Minnesota River Basin
TRENDS

Minnesota River near Redwood Falls by Brian Peterson, Star Tribune

Dear Reader

This is the first Minnesota River Trends document. The purpose of this report is to provide a broad overview of trends related to the state of the Minnesota River. It is meant to be easy-to-read overview that summarizes some of the major demographic, land use, water quality, biological and recreational trends in the Minnesota River Basin over the past 10 to 100 years depending on data availability. In a few cases, where an analysis of change over time was not possible, the report includes information on current conditions.

The indicators included in the following report were prioritized by a group of agency representatives and citizens with the hopes of providing some clues of broader ecosystem health across the Minnesota River Basin. What you will discover in this document is a mixed story—research shows some indicators improving, some declining, some static. We hope that this document will provide insight into this dynamic, complex and varied river basin.

The river has been studied extensively and is managed by a number of different agencies and organizations for a variety of purposes. The report draws data from researchers across many diverse fields. Thanks to our many project cooperators (see list on back page). If you want to learn more, a rich resource list used to develop this report is available online http://mrbdc.mnsu.edu/mnbasin/trends

As you will see, many actions and projects have been put in place to try to understand and improve the water quality across the basin. Cleaning up the rivers and lakes in the basin is a complex and challenging endeavor that will take time. Some progress has been made and much still needs to be accomplished. Many diverse groups across the basin are working together to improve ecosystem health for future generations.

We welcome your feedback, please contact us (see below).

Table of Contents

History .....p. 1
Land Use and Demographics .....p. 7
Water Quantity & Quality .....p. 27
Living Resources: Aquatic & Terrestrial Life .....p. 41
River & Lake Focused Recreation .....p. 54
Emerging Trends .....p. 62
Acknowledgements .....p. 64

Kimberly Musser, Scott Kudelka, Richard Moore & Project Partners
Water Resources Center
Minnesota State University, Mankato
184 Trafton Science Center South
Minnesota State University, Mankato
Mankato, MN 56003
507-389-5492

November 2009

Project Partners

Minnesota State University Mankato

Minnesota Pollution Control Agency

The Minnesota River Watershed Alliance

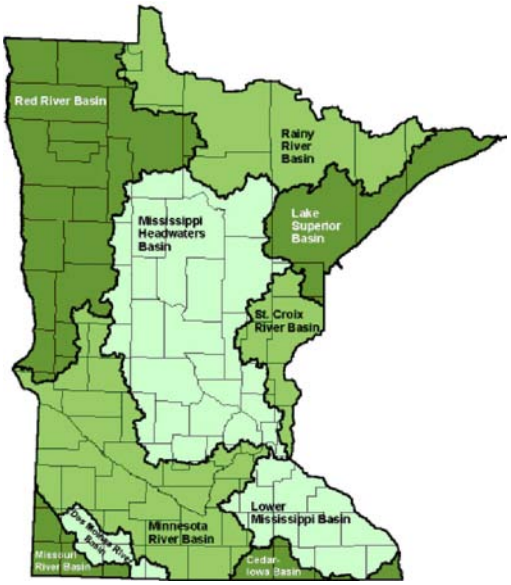
HISTORY

A Resource of Local, State, and National Importance

Basin Overview

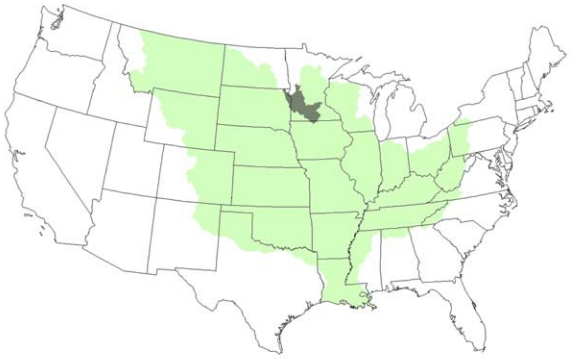
The Minnesota River Basin drains nearly 20 percent of Minnesota as well as portions of South Dakota, Iowa and North Dakota. The basin encompasses roughly 15,000 square miles and contains all or parts of 38 counties in Minnesota. The Minnesota River flows 335 miles from its source in Big Stone Lake on the Minnesota/South Dakota border to its confluence with the Mississippi at Fort Snelling near St. Paul. The river flows through some of the richest agricultural land in the state.

Minnesota's River Basins

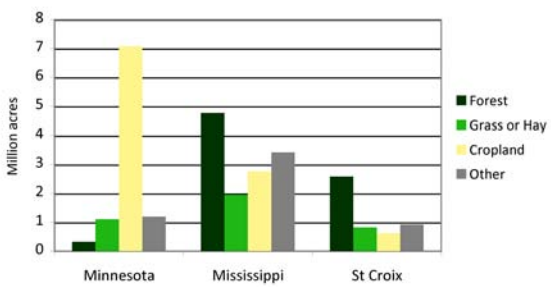


Map Source: Minnesota Planning
http://www.gda.state.mn.us/maps/RiverBasins.gif

One of ten major river basins in Minnesota, the Minnesota River Basin occupies a large portion of Southern Minnesota.



Land Use by River Basin 1997



Minnesota - Mississippi River

The Minnesota River is the state's largest tributary to the Mississippi River. When the Minnesota River flows into the Mississippi River, its flow doubles. The Minnesota River impacts downstream waters by carrying sediment and nutrients into the Mississippi River and ultimately the Gulf of Mexico.

History Section

The following section provides an overview of how the landscape has changed in the Minnesota River Basin over time. Researchers have pieced together what the landscape looked like before it was drained, plowed, logged and developed by Euro-American settlers in the mid-1800s.

Pre Euro-Settlement Conditions

Prairie, buffalo, wild rice, "lakes of grass" historically dominated the Minnesota River Basin

Early explorers accounts and paintings provide glimpses of what the landscape resembled before widespread European settlement. Many explorers wrote descriptions about the rich flora and fauna and Native Americans inhabiting the Minnesota River Valley in the 1700s and 1800s. They described a landscape covered in tall grass, wetlands, shallow lakes and forested areas with numerous American Indian tribes living along the Minnesota River.

"Early explorers …described many features we can no longer see, including huge prairie fires roaring across the landscape, abundant prairie chickens and "prairie dogs", flocks of whooping cranes feeding in wet meadows, and beds of wild rice in many lakes and Minnesota River backwaters. Bison and elk were vanishing by then. Though the explorers encountered many difficult circumstances, they often described the landscape with awe" (MCBS, 2007).

Minnesota Historical Society

Seth Eastman painting of the Minnesota River Valley from the 1830s or 1840s (near Fort Snelling)

Otters, Buffalo, Wild Rice, Ducks

"We paddled away at the rate of four or five miles an hour ... when the otters were seen swimming amongst the zizania. Milor said that buffaloes were killed here about five years ago, but that he thinks the animals have been so persecuted that they will never return. The musk-rats were already at work building their conical houses on the marshy grounds, with mud and straw of the wild rice, against the approach of winter. As we advanced through these low rice-grounds, clouds of wild ducks rose on the wing, and we killed them at our leisure from the canoe." – George Featherstonhaugh, 1835

Wild Rice

"A most delightful country, abounding with all the necessaries of life that grow spontaneously . . . Wild rice grows here in great abundance; and every part is filled with trees bending under their loads of fruit, such as plums, grapes, and apples." – Jonathan Carver, 1766

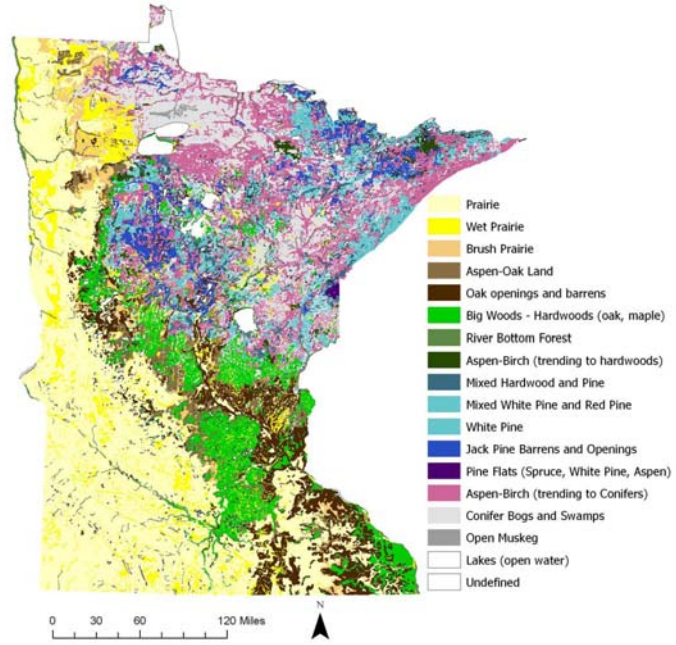
Minnesota Historical Society

Seth Eastman painting of the Prairie at the mouth of the Minnesota River from the 1830s or 1840s

Prairie, River Valley, Lakes of Grass

[Proceeding westwardly from new Ulm], "the plateau that opens here presents neither hills nor woods. It is a high, grand, and beautiful prairie. The view to the south seems limitless, the verdure losing itself far away in the azure of the sky. The spectacle is full of grandeur because of its simplicity that contrasts agreeably with the varied and picturesque countryside the valley of the Minnesota presented to us during the last five miles. Our route continues in generally a westerly direction, leaving on the right and on the left a great number of swampy ponds or more often depressions in the soil that form in the springtime some many "lakes of grass" as the Indians say. The route is lovely and firm. The prairie plants, tall, plentiful, and varied, indicate that the soil is good." – Joesph Nicollet, 1838

Minnesota's Original Vegetation
Map based on Public Land Surveys



The best information for mapping Minnesota's pre-European settlement vegetation was gathered by the Public Land Surveys from 1853-1870. Adapted from Marschner, F.J. 1974.

Prairies

Prairies that once dominated the landscape—less than one percent remains


C. Henderson

Rough blazingstar

Prior to Euro-American settlement, more than 18 million acres of prairie covered Minnesota. Our prairie lands were part of the largest ecosystem in North America, which stretched from Canada to Mexico and from the Rockies to Indiana. A wealth of diverse species, habitats and cultures thrived here. At the time of Euro-American settlement, upland prairie spread across most of the land south and west of Mankato. Historically, fires burned annually over large areas of Southern Minnesota limiting freqency and location of trees (MCBS, 2007). The prairie landscape of the Midwest was one of our nation's most diverse terrestrial ecosystems. Over 900 species of plants have been recorded on remaining prairies in Minnesota, with up to 300 or more species per individual prairie remnant. Almost half of Minnesota's rare species are prairie plants and animals (DNR, 2008).

Today less than one percent of the original expanse of Minnesota native prairie remains.

Conversion of Prairie to Cropland

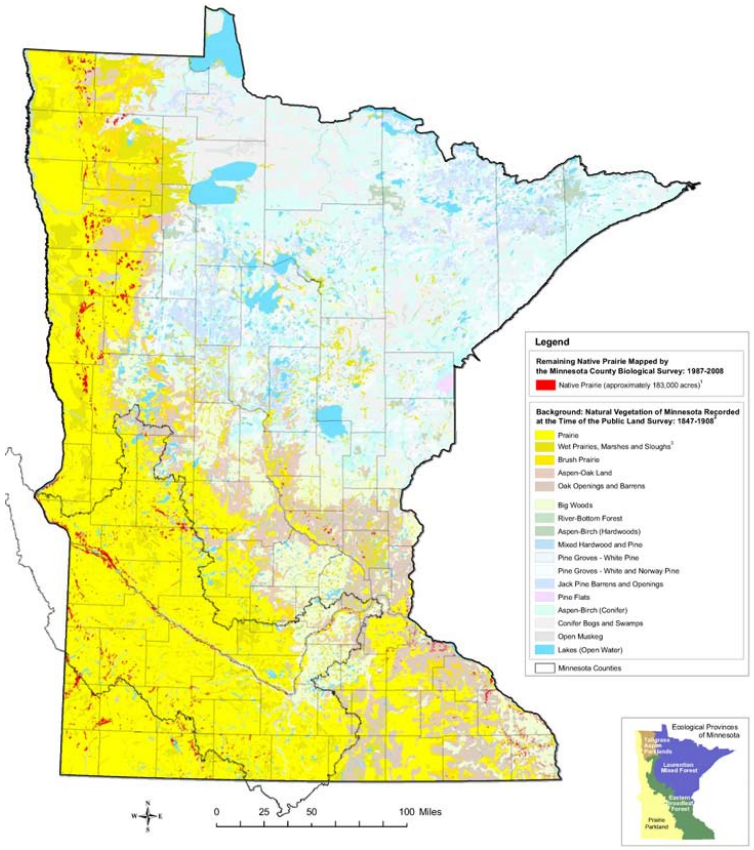
Statewide, today only 180,000-200,000 acres of prairie remain compared to the 18 million acres of prairie prior to Euro-American settlement, In the Minnesota River Prairie subsection of the state (see map left area in yellow) DNR researchers estimated landscape change from 1890s to 1990s that shows the conversion from prairie to cropland (DNR, 2006).

	1890s	1990s
Prairie	77.6%	0.0%
Wetland Non-forest	13.0%	1.9%
Grassland		9.0%
Cropland		83.0%

Source: DNR, 2006

"Prairie is rolling or gently undulating and bearing most everywhere an unusually healthy growth of grasses are auspicious [for settlers]...except for the entire want of timber." —Public land surveyor David Watson describing the prairies in Swede Prairie Township of Yellow Medicine County in 1867 (MCBS, 2007).

Minnesota's Remaining Prairie
100 Years After the Public Land Survey



The map above shows the small amount of native prairie that remains statewide. It depicts current native prairies documented by the DNR's Minnesota County Biological Survey from 1987-2008 (shown in red), in comparson with the prairie vegetation recorded during the Public Land Survey from 1847-1908 (shown in yellow and tan). Less than 1 percent of the prairies recorded in Minnesota during the Public Land Survey remain (MCBS, 2009).


Scott Kudelka

Big Bluestem


Scott Kudelka

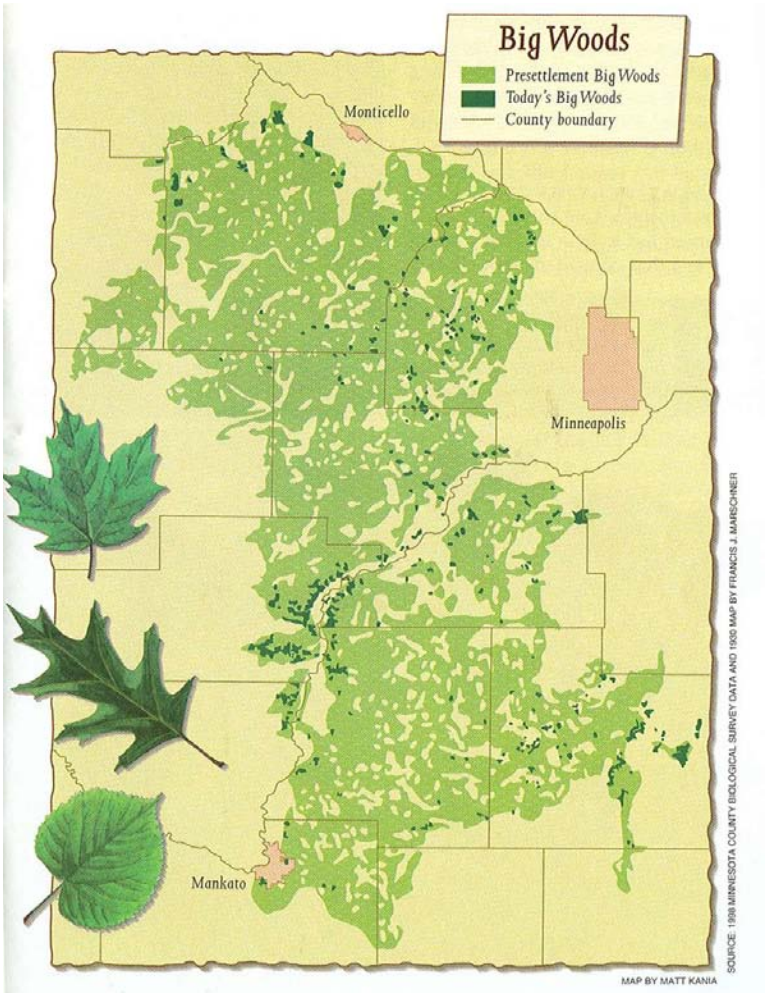
Yellow coneflower

Big Woods

Big woods whittled down—only two percent remain


Jay R. West

At one time, a 2,000 to 3,000-square mile forest extended from the Mankato area north to Monticello. Filled with elm, sugar maple, basswood and oak, this deciduous forest stood in contrast to the surrounding immense prairie-wetland landscape. French explorers in the 17th Century called it bois fort or bois grand, later translated as the "Big Woods" by English-speaking settlers. Today, less than 2 percent of the original "Big Woods" remains after Euro-American settlers began to clear the forest to establish farms, plant crops and build cities (Crosby, 2002). Surveyor N. H. Winchell wrote about the Big Woods of southern Minnesota in 1875, "The existence of this great spur of timber, shooting so far south from the boundary line separating the southern prairies from the northern forests, and its successful resistance against the fires that formerly must have raged annually on both sides, is a phenomenon in the natural history of the State that challenges the scrutiny of all observers" (DNR, 1998).



The Big Woods came into existence 300 to 400 years ago when the climate of North American began to cool. This change in temperatures resulted in fewer fires that were beneficial to the brush land, prairie and oak savannas dominating southern and western Minnesota. The area of the Big Woods didn't burn as frequently because it was made up of rivers, and a rolling, lake-dotted terrain. Over the next few hundred years, this dense, tall forest of elm, sugar maple, basswood and oak covered the landscape.

Big Woods Timeline

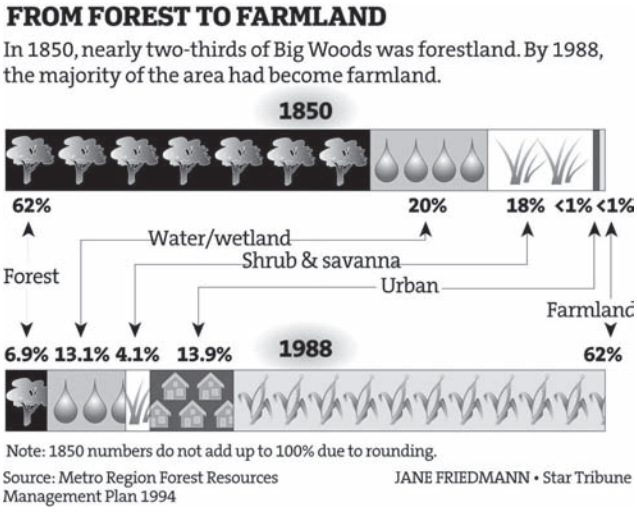
1850s: Euro-American settlers began to clear the 2,000 plus square mile Big Woods by converting it into cropland.

1930s: Only a patchwork of 40 to 80-acre woodlots of the Big Woods remained (DNR, 1998).

Today: Approximately 2 percent of the original Big Woods is left—a quarter of that is protected in parks or preserves—the rest in private hands.


Minnesota Historical Society

People living in the Big Woods collected maple syrup, dug ginseng root, cut the trees for building and fuel among other uses.



Land Drainage

Dramatic increase in a managed drainage system

BNC Water Quality Board

Swan Lake

BNC Water Quality Board

In the beginning tiling was mostly done by hand using a spade to lay concrete or clay tile.

BNC Water Quality Board

Kevin Kuehner

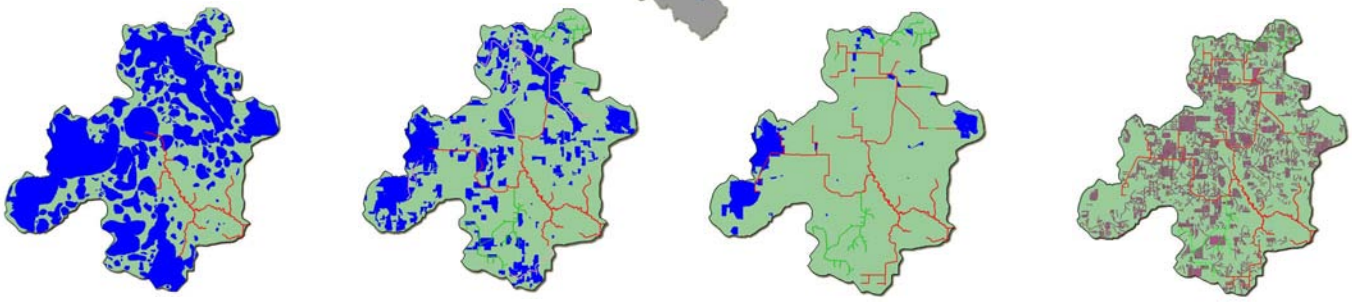
Modern corrugated plastic drainage tile

Wetlands historically dotted the Minnesota River Basin, with wetland complexes once common on the prairie-dominated landscape. Early explorer's accounts described the prairie and wetlands extending as far as the eye could see. Settlers moved in and drained the wetlands to farm the rich, productive farmland. Today, almost 90 percent of prairie wetlands have been lost.

Changes in Hydrology

The movement of water in the Minnesota River Basin before Euro-American settlement would have been different from today. The landscape consisted of a vast prairie pockmarked with wetlands. The prairie sod allowed rapid infiltration of precipitation. The wetlands were connected to subsurface hydrology. The flows of the rivers were likely sustained by ground water inputs for most of the year. As prairies were plowed precipitation followed surface runoff paths into lakes and wetlands which were ditched and drained in many areas to remove water rapidly from the landscape thus enabling large-scale farming (MPCA, 1997).

Wetlands in Seven Mile Creek Watershed



1854 1938 1968 2003

Seven Mile Creek is a minor watershed in the Lower Minnesota River Basin (near St. Peter, Minnesota). These maps are based on a study that examined historic aerial photos over time. The study found that the Seven Mile Creek watershed lost about 88 percent of wetlands from 1854 to 2003 (shown in blue). This correlates with other scientific research that estimate 90 percent of the wetlands have been lost in this part of Minnesota. The 2003 map highlights the engineered system. The purple lines illustrate private drainage tile and the red indicate county drainage ditches and natural channels. Researchers estimate that more than 5.3 million feet of tile have been laid in the Seven Mile Creek Watershed. In this relatively small watershed (36.8 square miles) the study calculated approximately 640 miles of artificial drainage systems.

The River Today

Today, the river is a reflection of its landscape. The wetlands have largely been drained and the prairies and big woods have been converted to row crop agriculture. With that conversion comes changes in water quality and impacts to plants and animals that live throughout the basin. Some progress has been made cleaning up the river and there are some encouraging signs. The job of cleaning up the river is much more challenging and complicated than many people realize.


Metropolitan Council Environmental Services

Twin Cities Metropolitan Area

Water quality

Many lakes, rivers and streams in the basin known to exceed water quality standards and are listed as "Impaired Waters" by MPCA. For 2008, there are 336 impairments listed in the Minnesota River Basin. The river is polluted to the extent that swimming is not recommended and anglers are warned to limit their consumption of fish taken from the river. On the other hand, long term statistical trend studies are showing some improvements in water quality, particularly in total suspended solids and total phosphorus.

Chetomba Creek (6-6-05)


Hawk Creek Watershed Project

After heavy rain (6-7-05)

Partnerships - Improvements

Many organizations are involved in the Minnesota River clean-up. Counties and Soil and Water Conservation Districts develop and implement local Water Management Plans. Counties are responsible for feedlots, septic systems, and planning and zoning. The Minnesota River Board provides policy and basin-wide program support. This joint powers board was created in 1995 to promote water quality improvement and management across 37 counties with land that drain into the Minnesota River.


Friends of the Minnesota Valley

Citizens pitch in at the Friends of the Minnesota Valley Clean up Day


Scott Kudelka

Stakeholders from across the basin share ideas at the Minnesota River Summit

The Minnesota River Basin is divided into 13 major watersheds and nearly every one of the major watersheds in the basin has a watershed project working to monitor and improve water quality. These projects partner with local, state, and federal government along with private groups and citizens. Agencies provide regulation, education, and incentives to improve the river. Academic institutions conduct research and provide information. Non-governmental and citizen organizations engage the general public, help popularize and communicate scientific information, and catalyze public debate about the river (MPCA, 2007). Many land restoration projects have been implemented and Best Management Practices (BMPs) are being applied across the basin. A conservation highlight for the basin was the Conservation Reserve Enhancement Program (CREP) where more than 100,000 acres were secured into permanent conservation easements. People are working together across the basin to improve the health of the ecosystem for future generations.


Scott Kudelka

Paddling the Minnesota River


MPCA

Walleye caught on Minnesota River near Carver Rapids

Recreation & Tourism

Increasingly citizens are realizing the recreational opportunities that the basin offers: fishing, boating and paddling rivers and lakes, visiting state parks and exploring this richly diverse landscape.