sawmills in the Southeast Landscape in 2007.

| <b>Sawmill Name</b>                      | <b>Map Number</b> | <b>County</b> |
|--|-------------------|---------------|
| Axley Bros. Inc.                         | 1                 | Wabasha       |
| Crystal Valley Hardwoods                 | 2                 | Houston       |
| Edgewood Lumber                          | 3                 | Olmsted       |
| Ellefson Mill                            | 4                 | Fillmore      |
| Fillmore Sawmill                         | 5                 | Fillmore      |
| G & G Logging                            | 6                 | Wabasha       |
| Holzwarth Mill                           | 7                 | Houston       |
| Jilk (Pete) Mill                         | 8                 | Winona        |
| Johnson Logging Inc.- Mill               | 9                 | Goodhue       |
| Johnson Logging Inc.- Residence/Woodyard | 10                | Goodhue       |
| Jordan (John) Mill                       | 11                | Houston       |
| Kolb - Jeff Mill                         | 12                | Wabasha       |
| Len's Wood Products                      | 13                | Freeborn      |
| Logan (Mike) Mill                        | 14                | Olmsted       |
| Mattson (Lynn) Mill                      | 15                | Fillmore      |
| Mulholland Logging                       | 16                | Olmsted       |
| Northern Hardwood                        | 17                | Goodhue       |
| Richards Wood Products                   | 18                | Freeborn      |
| Richards Wood Products                   | 19                | Steele        |
| Root River Hardwoods                     | 20                | Fillmore      |
| Root River Hardwoods - Woodyard          | 21                | Fillmore      |
| Schuman (Dick) Mill                      | 22                | Wabasha       |
| Scotland Sawmill                         | 23                | Fillmore      |
| Staggemeyer Stave Co.                    | 24                | Houston       |
| Thomas (Gary) Mill                       | 25                | Houston       |
| Tri - State Forest Products              | 26                | Houston       |

Source: Minnesota Dept. of Agriculture

Note: According to K. Hilstrom (2/24/2014), GIS Support Specialist for MN DNR Information Technology Services, this data is at least 7 years old (2007) and may require updating.

Figure 33: Sawmills in the Southeast Landscape, 2007.



Source: Minnesota Dept. of Agriculture

Note: According to K. Hilstrom (2/24/2014), GIS Support Specialist for MN DNR Information Technology Services, this data is at least 7 years old (2007) and may require updating.

Section 4.2.2: Forest Products Industry – Statewide, Minnesota

(Note: these are taken directly from the Northeast Conditions and Trends report)

In 2008, Minnesota had over 40,000 jobs statewide directly related to forestry, logging, and primary and secondary forest products manufacturing, and \$9.7 billion of direct economic impact from these industries (Table 56). In 2010, Minnesota ranked 8<sup>th</sup> among the 50 states in terms of gross state product per capita for combined pulp and paper and wood products (Figure 34). In 2012, the state had nearly 1500 forest industry-related facilities including four pulp and paper mills (Table 57). Figure 36 shows stumpage prices per cord for a variety of softwood and soft hardwood species statewide; aspen yielded the highest per cord price among these species in 2009.

Table 56: Direct contribution and total economic impact of Minnesota forest products manufacturing and related sectors, 2008.

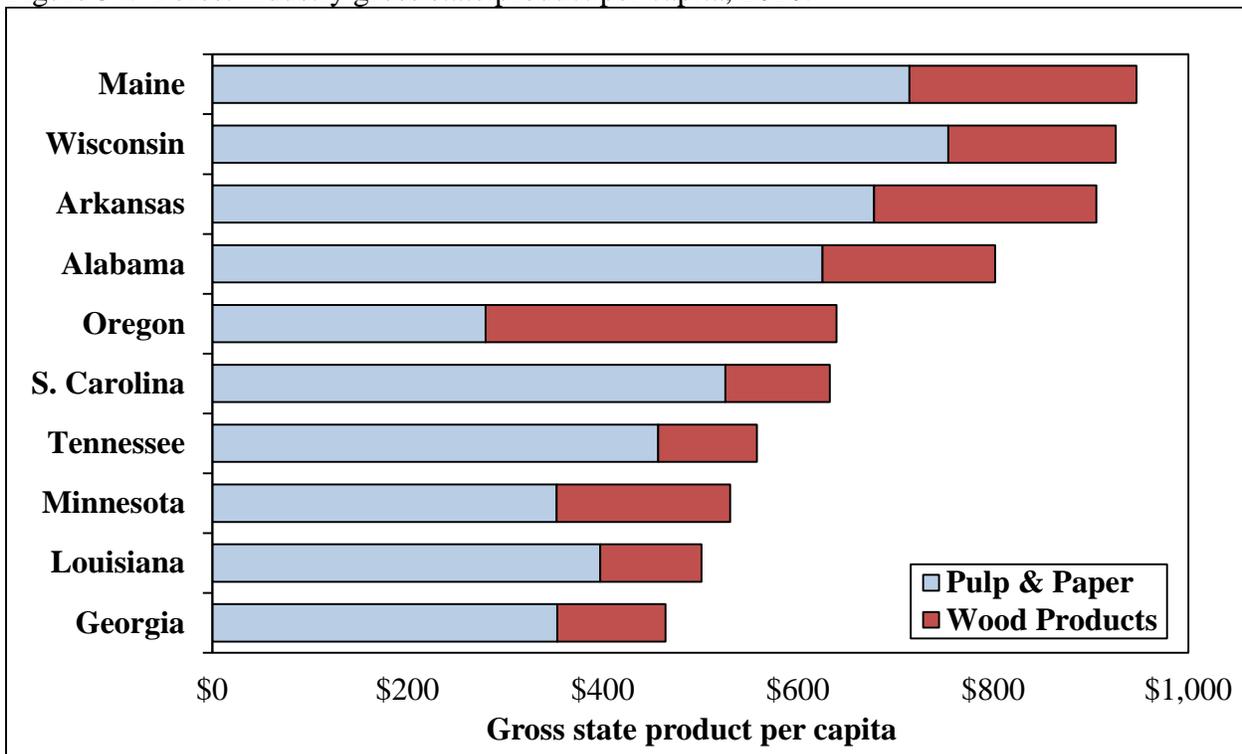
| IMPLAN <sup>1</sup><br>Sector  | Employment          |               | Output (Billion \$) |                | Value Added (Billion \$) |               |
|--------------------------------|---------------------|---------------|---------------------|----------------|--------------------------|---------------|
|                                | Direct Contribution | Total Impact  | Direct Contribution | Total Impact   | Direct Contribution      | Total Impact  |
| Primary Forest Products Mfg.   | 5,353               | 19,153        | \$2.90              | \$5.20         | \$0.80                   | \$1.90        |
| Secondary Forest Products Mfg. | 31,743              | 68,541        | \$6.80              | \$12.40        | \$2.20                   | \$5.20        |
| Forestry and Logging           | 3,273               | 6,231         | \$0.70              | \$1.10         | \$0.20                   | \$0.40        |
| <b>Totals<sup>2</sup></b>      | <b>40,369</b>       | <b>86,775</b> | <b>\$9.70</b>       | <b>\$17.10</b> | <b>\$3.00</b>            | <b>\$6.90</b> |

Source: Deckard and Skurla 2011.

<sup>1</sup> IMPLAN – (IMpact analysis for PLANning) software and data combines classic economic input-output analysis with regional specific social accounting matrices and multiplier models.

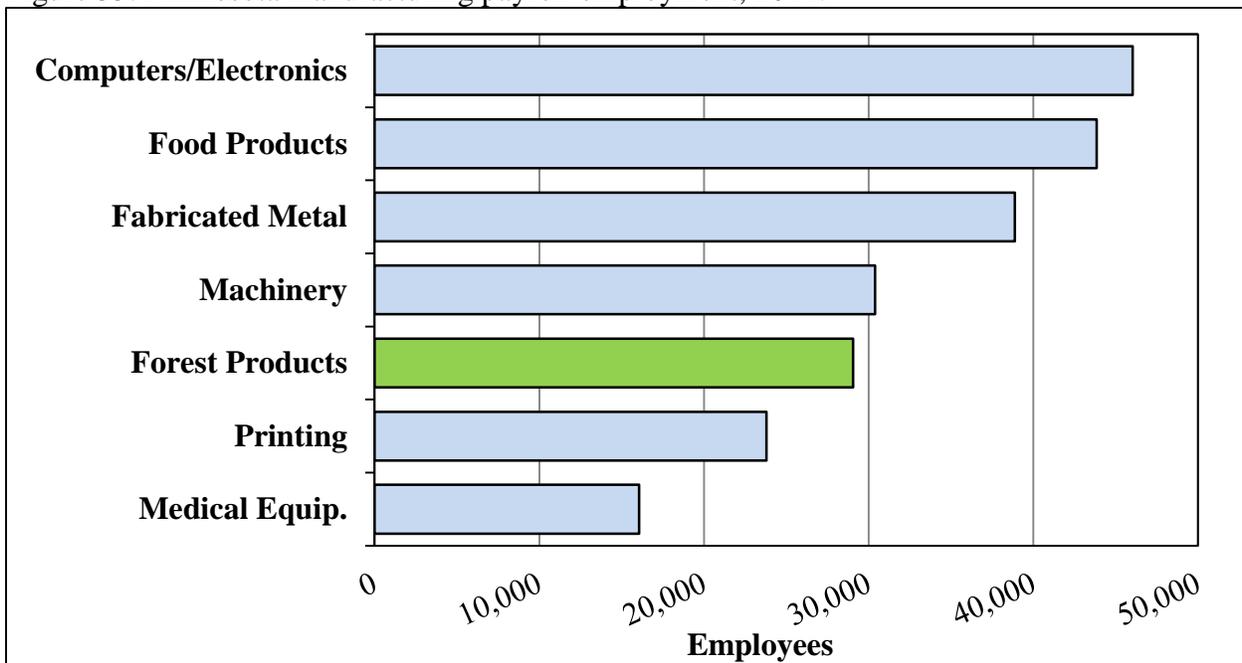
<sup>2</sup> To avoid the appearance of double counting, forestry and logging were discounted from primary manufacturing estimates of output and value added.

Figure 34: Forest industry gross state product per capita, 2010.



Source: Don Deckard, Minnesota DNR, Division of Forestry.

Figure 35: Minnesota manufacturing payroll employment, 2011.



Source: Don Deckard, Minnesota DNR, Division of Forestry.

Note: Forest products employment value includes Forestry and Logging (Industry Code; 113), Support Activities for Forestry (Industry Code; 1153), Wood Product Manufacturing (Industry Code; 321), Paper Manufacturing (Industry Code; 322), 50% of Furniture and Related Product Manufacturing total (Industry Code; 337), and Forest Products Non-employer values.

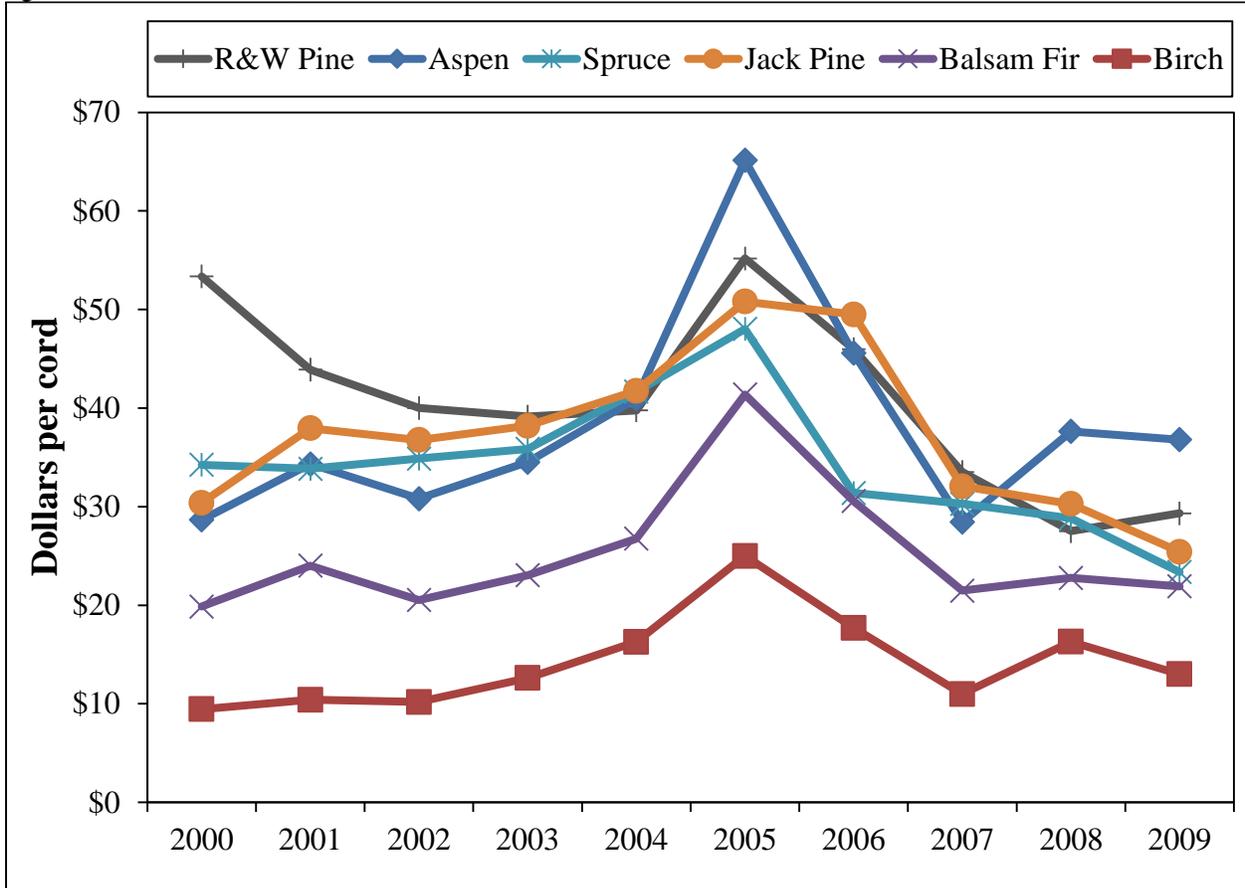
Table 57: Forest industry related facilities in Minnesota.

| <b>Manufacturing &amp; Energy Facilities 2012</b> |                                  |
|---|----------------------------------|
| Pulp & Paper Mills                                | 4 (Verso, Sartell shutdown 8/12) |
| Recycled Pulp & Paper Mills                       | 3                                |
| Hardboard & Specialty Plants                      | 1 (G-P, Duluth shutdown 8/12)    |
| Oriented Strand Board / Structural Panel Plants   | 2                                |
| Sawmills  | 500+                             |
| Specialty Businesses                              | 150                              |
| Secondary Manufacturers                           | 800+                             |
| Renewable Energy <sup>1</sup>                     | 14                               |

Source: Don Deckard, Minnesota DNR, Division of Forestry

<sup>1</sup>Includes: electricity generation, combined heat & power (CHP), and fuel pellet manufacturing facilities with >10,000 cord annual consumption.

Figure 36: Average prices received for stumpage per cord by species sold by public land agencies in Minnesota, 2000-2009



Source: Minnesota DNR, Minnesota’s Forest Resources 2010

Note: Data represents the Pulp & Bolts in Combination. A bolt is defined as a short log, usually 100” length, with a specific minimum top diameter, generally sawn for lumber.

### *Section 4.2.3: Land Value Data*

According to 2014 estimates created by Steven Taff of Minnesota Land Economics at the University of Minnesota, land prices in the Southeast Landscape have increased enormously over the past 20 years. Farmland (which includes “2a agricultural land” after 2008) increased by over 450% in all counties, with greatest increases in Houston (997%), Winona (915%), and Fillmore (901%) Counties. Mower County currently (2013) has the most expensive farmland, valued at \$7,440 per acre (Table 58).

Tillable land (“2a tillable land” after 2008) increased somewhat less than farmland, but still significantly; price per acre increased approximately 450% to 750% among the counties, with Fillmore (757%), Olmsted (707%), and Winona (647%) Counties seeing the largest increase among counties with 20-year records (Table 59). Wabasha county lacked records for 1993, but saw a 19-year increase of 525%, placing it 8<sup>th</sup> of the 13 counties in terms of tillable acreage value increase for that same time span. Mower County currently (2013) has the most expensive tillable land, valued at \$7,704 per acre.

Timberland (“2b timberland” after 2008) was not well documented for most counties, especially before 2007, but so the largest percent increases for some of the counties that did have available data for the 20 year period (Table 60). The top three counties in the region with 20-year data, in terms of percent increase for timberland, were Fillmore (1374%), Wabasha (1283%), and Houston (1188%) Counties. Olmsted County currently (2013) has the most expensive timberland, valued at \$3,958 per acre.

Table 58: Changes in land value (\$) per acre in Farmland (1993-2008) and 2a agricultural land (2009-2013) in the MFRC Southeast Landscape.

|                            | Dodge | Fillmore | Freeborn | Goodhue | Houston | Le Sueur | Mower | Olmsted | Rice | Steele | Wabasha | Waseca | Winona |
|----------------------------|-------|----------|----------|---------|---------|----------|-------|---------|------|--------|---------|--------|--------|
| <b>1993</b>                | 955   | 538      | 1090     | 899     | 439     | 901      | 951   | 726     | 963  | 1062   | 615     | 1160   | 537    |
| <b>1994</b>                | 991   | 588      | 1089     | 964     | 483     | 900      | 952   | 827     | 1029 | 1074   | 668     | 1272   | 570    |
| <b>1995</b>                | 1010  | 671      | 1089     | 969     | 585     | 1045     | 1028  | 829     | 1123 | 1146   | 670     | 1278   | 617    |
| <b>1996</b>                | 1062  | 734      | 1023     | 981     | 800     | 1142     | 1087  | 913     | 1226 | 1209   | 705     | 1415   | 669    |
| <b>1997</b>                | 1212  | 770      | 1260     | 1112    | 759     | 1220     | 1217  | 1009    | 1391 | 1319   | 825     | 1416   | 676    |
| <b>1998</b>                | 1364  | 927      | 1323     | 1212    | 786     | 1296     | 1293  | 1052    | 1574 | 1528   | 949     | 1565   | 835    |
| <b>1999</b>                | 1512  | 1027     | 1494     | 1326    | 814     | 1374     | 1425  | 1218    | 1651 | 1534   | 1039    | 1751   | 1032   |
| <b>2000</b>                | 1660  | 1226     | 1494     | 1425    | 998     | 1586     | 1524  | 1334    | 1905 | 1597   | 1171    | 1751   | 1288   |
| <b>2001</b>                | 1682  | 1237     | 1633     | 1587    | 1038    | 1688     | 1665  | 1490    | 2141 | 1648   | 1366    | 1752   | 1556   |
| <b>2002</b>                | 1793  | 1473     | 1641     | 1786    | 1370    | 2029     | 1798  | 1716    | 2360 | 1805   | 1434    | 2050   | 1586   |
| <b>2003</b>                | 1944  | 1595     | 1708     | 1914    | 1436    | 2260     | 1874  | 1935    | 2997 | 1926   | 1505    | 2274   | 1814   |
| <b>2004</b>                | 2309  | 1798     | 1998     | 2255    | 1548    | 2648     | 2146  | 2914    | 3461 | 2104   | 1708    | 2270   | 1994   |
| <b>2005</b>                | 2591  | 2106     | 2430     | 2847    | 1868    | 3098     | 2325  | 3475    | 4142 | 2472   | 1910    | 2567   | 2302   |
| <b>2006</b>                | 2807  | 2536     | 2626     | 3488    | 2176    | 3912     | 2679  | 3771    | 5772 | 2806   | 2315    | 2968   | 2588   |
| <b>2007</b>                | 3253  | 2537     | 2787     | 3461    | 2563    | 4401     | 3124  | 4003    | 5801 | 3098   | 2494    | 3252   | 2823   |
| <b>2008</b>                | 3453  | 2937     | 3001     | 3669    | 2712    | 4438     | 3281  | 4077    | 5810 | 3380   | 2880    | 3584   | 3202   |
| <b>2009</b>                | 3919  | 3136     | 3968     | 3830    | 2895    | 5024     | 3806  | 3137    | 5705 | 3958   | 3508    | 4168   | 3848   |
| <b>2010</b>                | 4249  | 3444     | 4366     | 3778    | 2888    | 4887     | 4069  | 4049    | 4984 | 3958   | 3571    | 4554   | 3789   |
| <b>2011</b>                | 4677  | 3685     | 4230     | 4031    | 3215    | 4797     | 4280  | 4072    | 4686 | 4183   | 3775    | 4781   | 3838   |
| <b>2012</b>                | 5521  | 4406     | 4901     | 4516    | 3765    | 5501     | 5176  | 4489    | 5304 | 5046   | 4374    | 5343   | 4171   |
| <b>2013</b>                | 7223  | 5383     | 6793     | 6117    | 4817    | 6446     | 7440  | 5652    | 5593 | 6043   | 5240    | 6979   | 5451   |
| <b>20 year change (\$)</b> | 6268  | 4845     | 5703     | 5218    | 4378    | 5545     | 6489  | 4926    | 4630 | 4981   | 4625    | 5819   | 4914   |
| <b>20 year change (%)</b>  | 656%  | 901%     | 523%     | 580%    | 997%    | 615%     | 682%  | 679%    | 481% | 469%   | 752%    | 502%   | 915%   |

Source: Steven Taff, Minnesota Land Economics. 2014. "Estimated Land Values." University of Minnesota. landeconomics.umn.edu

Table 59: Changes in land value (\$) per acre in Tillable land (1993-2008) and 2a tillable land (2009-2013) in the MFRC Southeast Landscape.

|                            | Dodge | Fillmore | Freeborn | Goodhue | Houston | Le Sueur | Mower | Olmsted | Rice | Steele | Wabasha | Waseca | Winona |
|----------------------------|-------|----------|----------|---------|---------|----------|-------|---------|------|--------|---------|--------|--------|
| <b>1993</b>                | 1027  | 696      | 1166     | 1008    | 740     | 1044     | 1012  | 744     | 1077 | 1096   | 0       | 1123   | 764    |
| <b>1994</b>                | 1066  | 766      | 1166     | 1086    | 776     | 1043     | 1014  | 911     | 1126 | 1092   | 801     | 1114   | 832    |
| <b>1995</b>                | 1087  | 874      | 1166     | 1089    | 917     | 1208     | 1086  | 911     | 1202 | 1213   | 805     | 1063   | 924    |
| <b>1996</b>                | 1139  | 944      | 1095     | 1089    | 1186    | 1307     | 1155  | 1016    | 1263 | 1211   | 850     | 1473   | 1018   |
| <b>1997</b>                | 1305  | 965      | 1349     | 1218    | 1058    | 1376     | 1302  | 1130    | 1421 | 1367   | 926     | 1442   | 1021   |
| <b>1998</b>                | 1444  | 1151     | 1419     | 1318    | 1024    | 1437     | 1375  | 1169    | 1563 | 1600   | 993     | 1376   | 1026   |
| <b>1999</b>                | 1603  | 1179     | 1604     | 1448    | 989     | 1473     | 1522  | 1357    | 1641 | 1600   | 1114    | 1688   | 1249   |
| <b>2000</b>                | 1762  | 1352     | 1604     | 1524    | 1060    | 1698     | 1627  | 1474    | 1882 | 1681   | 1276    | 1686   | 1537   |
| <b>2001</b>                | 1782  | 1350     | 1755     | 1652    | 1095    | 1708     | 1776  | 1651    | 2001 | 1719   | 1493    | 1680   | 1652   |
| <b>2002</b>                | 1900  | 1559     | 1766     | 1871    | 1412    | 2034     | 1923  | 1845    | 2259 | 1876   | 1567    | 1996   | 1620   |
| <b>2003</b>                | 2060  | 1660     | 1841     | 1983    | 1484    | 2291     | 1995  | 2505    | 2825 | 1997   | 1639    | 2184   | 1752   |
| <b>2004</b>                | 2454  | 1859     | 2137     | 2364    | 1573    | 2398     | 2283  | 2585    | 3201 | 2199   | 1855    | 2145   | 1800   |
| <b>2005</b>                | 2698  | 2159     | 2612     | 2987    | 1768    | 2689     | 2461  | 2888    | 3339 | 2588   | 2059    | 2456   | 1988   |
| <b>2006</b>                | 2857  | 2567     | 2811     | 3632    | 2053    | 2970     | 2824  | 3072    | 5027 | 2939   | 2481    | 2808   | 2276   |
| <b>2007</b>                | 3115  | 2568     | 2977     | 3703    | 2272    | 4309     | 3189  | 3748    | 6103 | 3256   | 2665    | 3186   | 2993   |
| <b>2008</b>                | 3521  | 2972     | 3214     | 3958    | 2558    | 4352     | 3342  | 3806    | 6104 | 3570   | 3112    | 3518   | 3546   |
| <b>2009</b>                | 3925  | 3266     | 3865     | 4114    | 2684    | 4811     | 3744  | 3327    | 5679 | 3933   | 3302    | 3975   | 3455   |
| <b>2010</b>                | 4245  | 3467     | 4309     | 4056    | 2685    | 4843     | 4143  | 4150    | 5278 | 3934   | 3362    | 4351   | 3453   |
| <b>2011</b>                | 4685  | 3754     | 4509     | 4346    | 3038    | 4844     | 4361  | 4124    | 4730 | 4160   | 3556    | 4572   | 3604   |
| <b>2012</b>                | 5607  | 4755     | 5237     | 4874    | 3534    | 5709     | 5306  | 4594    | 5406 | 5022   | 4151    | 5178   | 3990   |
| <b>2013</b>                | 7451  | 5966     | 7325     | 6649    | 4585    | 6777     | 7704  | 6005    | 5863 | 6356   | 5004    | 6887   | 5709   |
| <b>20 year change (\$)</b> | 6424  | 5270     | 6159     | 5641    | 3845    | 5733     | 6692  | 5261    | 4786 | 5260   | 5004    | 5764   | 4945   |
| <b>20 year change (%)</b>  | 626%  | 757%     | 528%     | 560%    | 520%    | 549%     | 661%  | 707%    | 444% | 480%   | n/a     | 513%   | 647%   |

Source: Steven Taff, Minnesota Land Economics. 2014. "Estimated Land Values." University of Minnesota. landeconomics.umn.edu

Table 60: Changes in land value (\$) per acre in Timberland (1993-2008) and 2b timber land (2009-2013) in the MFRC Southeast Landscape.

|                            | Dodge | Fillmore | Freeborn | Goodhue | Houston | Le Sueur | Mower | Olmsted | Rice | Steele | Wabasha | Waseca | Winona |
|----------------------------|-------|----------|----------|---------|---------|----------|-------|---------|------|--------|---------|--------|--------|
| 1993                       |       | 150      |          | 409     | 156     |          |       |         |      |        | 214     |        | 380    |
| 1994                       |       | 170      |          | 420     | 218     |          |       |         |      |        | 253     |        | 397    |
| 1995                       |       | 170      |          | 436     | 280     |          |       |         |      |        | 270     |        | 391    |
| 1996                       |       | 170      |          | 452     | 450     |          |       |         |      |        | 312     |        | 305    |
| 1997                       |       | 248      |          | 492     | 340     |          |       |         |      |        | 484     |        | 340    |
| 1998                       |       | 344      |          | 590     | 418     |          |       |         |      |        | 742     |        | 780    |
| 1999                       |       | 614      |          | 624     | 533     |          |       |         |      |        | 783     |        | 968    |
| 2000                       |       | 857      |          | 650     | 873     |          |       |         |      |        | 773     |        | 1199   |
| 2001                       |       | 860      |          | 807     | 921     |          |       |         |      |        | 834     |        | 1516   |
| 2002                       |       | 1125     |          | 850     | 1228    |          |       |         |      |        | 854     |        | 1614   |
| 2003                       |       | 1291     |          | 870     | 1275    |          |       |         |      |        | 928     |        | 1787   |
| 2004                       |       | 1493     |          | 959     | 1456    |          |       |         |      |        | 1021    |        | 2205   |
| 2005                       |       | 1862     |          | 1060    | 1904    |          |       |         |      |        | 1227    |        | 2584   |
| 2006                       |       | 2283     |          | 1198    | 2207    | 3231     |       |         |      |        | 1535    |        | 2816   |
| 2007                       |       | 2308     |          | 1236    | 2792    | 3700     | 1190  |         | 3903 |        | 1663    |        | 2447   |
| 2008                       | 1958  | 2628     | 2476     | 1346    | 2779    | 4309     | 1577  | 5000    | 5170 |        | 1929    |        | 2645   |
| 2009                       | 1945  | 2682     |          | 1779    | 2900    | 4262     |       | 2419    |      | 1502   | 2056    |        | 2537   |
| 2010                       | 2296  | 2921     | 985      | 1601    | 2700    | 4244     | 2000  | 3984    | 3829 | 1794   | 1982    |        | 2537   |
| 2011                       | 2520  | 2914     | 1057     | 1604    | 2499    | 3879     | 1998  | 4003    | 3352 | 1794   | 2112    | 1190   | 2515   |
| 2012                       | 2583  | 2612     | 1551     | 1803    | 2250    | 3580     | 1997  | 3827    | 3652 | 1996   | 2493    | 1447   | 2365   |
| 2013                       | 2760  | 2211     | 1370     | 2152    | 2009    | 3574     | 1997  | 3958    | 3199 | 2293   | 2959    | 1833   | 2368   |
| <b>20 year change (\$)</b> | n/a   | 2061     | n/a      | 1743    | 1853    | n/a      | n/a   | n/a     | n/a  | n/a    | 2745    | n/a    | 1988   |
| <b>20 year change (%)</b>  | n/a   | 1374%    | n/a      | 426%    | 1188%   | n/a      | n/a   | n/a     | n/a  | n/a    | 1283%   | n/a    | 523%   |

Source: Steven Taff, Minnesota Land Economics. 2014. "Estimated Land Values." University of Minnesota. landeconomics.umn.edu

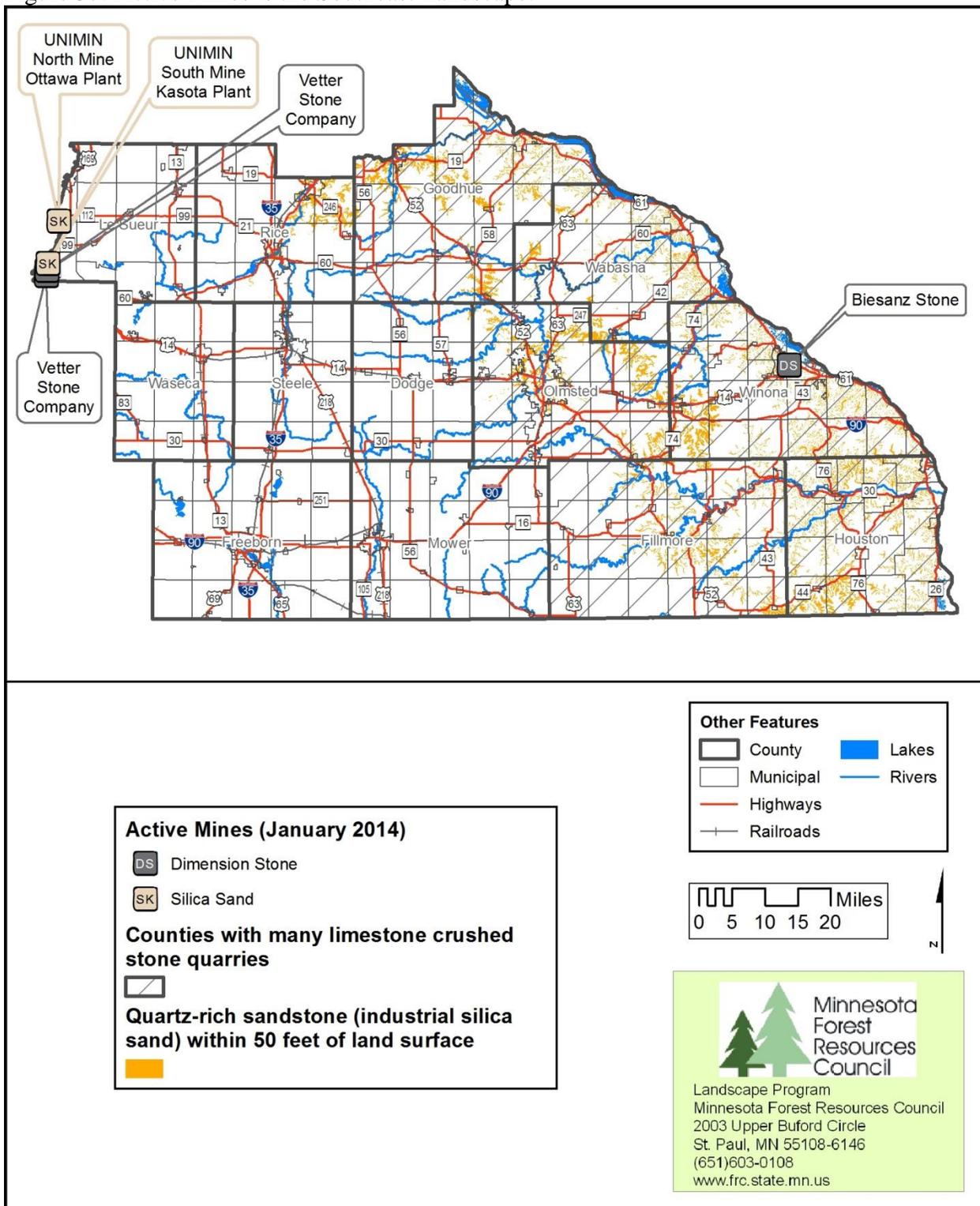
### **4.3. Mining**

According to the MN DNR Division of Lands and Minerals and the Minnesota Geological Survey, there are currently five active dimension stone or silica sand mines in the Southeast Landscape: four in Le Sueur County and one in Winona County (Figure 37). Limestone crushed stone quarries are abundant, however, and spread throughout the quart-rich sandstone regions of the Blufflands and Rochester Plateau.

Only three of the 13 counties in the region had specific data available on resource potential for mining aggregate crushed stone and sand/gravel: Dodge, Le Sueur, and Olmsted Counties. Of these, Olmsted County has the highest crushed stone resource potential, with over half of the county's total acreage identified as having low to high potential for this material (Figure 38, Table 61). Dodge County had the highest potential for sand and gravel of the three counties, with 18.3% of its total acreage identified as having low to high potential for this material (Figure 39, Table 62). However, most of this potential was “low” for all three counties – less than 2.5% for each. Between the three counties, there are 765 aggregate mining locations (Table 63).

According to the State Program Director of the MN DNR, in terms of hydraulic fracturing sand mining no new mines are currently being planned in the region, as development of new mines is currently halted in the state. However, many small silica sand mines that produce agricultural bedding exist throughout the region and are tracked at the county level (H. Arends, personal communication).

Figure 37: Active Mines in the Southeast Landscape.



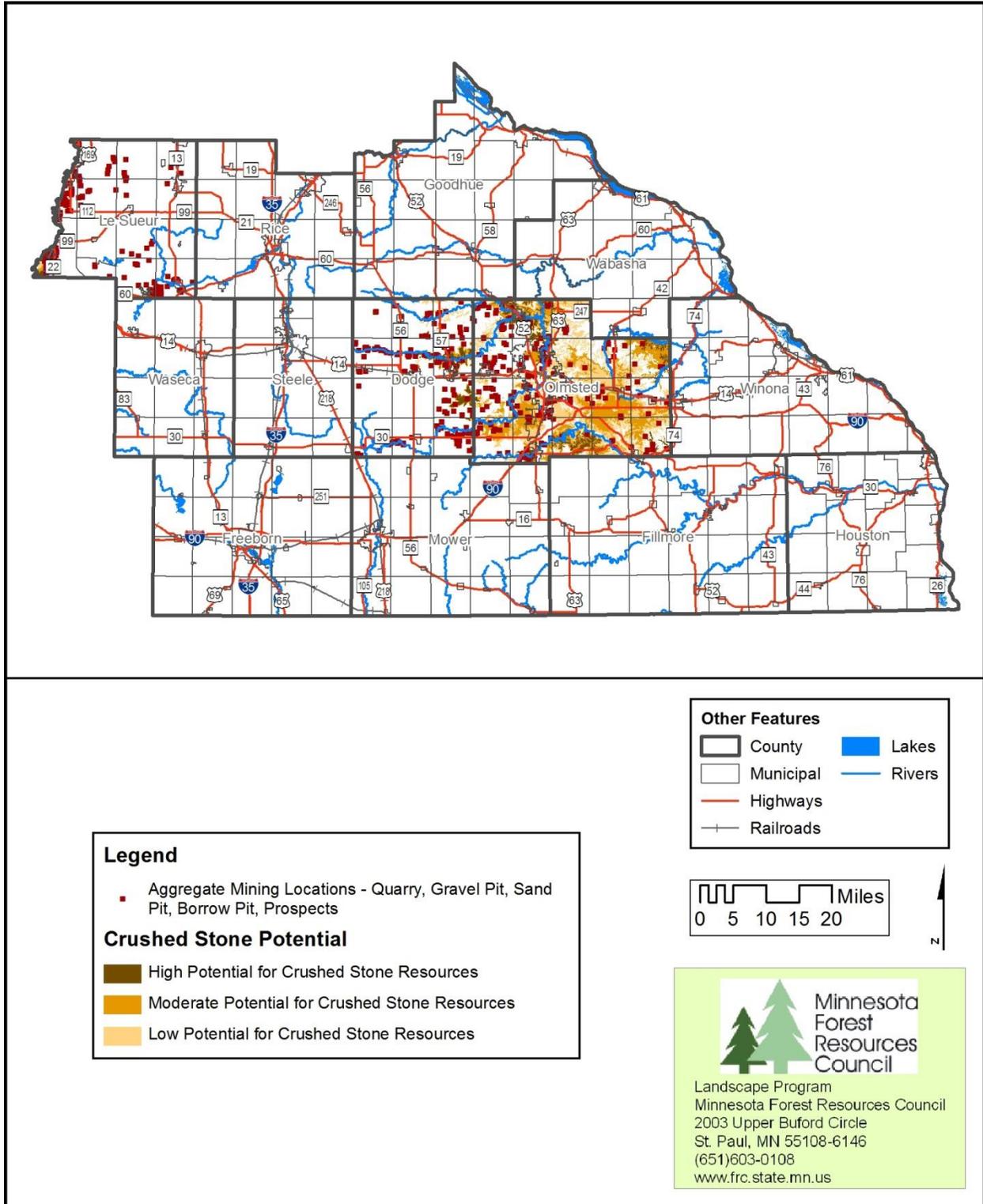
Source: MN DNR Division of Lands & Minerals and Minnesota Geological Survey

Table 61: Resource Potential for mining aggregate crushed stone in Dodge, Le Sueur, and Olmstead Counties.

| <b>County</b>                           | <b>Aggregate Potential</b>                     | <b>Acres</b>   | <b>% of Total</b> |
|---|--|----------------|-------------------|
| Dodge                                   | High Potential for Crushed Stone Resources     | 8,225          | 2.9               |
|   | Moderate Potential for Crushed Stone Resources | 4,878          | 1.7               |
|   | Low Potential for Crushed Stone Resources      | 9,296          | 3.3               |
| Total Crushed Stone Resources Potential |  | 22,398         | 8.0               |
| <b>Total County Area</b>                |  | <b>281,164</b> |                   |
| <b>County</b>                           | <b>Aggregate Potential</b>                     | <b>Acres</b>   | <b>% of Total</b> |
| Le Sueur                                | High Potential for Crushed Stone Resources     | 813            | 0.3               |
|   | Moderate Potential for Crushed Stone Resources | 2,553          | 0.8               |
|   | Low Potential for Crushed Stone Resources      | 1,360          | 0.4               |
| Total Crushed Stone Resources Potential |  | 4,726          | 1.6               |
| <b>Total County Area</b>                |  | <b>303,022</b> |                   |
| <b>County</b>                           | <b>Aggregate Potential</b>                     | <b>Acres</b>   | <b>% of Total</b> |
| Olmsted                                 | High Potential for Crushed Stone Resources     | 25,244         | 6.0               |
|   | Moderate Potential for Crushed Stone Resources | 90,610         | 21.6              |
|   | Low Potential for Crushed Stone Resources      | 113,372        | 27.1              |
| Total Crushed Stone Resources Potential |  | 229,226        | 54.7              |
| <b>Total County Area</b>                |  | <b>418,743</b> |                   |

Source: Minnesota DNR Lands and Minerals, Aggregate Resource Mapping Program

Figure 38: Mining locations and resource potential for mining aggregate crushed stone in Dodge, Le Sueur, and Olmstead Counties.



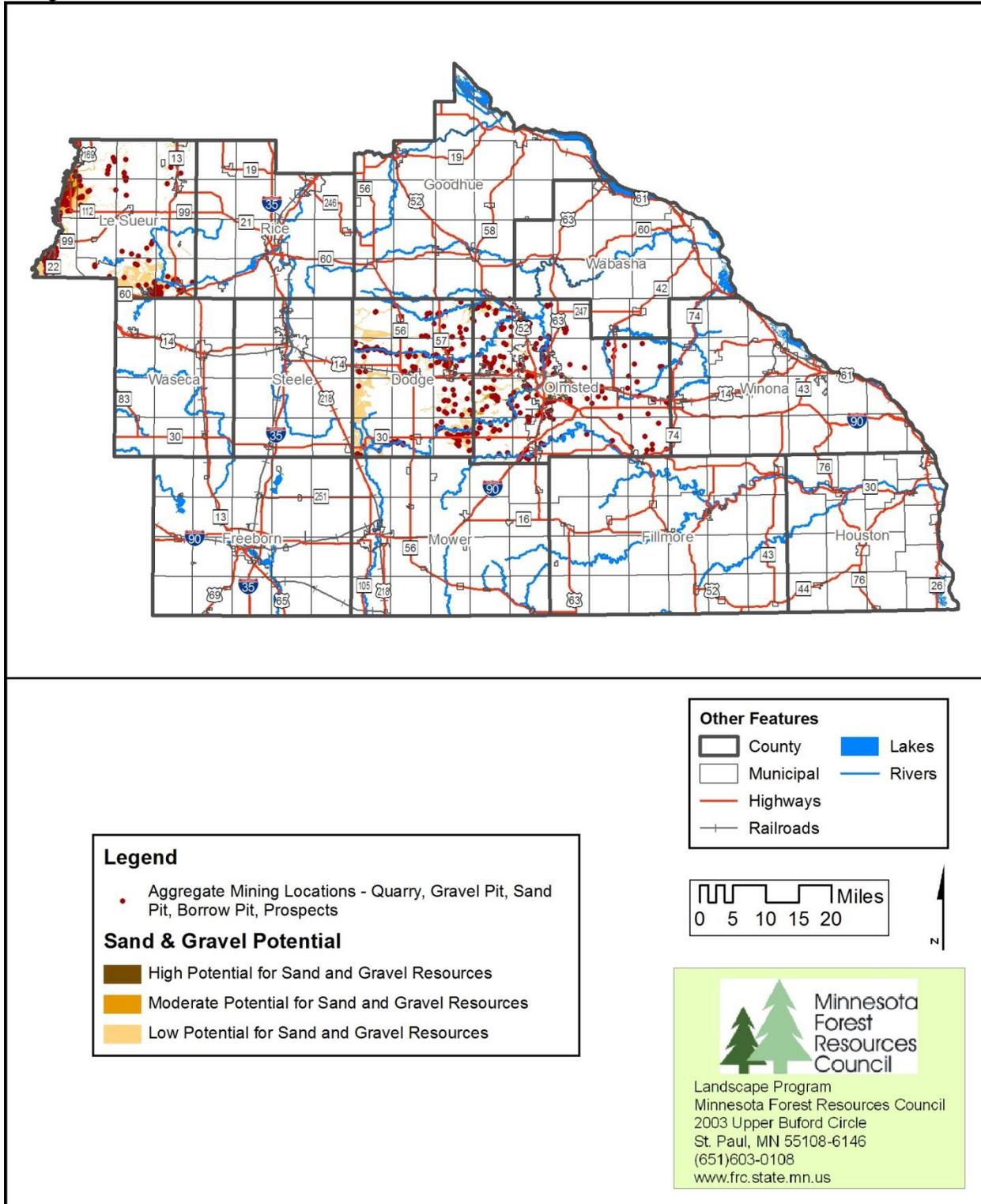
Source: Minnesota DNR Lands and Minerals, Aggregate Resource Mapping Program

Table 62: Resource potential for mining aggregate sand and gravel in Dodge, Le Sueur, and Olmstead Counties.

| <b>County</b>                             | <b>Aggregate Potential</b>                       | <b>Acres</b>   | <b>% of Total</b> |
|---|--|----------------|-------------------|
| Dodge                                     | High Potential for Sand and Gravel Resources     | 1,813          | 0.6               |
|   | Moderate Potential for Sand and Gravel Resources | 3,219          | 1.1               |
|   | Low Potential for Sand and Gravel Resources      | 46,507         | 16.5              |
| Total Sand and Gravel Resources Potential |  | 51,539         | 18.3              |
| <b>Total County Area</b>                  |  | <b>281,164</b> |                   |
| <b>County</b>                             | <b>Aggregate Potential</b>                       | <b>Acres</b>   | <b>% of Total</b> |
| Le Sueur                                  | High Potential for Sand and Gravel Resources     | 4,418          | 1.5               |
|   | Moderate Potential for Sand and Gravel Resources | 7,878          | 2.6               |
|   | Low Potential for Sand and Gravel Resources      | 37,966         | 12.5              |
| Total Sand and Gravel Resources Potential |  | 50,263         | 16.6              |
| <b>Total County Area</b>                  |  | <b>303,022</b> |                   |
| <b>County</b>                             | <b>Aggregate Potential</b>                       | <b>Acres</b>   | <b>% of Total</b> |
| Olmsted                                   | High Potential for Sand and Gravel Resources     | 8,633          | 2.1               |
|   | Moderate Potential for Sand and Gravel Resources | 10,087         | 2.4               |
|   | Low Potential for Sand and Gravel Resources      | 21,127         | 5.0               |
| Total Sand and Gravel Resources Potential |  | 39,847         | 9.5               |
| <b>Total County Area</b>                  |  | <b>418,743</b> |                   |

Source: Minnesota DNR Lands and Minerals, Aggregate Resource Mapping Program

Figure 39: Mining locations and resource potential for mining aggregate sand and gravel in Dodge, Le Sueur, and Olmstead Counties.



Source: Minnesota DNR Lands and Minerals, Aggregate Resource Mapping Program

Table 63: Aggregate Mining Locations. in Dodge, Le Sueur, and Olmstead Counties

| County                                  | Aggregate Mining Locations |
|---|----------------------------|
| Dodge                                   | 169                        |
| Le Sueur                                | 326                        |
| Olmsted                                 | 270                        |
| <b>Total Recorded Pits and Quarries</b> | <b>765</b>                 |

Source: Minnesota DNR Lands and Minerals, Aggregate Resource Mapping Program

#### 4.4 Recreation

##### Section 4.4.1: Participation and Economic Impact

Data on recreation activity preferences of Minnesotans was not specifically available for the 13-county Southeast Landscape; however, data was available for a broader 38-county South Region as defined in the 2004 Outdoor Recreation Participation Survey of Minnesotans. The top three most popular outdoor activities among South Region citizens were walking/hiking, boating (including fishing from boats), and swimming (Table 64).

The Leisure and Hospitality Industry in the Southeast Landscape is a nearly \$1 billion industry that employs over 21,000 people (Table 65). These numbers encompass accommodations, food and drink places, and arts, entertainment, and recreation. Olmsted County makes up the largest portion of this industry, with nearly \$400 million in gross sales in 2012 and nearly 8,000 jobs. The next three top grossing counties in the region are Rice, Winona, and Goodhue. Winona County employs over 100 more jobs than Rice County, despite lower overall gross sales.

According to Explore Minnesota, Whitewater State Park was the most popular tourism attraction in the Southern region and 23<sup>rd</sup> ranking attraction in the state in 2010 (of attractions that monitored and reported attendance to Explore Minnesota that year), with 256,218 visitors<sup>1</sup>.

<sup>1</sup>Source: Explore Minnesota. 2012. "PRELIMINARY Top Minnesota Attractions by Region, 2010." [www.exploreminnesota.com](http://www.exploreminnesota.com)

Table 64: Recreation Activity Participation by South Region (see note)

| Activity   | Participation (%) |
|--|-------------------|
| Walking/hiking   | 51                |
| Boating of all types, including fishing from a boat          | 40                |
| Swimming or wading (all places)                              | 38                |
| Driving for pleasure on scenic roads or in a park            | 35                |
| Picnicking   | 35                |
| Fishing of all types   | 30                |
| Biking (bicycling of all types, including mountain biking)   | 26                |
| Camping of all types   | 22                |
| Visiting nature centers                                      | 25                |
| Nature observation of all types (e.g., viewing, identifying) | 23                |

|  |    |
|--|----|
| Golfing  | 21 |
| Outdoor field sports (e.g., soccer, softball/baseball, football) | 19 |
| Visiting historic or archaeological sites                        | 18 |
| Sledding and snow tubing   | 16 |
| Outdoor court sports (e.g., volleyball, basketball, tennis)      | 16 |
| Hunting of all types   | 14 |
| Running or jogging   | 13 |
| Snowmobiling   | 10 |
| Off-road ATV driving   | 9  |
| Downhill skiing/snowboarding                                     | 9  |
| Gather mushrooms, berries, or other wild foods                   | 7  |
| Inline skating, rollerblading, roller skating, roller skiing     | 6  |
| Horseback riding   | 5  |
| Ice skating/hockey outdoors                                      | 4  |
| Cross country skiing   | 4  |
| Snowshoeing  | 3  |

**Notes:** Data based on population 20 years of age and older. The South Region, as defined by this study, consists of 38 Minnesota counties to the south and west of the Metro area, including the 13 counties in the MFRC Southeast Landscape. It should be noted that Minnesota citizens in the southwest portion of the state may value very different recreation activities than those in the southeast.

**Source:** Kelly, T. (2005). 2004 Outdoor Recreation Participation Survey of Minnesotans: Report on Findings. Saint Paul, MN: Minnesota Department of Natural Resources, Office of Management and Budget Services. In Davenport, M, I. Schneider, A. Date, and L. Filter. 2010. Minnesota's Network of Parks and Trails, An Inventory of Recreation Experience Opportunities in Minnesota: South Region Profile. University of Minnesota, College of Design. Available online at: [http://ccl.design.umn.edu/documents/SouthRegionRecreationInventory05-26-10forweb\\_000.pdf](http://ccl.design.umn.edu/documents/SouthRegionRecreationInventory05-26-10forweb_000.pdf).

Table 65: The Southeast Landscape’s Leisure and Hospitality Industry, 2012.

| County                           | Gross Sales          | Sales Tax           | Private Sector Employment |
|----------------------------------|----------------------|---------------------|---------------------------|
| Dodge                            | \$10,603,708         | \$748,724           | 402                       |
| Fillmore                         | \$20,503,063         | \$1,444,022         | 578                       |
| Freeborn                         | \$42,175,002         | \$2,830,232         | 1,092                     |
| Goodhue                          | \$69,132,826         | \$4,750,638         | 1,733                     |
| Houston                          | \$9,754,403          | \$694,858           | 275                       |
| Le Sueur                         | \$24,367,527         | \$1,550,019         | 613                       |
| Mower                            | \$56,191,224         | \$3,363,419         | 1,306                     |
| Olmsted                          | \$396,425,482        | \$26,354,806        | 7,982                     |
| Rice                             | \$139,958,353        | \$6,025,710         | 2,333                     |
| Steele                           | \$61,538,609         | \$4,121,598         | 1,401                     |
| Wabasha                          | \$25,620,714         | \$1,718,486         | 777                       |
| Waseca                           | \$14,349,281         | \$907,047           | 388                       |
| Winona                           | \$93,844,551         | \$6,407,935         | 2,448                     |
| <b>Total Southeast Landscape</b> | <b>\$964,464,743</b> | <b>\$60,917,494</b> | <b>21,328</b>             |

**Note:** The Leisure and Hospitality industry consists of Accommodations; Food Services and Drinking Places; and Arts, Entertainment and Recreation.

**Sources:** Minnesota Department of Revenue; Minnesota Department of Employment and Economic Development. In Explore Minnesota Tourism. 2014. Tourism and Minnesota's Economy factsheet. Available online at: <http://www.exploreminnesota.com/industry-minnesota/research-reports/researchdetails/index.aspx?nid=135>.

#### *Section 4.4.2: Fish and Wildlife-based Recreation*

A Creel Survey performed in the summer of 2005 by the MN DNR identified a variety of metrics related to trout fishing in southeast Minnesota:

“Thirty-three trout streams were surveyed from April 1 to September 30, 2005 throughout southeast Minnesota in a roving creel survey. Anglers were interviewed, counted, and given a post-card to return indicating total hours fished. Anglers consisted of mostly males (90.2%) using a variety of bait (37.0%), fly (35.3%), lure (20.7%), and mixed method (7.0%) gear types. Mean angler trip length was calculated as 3.77 hours with a catch rate of 1.10 trout/hour. An estimated 214,307 trout were caught in 52,687 angler trips totaling 190,859 angler-hours. Angler harvest rates were 17.3% for brown trout and 34.4% for rainbow trout.”<sup>2</sup>

Further, the survey identified the vast majority of anglers as Minnesotan residents:

“Minnesota residents consisted of 90.6% of anglers interviewed, while Wisconsin and Iowa residents consisted of 3.9 and 0.9% of anglers, respectively. About 40% of anglers traveled 50 miles or less to fish, while about 20% drove between 50 and 100 miles.” “Local” anglers were defined as those living in the eleven counties in our management area (Fillmore, Goodhue, Houston, Olmsted, Rice, Wabasha, Winona, Dodge, Freeborn, Mower, and Steele) and were 52.3% of anglers interviewed. “Metro” anglers were defined as those living in the seven counties surrounding Minneapolis/St Paul (Dakota, Ramsey, Washington, Anoka, Scott, Carver, and Hennepin). Those anglers consisted of approximately 31.1% of anglers interviewed.”<sup>2</sup>

According to a 2008 study by North Star Economics and Trout Unlimited, the total economic impact of trout anglers in the Driftless Area may be as much as \$210 per outing for residents and \$392 per outing for non-residents (Table 66). Non-residents spend more than residents in all areas (restaurants, entertainment, guiding services, lodging, etc.) except actual fishing supplies, suggesting that angling may be part of overall vacation plans for non-resident anglers.

Total harvest of deer in the Southeast Landscape decreased between 2003 and 2013; this may be reflective of changes in harvest regulations rather than deer population numbers (Table 67). Population models for designated permit areas (DPAs) show relatively stable deer populations in the region between 2008 and 2013, having decreased somewhat in DPAs that had the highest deer densities in 2008 (Table 68).

A survey of 2,312 landowners (with 40 acres or more) in Goodhue, Wabasha, Houston, and Winona counties found that respondents estimated a total of over \$3.5 million worth of damage - the majority of this to corn - from deer in 2011 and attributed 40% of total crop damage that year to deer. The majority of respondents did not perceive a change in amount of damage from deer compared to 5 years prior to the survey. Over 60% of the respondents reported hunting deer in the recent seasons; most of these hunted on their own land. 88% allowed hunting on their

land, most commonly to friend or neighbors (77%), or family (74%). While the highest percentage of respondents in both the hunting and non-hunting strata felt that deer populations were “about right” around their property, landowners who do not hunt were more likely to report that numbers were “too high” (45%) than those who do hunt (23%) (Table 69).

Based on car counts within the Whitewater Wildlife Management Area on opening day of the first and second deer seasons, deer hunting pressure fluctuated somewhat between 1979 and 2000, then decreased gradually until 2010 and 2011, which saw an increase in visitors on those opening days (Table 70). However, the increase was mostly for the opening day of the first (or “buck”) season; visits during the opening day of the second (or “doe”) season have generally decreased gradually since 1979 (J. Cole, personal communication).

<sup>2</sup> Source: Snook, V.A. and D. J. Dieterman. 2006. A Roving Creel Survey of Selected Southeast Minnesota Trout Streams – 2005. Minnesota Department of Natural Resources, report: F-29-R(P)-25. Available online at: [http://files.dnr.state.mn.us/areas/fisheries/lanesboro/Creel\\_Report\\_Final\\_7\\_25\\_06.pdf](http://files.dnr.state.mn.us/areas/fisheries/lanesboro/Creel_Report_Final_7_25_06.pdf).

Table 66: Average Spending Per Outing by Driftless Area Anglers\*

|                             | Resident Anglers | Non-resident anglers |
|-----------------------------|------------------|----------------------|
| Fishing Supplies            | \$43.22          | \$31.84              |
| Guiding Services            | \$13.93          | \$37.37              |
| Restaurants / Bars          | \$39.73          | \$86.76              |
| Amusements / Entertainment  | \$5.78           | \$9.58               |
| Auto-related Expenses       | \$47.08          | \$60.77              |
| Lodging                     | \$20.75          | \$112.54             |
| Groceries                   | \$32.29          | \$40.89              |
| Souvenirs / Gifts / Apparel | \$3.65           | \$8.57               |
| Other                       | \$3.07           | \$3.55               |
| <b>Total Per Outing</b>     | <b>\$209.50</b>  | <b>\$391.88</b>      |

Source: North Star Economics, Inc. and Trout Unlimited. 2008. "The Economic Impact of Recreational Trout Angling in the Driftless Area," p. 4.

\*Due to rounding, the sums and products of the numbers shown in these tables may not appear to exactly equal the totals. However, these totals are correct and are based upon the calculation of the precise mean spending figures.

Table 67: Total Deer Harvest by Designated Permit Area (DPA) for all permit areas in the Southeast Landscape\*, 2003 and 2013.

| DPA     | 2003  | 2013  |
|---------|-------|-------|
| 461/292 | 1,213 | 991   |
| 463/230 | 541   | 561   |
| 466/254 | 1,311 | 1,228 |
| 464/232 | 591   | 622   |
| 462/293 | 1,296 | 1,312 |
| 465/233 | 622   | 520   |

|              |               |              |
|--------------|---------------|--------------|
| 467/255      | 1,451         | 1,072        |
| 341          | 2,351         | 1,735        |
| 343          | 2,429         | 1,602        |
| 347          | 1,831         | 1,293        |
| 342          | 1,788         | 1,762        |
| 344          | 1,205         | 1,008        |
| 345          | 1,334         | 1,067        |
| 348          | 2,137         | 1,638        |
| 346          | 2,687         | 2,515        |
| 349          | 3,447         | 2,988        |
| 602          | -             | 1,345        |
| <b>Total</b> | <b>26,234</b> | <b>23259</b> |

\* Notes: All designated permit areas that were at least 50% within the 13-county Southeast Landscape. Permit area numbers changed between 2003 and 2013 for 7 areas, but boundaries of these areas did not change.

Source: MN DNR. "Minnesota Deer Harvest Report" 2003 and 2013. Division of Fish and Wildlife.

Table 68: Pre-fawn deer density (deer/mi<sup>2</sup>) as simulated from population modeling in each designated permit area (DPA) in Minnesota, 2008-2013.

| DPA | Area (mi <sup>2</sup> ) | Pre-fawn density |      |      |      |      |      |
|-----|-------------------------|------------------|------|------|------|------|------|
|     |                         | 2008             | 2009 | 2010 | 2011 | 2012 | 2013 |
| 230 | 453                     | 3                | 3    | 3    | 4    | 3    | 4    |
| 232 | 377                     | 5                | 4    | 4    | 4    | 5    | 5    |
| 233 | 390                     | 4                | 4    | 4    | 4    | 5    | 5    |
| 254 | 931                     | 3                | 3    | 3    | 3    | 3    | 3    |
| 255 | 774                     | 3                | 3    | 3    | 3    | 3    | 4    |
| 292 | 481                     | 8                | 7    | 7    | 6    | 6    | 6    |
| 293 | 506                     | 7                | 7    | 7    | 7    | 7    | 7    |
| 341 | 596                     | 10               | 10   | 10   | 10   | 11   | 12   |
| 342 | 352                     | 13               | 13   | 14   | 14   | 14   | 14   |
| 343 | 663                     | 11               | 11   | 10   | 10   | 10   | 11   |
| 345 | 326                     | 10               | 9    | 8    | 8    | 9    | 10   |
| 346 | 319                     | 21               | 20   | 19   | 19   | 17   | 16   |
| 347 | 434                     | 9                | 8    | 7    | 8    | 8    | 8    |
| 348 | 332                     | 18               | 15   | 14   | 14   | 14   | 14   |
| 349 | 492                     | 22               | 21   | 20   | 19   | 19   | 18   |

Source: Grund, Marrett. 2013. "Monitoring Population Trends of White-tailed Deer in Minnesota - 2013." MN DNR, Farmland Wildlife Populations and Research Group.

Table 69: Perception of deer population around property and surrounding area: Comparison of landowners\* who hunt deer and do not hunt deer.

| Strata    | n    | Too high | About right | Too low |
|-----------|------|----------|-------------|---------|
| Hunt deer | 1281 | 23.20%   | 55.40%      | 21.40%  |

|                         |     |                            |        |       |
|-------------------------|-----|----------------------------|--------|-------|
| <b>Do not hunt deer</b> | 722 | 44.70%                     | 49.00% | 6.20% |
|                         |     | Chi-Sq = 139.45, P < 0.001 |        |       |

**Notes:** n = 2,312 survey of landowners in Goodhue, Wabasha, Houston, and Winona counties with 40 or more acres.

**Source:** Table taken directly from Pradhananga, A., Davenport, M., & Cornicelli, L. (2013). 2013 survey of deer management on private lands in southeast Minnesota. University of Minnesota, Minnesota Cooperative Fish and Wildlife Research Unit, Department of Fisheries, Wildlife, and Conservation Biology and Department of Forest Resources.

Table 70: Car counts on opening day of different deer hunting seasons in the Whitewater Wildlife Management Area, 1979-2011.

|      | 1st Season (Buck) | 2nd Season (Doe) | Muzzleloader |
|------|-------------------|------------------|--------------|
| 1979 | 1000              | 1500             | 580          |
| 1980 | 825               | 1500             | 517          |
| 1981 | 972               | 1085             | 385          |
| 1982 | 1113              | 1350             | 405          |
| 1983 | 1030              | 1280             | 347          |
| 1984 | 970               | 1222             | 525          |
| 1985 | 1072              | 1162             | 265          |
| 1986 | 1205              | 1202             | 265          |
| 1987 | 1325              | 1215             | 350          |
| 1988 | 1287              | 1017             | 267          |
| 1989 | 1062              | 1005             | NS           |
| 1990 | 1107              | 1045             | 282          |
| 1991 | 1037              | 905              | 80           |
| 1992 | 1220              | 1270             | 248          |
| 1993 | 1072              | 1160             | 195          |
| 1994 | 1285              | 1320             | 153          |
| 1995 | 1105              | 1237             | 132          |
| 1996 | 1325              | 1135             | NS           |
| 1997 | 1305              | 1237             | NS           |
| 1998 | 1198              | 1293             | NS           |
| 1999 | 1270              | 1210             | NS           |
| 2000 | 1145              | 970              | NS           |
| 2001 | 1078              | 1043             | NS           |
| 2002 | 1038              | 845              | NS           |
| 2003 | 965               | 867              | NS           |
| 2004 | NS                | NS               | NS           |
| 2005 | 1020              | 520              | NS           |
| 2006 | 1085              | 622              | NS           |
| 2007 | 1070              | 497              | NS           |

|      |      |     |    |
|------|------|-----|----|
| 2008 | 1150 | 505 | NS |
| 2009 | 1218 | 485 | NS |
| 2010 | 1480 | 525 | NS |
| 2011 | 1450 | 503 | NS |

**Note:** NS = Not Surveyed

**Source:** Jon Cole, Whitewater Wildlife Management Area Manager, personal communication. Feb. 6, 2014.

## 4.5 Roads and Trails

This section provides information on the length, distribution, and usage of roads and trails statewide as well as those specifically within the 13-county MFRC Southeast Landscape.

### 4.5.1 Roads

Table 71 shows the total mileage of roads in Minnesota from 1989-2005. Table 72 shows the general breakdown of these roads with the majority being town roads and county highways. Historic road mileage summaries not available by county. An average net gain of 162 miles per year was added to Minnesota roads annually from 1989 to 2005 with an overall increase of 2,594 miles.

Nearly 12 million vehicles travel along southeast Minnesota roads every day (Table 73). Approximately 450,000 of these vehicles, or nearly 1 out of every 25 (3.8%), are considered “heavy commercial” (Table 74). As would be expected, heaviest annual average daily traffic (AADT) centers around and flows through major city centers, e.g. Rochester, Owatonna, Faribault (Figure 40). Heavy commercial daily traffic (HCDT) tends not to cluster around city centers, but does flow through them via the major highways and interstates (Figure 41). Though AADT is heavy along Highway 61, which follows the Mississippi River and travels through the Blufflands, HCDT is somewhat lighter along this highway.

There are over 7800 miles of roads in the Southeast Landscape, and vehicles travel an average of over 22.5 million miles along these roads every day (Table 75, Figure 42). Measurements of heavy commercial vehicle mileage in the region is restricted to interstates and United States and Minnesota highways (approximately 2050 miles of road); despite making up on 3.8% of the vehicle traffic, heavy commercial vehicles average over 2 million miles per day along these roads, or 8.8% of the total daily miles travelled (Table 76, Figure 43). For information on the functional classes of these roads, see Table 77 and Figure 44.

**Table 71:** Minnesota statewide road mileage, 1989-2005.

| Year | Mileage |
|------|---------|
| 1989 | 132,697 |
| 1995 | 133,710 |
| 1999 | 134,337 |
| 2005 | 135,291 |

**Source:** Minnesota Department of Transportation.

**Table 72:** Minnesota statewide road mileage by road type, June 2005.

|                      | <b>Road type</b>               | <b>Miles</b>   |
|----------------------|--------------------------------|----------------|
| State trunk highways | Interstate highways            | 914            |
|                      | Other trunk highways           | 10,983         |
|                      | Total state trunk highways     | 11,897         |
| County highways      | County state-aid highways      | 30,459         |
|                      | Other county highways          | 14,752         |
|                      | Total county highways          | 45,211         |
| City streets         | Municipal state-aid streets    | 2,970          |
|                      | Other city streets             | 16,005         |
|                      | Total city streets             | 18,975         |
| Town roads           | Town roads                     | 54,785         |
| Other roads          | Roads in unorganized townships | 1,300          |
|                      | State & U. S. forest roads     | 2,379          |
|                      | Indian reservations            | 383            |
|                      | Other                          | 361            |
|                      | Total other roads              | 4,423          |
| <b>State Total</b>   |                                | <b>135,291</b> |

**Source:** Minnesota House of Representatives Research Department.

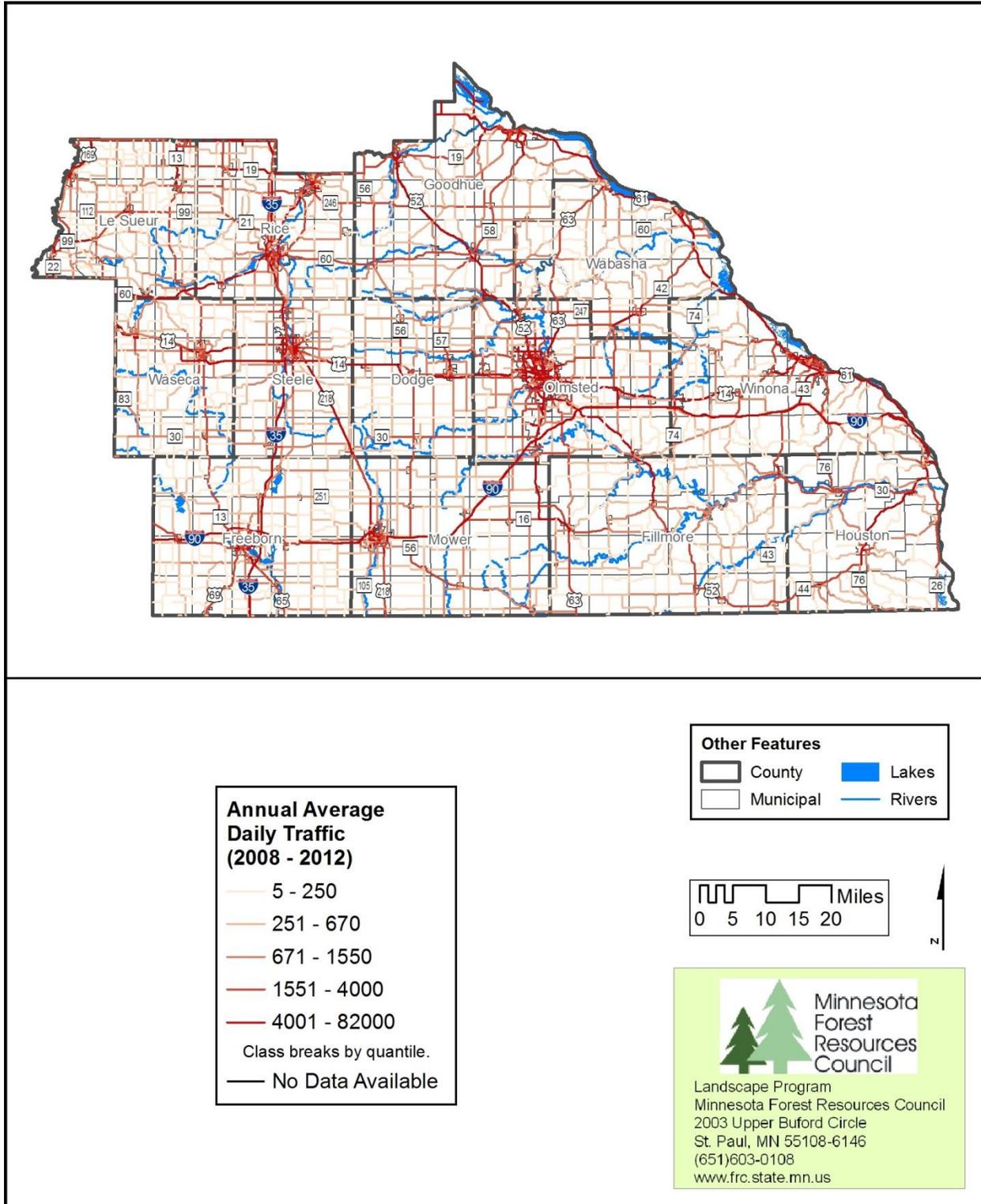
**Table 73:** Annual average daily traffic on selected highways in the Southeast Landscape (2008-2012).

| <b>Route Type</b>          | <b>Annual Average Daily Traffic</b> |
|----------------------------|-------------------------------------|
| Interstate                 | 1,063,200                           |
| US Highway                 | 2,772,700                           |
| MN Highway                 | 1,556,330                           |
| County State Aid Highway   | 2,857,645                           |
| Municipal State Aid Street | 3,198,815                           |
| County Road                | 294,810                             |
| Township Road              | 13,615                              |
| Municipal Street           | 89,410                              |
| <b>Total</b>               | <b>11,846,525</b>                   |

**Source:** Minnesota Department of Transportation.

Note: Annual Average Daily Traffic (AADT) is the number of vehicles that travel a section of road per day (averaged for 365 days in one year). MNDOT measures traffic for road sections every 2-4 years. Note that AADT is per section of road. If more sections of road exist for a Route Type, more AADT will be reported for that Route Type in the table above. For a normalized comparison of the amount of traffic on each route type, refer to the Annual Average Daily Vehicle Miles Traveled.

**Figure 40:** Annual average daily traffic on selected highways in the Southeast Landscape (2008-2012).



**Source:** Minnesota Department of Transportation.

Note: Reported value represents a mean of all sampling points along the road and data only represents traffic on these roads within the thirteen-county area.

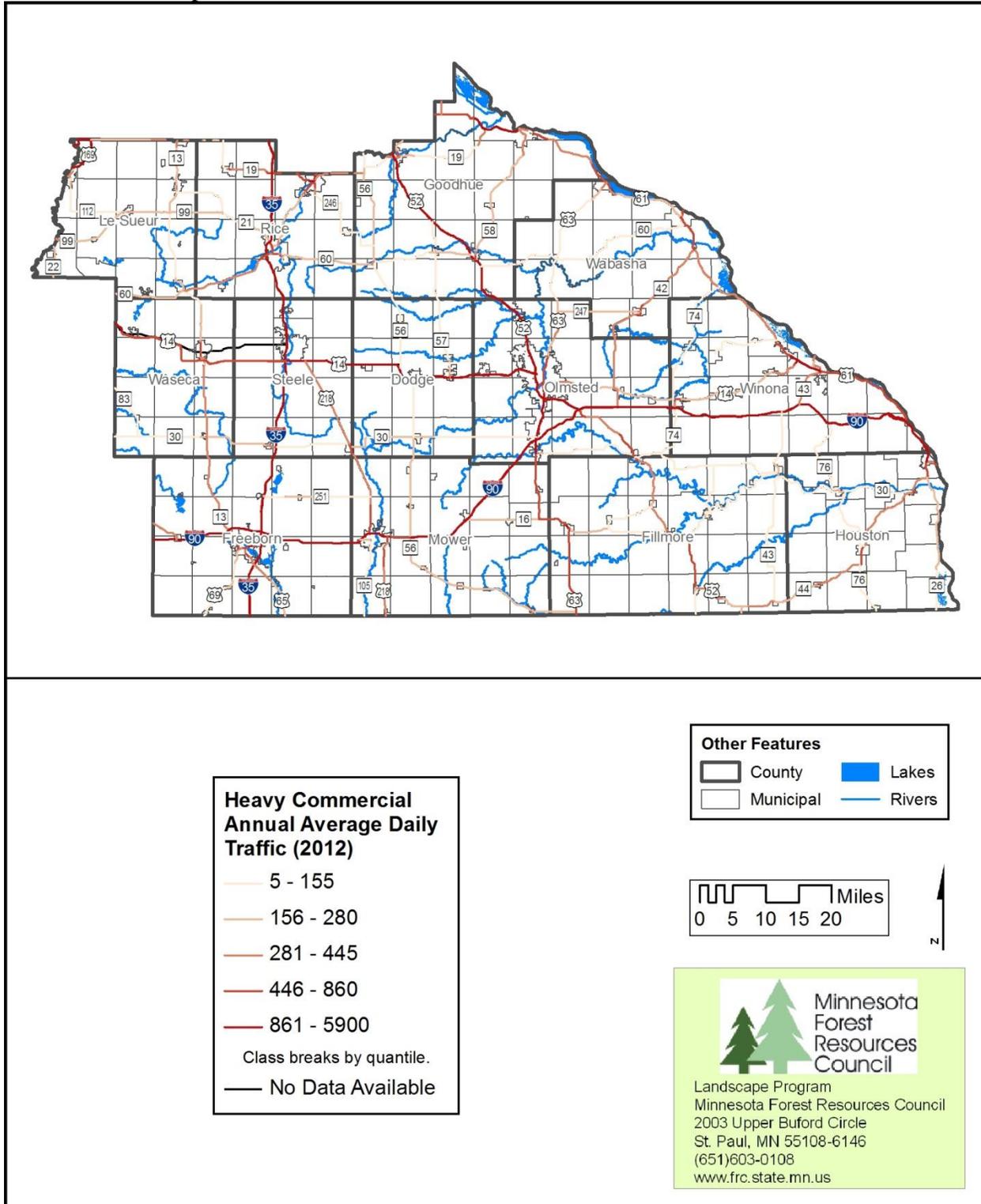
**Table 74:** Heavy commercial annual average daily traffic on selected highways in the Southeast Landscape (2012).

| Route Type   |  | Heavy Commercial Annual Average Daily Traffic |
|--------------|--|---|
| Interstate   |  | 160,880                                       |
| US Highway   |  | 182,955                                       |
| MN Highway   |  | 104,960                                       |
| <b>Total</b> |  | <b>448,795</b>                                |

**Source:** Minnesota Department of Transportation.

Note: Heavy Commercial Annual Average Daily Traffic (HCAADT) is the number of trucks with at least 2 axles and 6 tires that travel a section of road per day (averaged for 365 days in one year). MNDOT measures traffic for road sections every 2-4 years. Note that HCAADT is per section of road. If more sections of road exist for a Route Type, more HCAADT will be reported for that Route Type in the table above. For a normalized comparison of the amount of traffic on each route type, refer to the Heavy Commercial Annual Average Daily Vehicle Miles Traveled map.

**Figure 41:** Heavy commercial annual average daily traffic on selected highways in the Southeast Landscape (2012).



Source: Minnesota Department of Transportation.

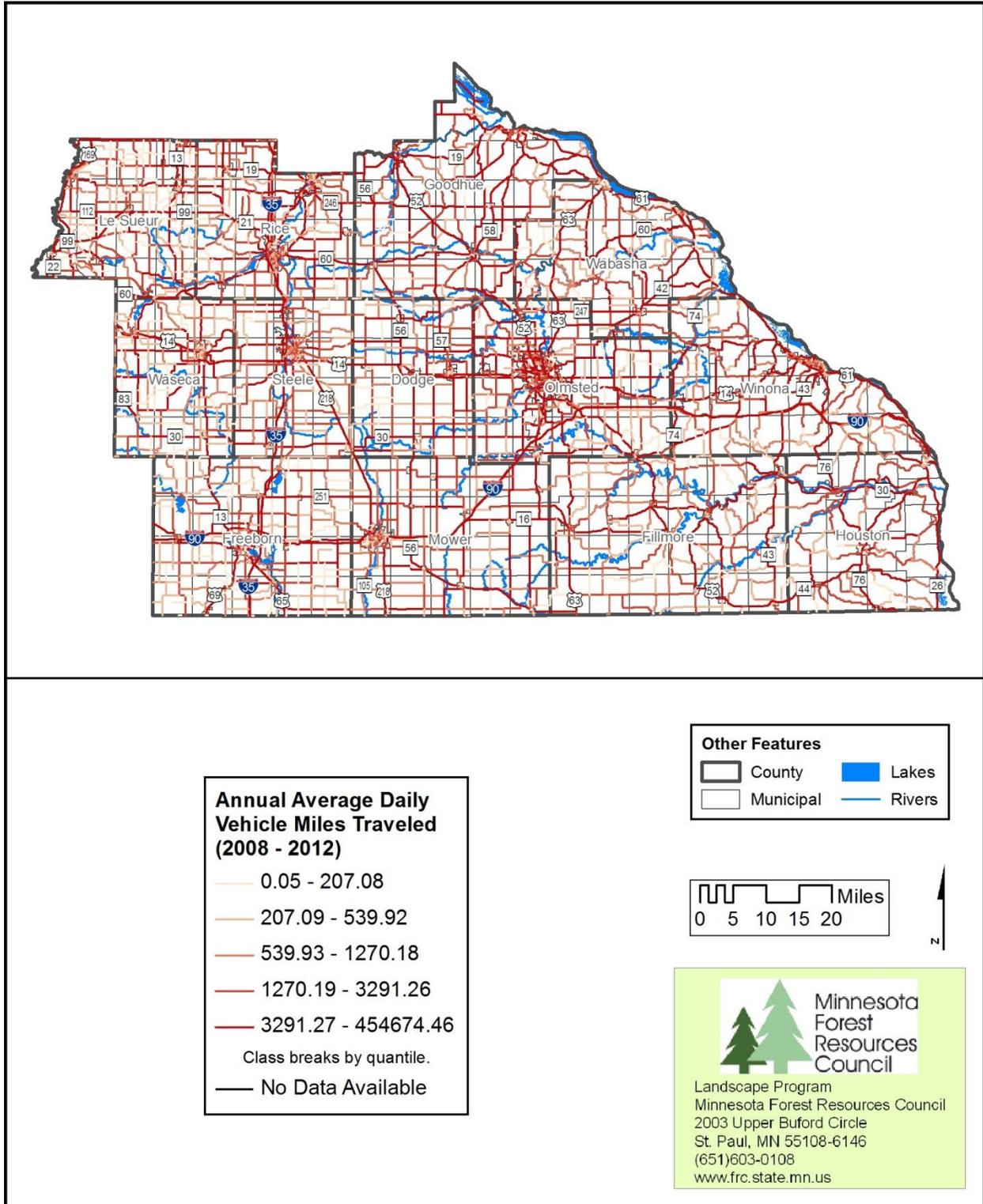
**Table 75:** Annual average daily vehicle miles travelled in the MFRC Southeast Landscape (2012).

| <b>Route Type</b>          | <b>Length (miles)</b> | <b>Annual Average Daily Vehicle Miles Traveled</b> |
|----------------------------|-----------------------|--|
| Interstate                 | 415.2                 | 7,048,944  |
| US Highway                 | 688.2                 | 7,808,147  |
| MN Highway                 | 961.9                 | 2,588,087  |
| County State Aid Highway   | 4039.8                | 3,638,322  |
| Municipal State Aid Street | 296.0                 | 1,227,592  |
| County Road                | 1381.1                | 350,190  |
| Township Road              | 18.9                  | 13,356   |
| Municipal Street           | 11.5                  | 23,666   |
| <b>Total</b>               | <b>7812.6</b>         | <b>22,698,305</b>                                  |

**Source:** Minnesota Department of Transportation.

Note: Annual Average Daily Vehicle Miles Traveled (AAD VMT) is the number of vehicles that travel a section of road per day (averaged for 365 days in one year) multiplied by the length of the section of road. If 2 vehicles traveled a 2 mile section of road every day over the course of one year, the AAD VMT for that section of road would be 4. The AAD VMT should be used when comparing routes for traffic volume given that it provides a normalized comparison for traffic measurements (the Annual Average Daily Traffic count can be skewed by the presence of multiple sections of a Route Type).

**Figure 42:** Annual average daily vehicle miles travelled in the MFRC Southeast Landscape (2012).



Source: Minnesota Department of Transportation.

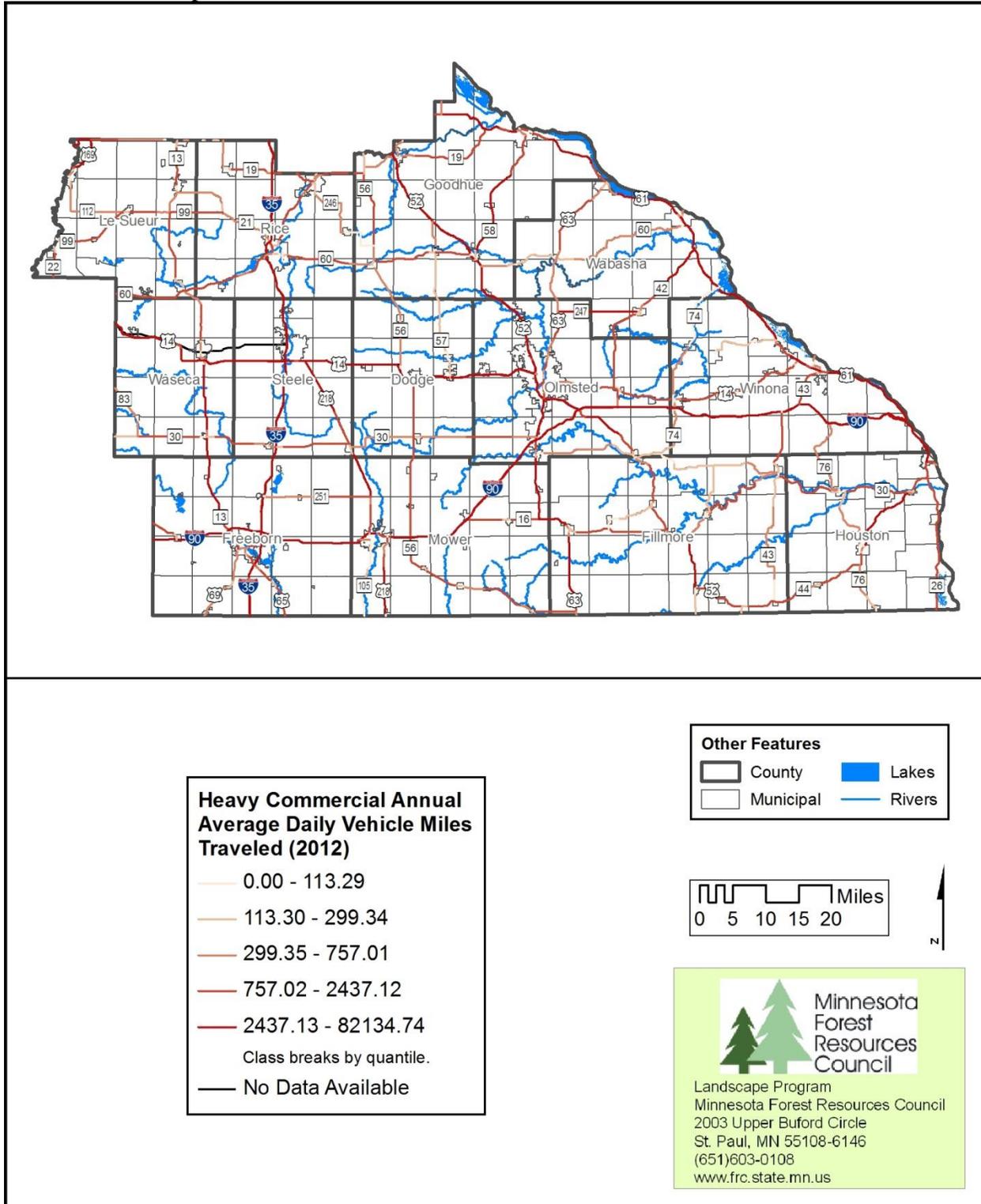
**Table 76:** Heavy commercial annual average daily vehicle miles travelled in the MFRC Southeast Landscape (2012).

| <b>Route Type</b> | <b>Length<br/>(miles)</b> | <b>Heavy Commercial<br/>Annual Average Daily<br/>Vehicle Miles Traveled</b> |
|-------------------|---------------------------|---|
| Interstate        | 415.2                     | 1,200,518   |
| US Highway        | 670.9                     | 611,621   |
| MN Highway        | 961.1                     | 188,034   |
| <b>Total</b>      | <b>2047.3</b>             | <b>2,000,173</b>  |

**Source:** Minnesota Department of Transportation.

Note: Heavy Commercial Annual Average Daily Vehicle Miles Traveled (HCAAD VMT) is the number of trucks with at least 2 axles and 6 tires that travel a section of road per day (averaged for 365 days in one year) multiplied by the length of the section of road. If 2 trucks traveled a 2 mile section of road every day over the course of one year, the HCAAD VMT for that section of road would be 4. The HCAAD VMT should be used when comparing routes for traffic volume given that it provides a normalized comparison for traffic measurements (the Heavy Commercial Annual Average Daily Traffic count can be skewed by the presence of multiple sections of a Route Type).

**Figure 43:** Heavy commercial annual average daily vehicle miles travelled in the MFRC Southeast Landscape (2012).



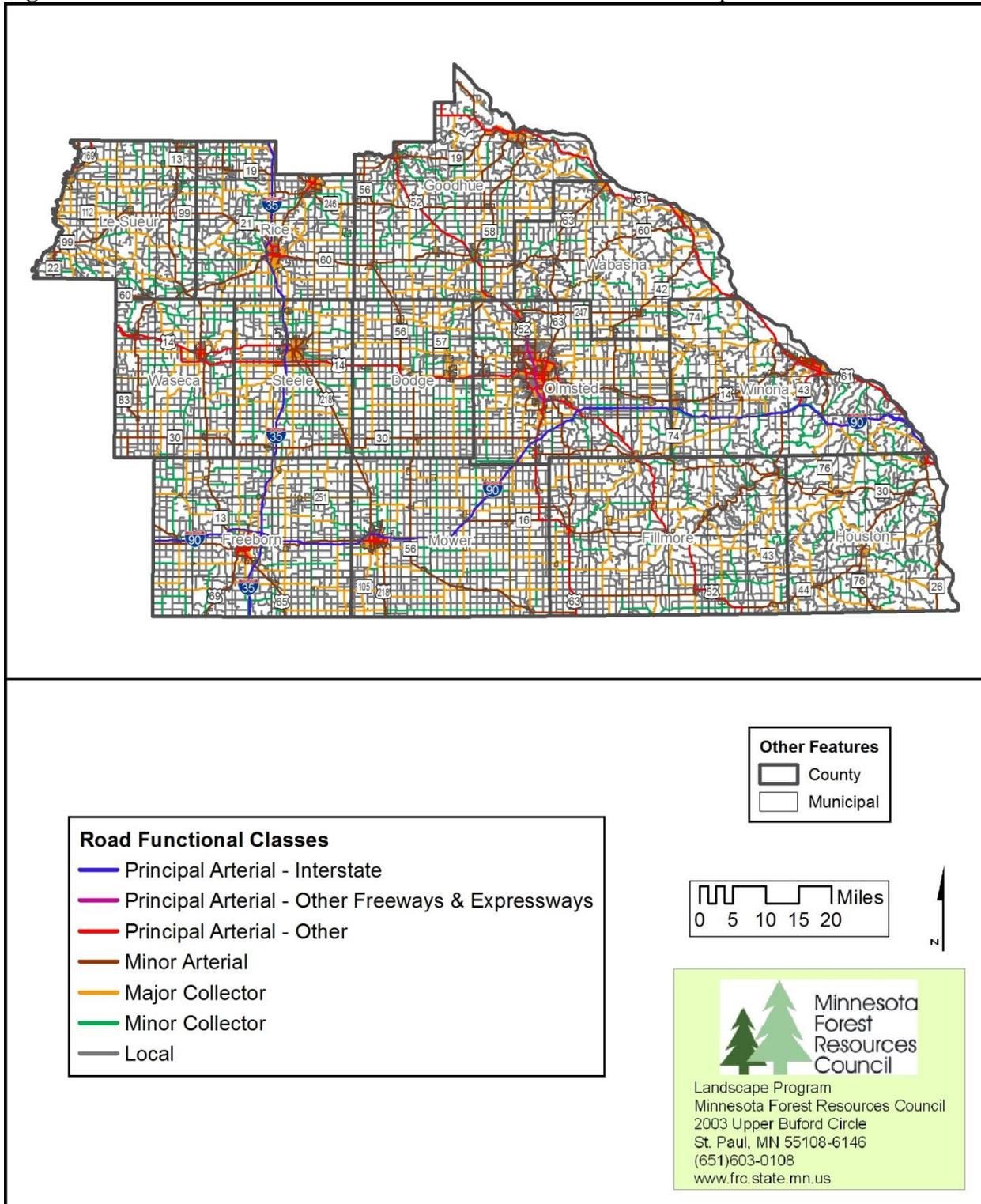
Source: Minnesota Department of Transportation.

**Table 77: Road Functional Classes for the MFRC Southeast Landscape**

| <b>Road Functional Class</b>                      | <b>Miles</b>  |
|---|---------------|
| Principal Arterial - Interstate                   | 415           |
| Principal Arterial - Other Freeways & Expressways | 21            |
| Principal Arterial - Other                        | 639           |
| Minor Arterial                                    | 1,280         |
| <b>Total Arterial</b>                             | <b>2,355</b>  |
| Major Collector                                   | 2,256         |
| Minor Collector                                   | 1,507         |
| <b>Total Collector</b>                            | <b>3,762</b>  |
| Local   | 10,721        |
| <b>Total Local</b>                                | <b>10,721</b> |
| <b>Total Southeast Landscape</b>                  | <b>16,838</b> |

Source: Minnesota Department of Transportation.

**Figure 44:** Road Functional Classes for the MFRC Southeast Landscape



Source: Minnesota Department of Transportation.

#### *4.5.2. Trails*

Snowmobiling trails are the most common trail type in both Minnesota and the Southeast Landscape (Table 78, Figure 45). Hiking trails are also common both state-wide and region-wide. All-terrain vehicle trails, however, while the 3<sup>rd</sup> most common trail type of those queried for Minnesota, made up a smaller percentage of total queried trail miles in southeast Minnesota, suggesting that this activity may be less common there than in other parts of the state.

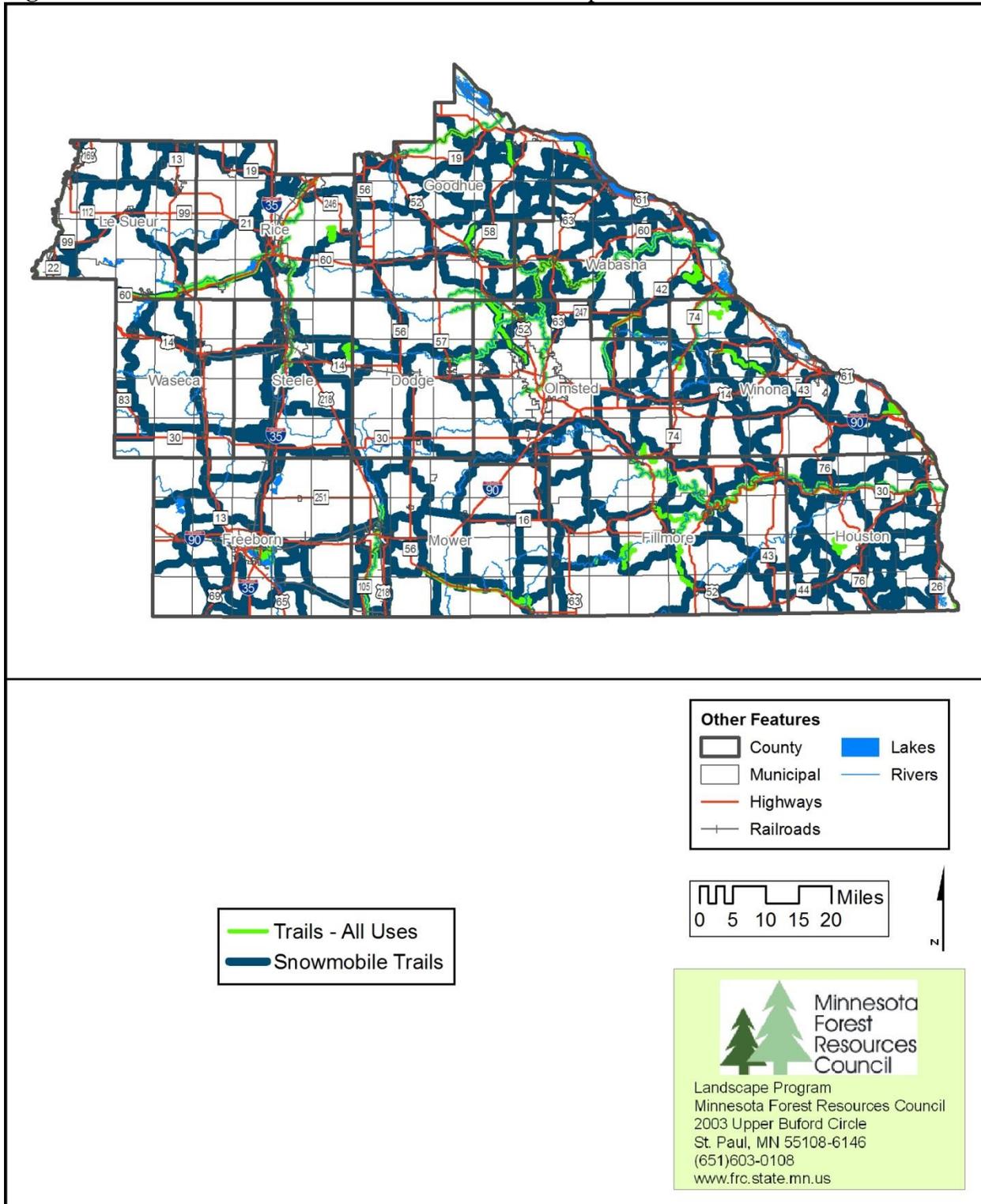
**Table 78:** Length of MN DNR recreational trails in Minnesota and Southeast Landscape.

| Trail Type   | Minnesota miles | SE Miles (rounded)       |
|--|-----------------|--------------------------|
| Snowmobile   | 22,361          | 2,956                    |
| Bicycle  | 698             | 152                      |
| Mountain Bike  | 1,124           | 137                      |
| Hiking   | 2,415           | 360                      |
| Winter Hiking  | 142             | 32                       |
| Horse  | 1,061           | 50                       |
| Cross-country ski  | 993             | 186                      |
| All-Terrain Vehicle (ATV) trails (category includes both Class 1 and Class 2 ATVs) | 1,941           | 52                       |
| Off-Highway Motorcycle (OHM) trails  | 1,496           | 21                       |
| Off-Road Vehicle (ORV) trails  | 458             | 0                        |
| Inline skates  | [not requested] | 151                      |
| Snowshoe   | [not requested] | 1                        |
| Motorized watercraft (water trail)   | [not requested] | 453                      |
| Nonmotorized watercraft (water trail)  | [not requested] | 632                      |
| Skateski   | [not requested] | 3                        |
| <b>Total</b>   | <b>32,689</b>   | <b>3,946<br/>(5,186)</b> |

**Source:** MN DNR Division of Parks and Trails

Note: The mileage value for each trail use was calculated from the subset of trail features that met the conditions of the associated query listed above; therefore each use category is NOT mutually exclusive, since many trails permit more than one use. Therefore, some multiple use trail miles may be counted more than once. Further, this is not an exhaustive list of trail types in Minnesota.

**Figure 45:** Distribution of trails in the Southeast Landscape.



**Source:** Minnesota DNR Data Deli

Notes: Additional trails may exist that are not represented in this data set. Green “All Uses” trails may also include snowmobiling, as the information comes from a separate dataset than the “Snowmobile Trails” dataset.

#### **4.6 Additional Data Needs**

- Further forest products industry data for Southeast MN
- Destination Medical Center information