Iowa’sForest Resource Assessment & Strategies

State Forester Comments

The Tauke family arrived in Dubuque in the late 1830s. Their plans to move further west were temporarily placed on hold when the father of the Fangman family they were traveling with suffered a broken leg. Not wanting to separate, the two families sought advice from Bishop Mathias Loras. Bishop Loras advised the families to overwinter in the area near what is now New Vienna. As it turned out there was something about the area that captivated both families and over 170 years later both the Tauke and Fangman families are still "temporarily" in the area.

At the time these families settled in the Iowa Territory it contained slightly over 22,000 settlers and near 7 million acres of woodland. Today the State of Iowa has over 3 million people and slightly over 3 million acres of woodlands. As you will see in our State Forest Resource Assessment and Strategies document the fortunes of Iowa's woodlands have ebbed and flowed since eastern European settlement.

The purpose of this document, which is required by law in the 2008 Farm Bill, is to assess the condition of Iowa's rural and urban forest resources and provide a framework or strategy for how all Iowans might move forward to better care for this resource. The care and stewardship of Iowa's forest resource is critical to providing forest related jobs, forest products, wildlife habitat, erosion control, recreation, energy savings, community cohesiveness and quality water.

While Iowa's forested acres have almost doubled since 1974, the threats to our woodlands have never been greater. Emerald Ash Borer, gypsy moth, bur oak blight, oak tatters and garlic mustard are but of few of the problems that have emerged in Iowa in the last ten years. Threats not yet in Iowa but on the horizon include Asian longhorn beetle, thousand cankers disease and sirex wood wasp.

Generally, the most devastating forest health issues are those that occur slowly over time and therefore are not readily apparent to the majority of individuals. The slow decline in oak forest acres is such an example. Iowa has lost almost 5,800 acres of oak forests annually since 1954. The primary culprit in this loss of oak is not an exotic invasive pest but a lack of vision and foresight in the care of our public and private woodland resources.

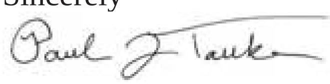
I could go on at length about the multitude of forest benefits, forest threats and forest related opportunities. However, these issues are covered in great depth and detail in the following pages of this document that has been so well put together by our Special Projects Forester Aron Flickinger. Instead I would like to share some personal history and a few thoughts.

I grew up on a farm in southwest Dubuque County. To my lasting good fortune this farm, which was owned my Grandpa Nick Polfer, was nestled up against the east bank of the North Fork of the Maquoketa River and contained 110 acres of woodland. I was fortunate to find time between helping with haying, cultivating corn, and caring for livestock to wander the timber, follow ravines as they threaded their way to the river, hunt mushrooms and pick blackberries. Time spent in the woods was some of the most enjoyable time of my childhood and one of the great tragedies of modern society is that every child does not have a river and a hundred of acres of woods in which to learn about Creation, nature and themselves.

It is through the woods of my childhood that I came to understand how my ancestors were captivated by the beauty, uniqueness and opportunities afforded by Iowa's forests and landscapes. It is through the woods of my childhood that I have also come to understand my own welcomed captivity to Iowa and Iowa's forest resource.

It is my sincere hope that through this document you will in some small way be captivated by Iowa's woodlands and that you will utilize that captivity to advocate and assist with addressing the many issues, opportunities and threats faced by Iowa's forest resource. If we start working together today, Iowa's forest will be in great shape for the next 170 years and perhaps even in the year 2180 children and adults will have healthy woodlands to roam and will themselves become imprisoned by the many benefits provided by Iowa's woodlands.

Sincerely



Paul Tauke
State Forester

Executive Summary

The primary goal of the 2010 State Forest Resource Assessment and Strategies document is to use the best available data to elaborate on a variety of issues pertaining to the past, present and future condition of Iowa's forests. The document is divided into nine chapters showing trends and highlighting issues; at the end of the first seven chapters a summary outlining the key points of that particular chapter is provided.

Data for this document was collected from a wide variety of sources, including Forest Service publications, DNR forester experiences, Community Wildfire Protection Plans, Wildlife Action Plans and strategic planning documents. It also contains information based on input from nearly 200 stakeholder groups, including the Iowa Woodland Owners Association, Urban Council, State Forest Stewardship Coordinating Committee, State Wildlife Agency, State Technical Committee, Forest Legacy Program, U.S. Army Corps of Engineers, U.S. Dept. of the Interior National Park Service Effigy Mounds, and U.S. Fish and Wildlife Service.

This document describes forest conditions and trends based on qualitative, quantitative, and geospatial data to provide an analysis of past, present and future forest conditions and trends on all ownership types in Iowa. The first seven chapters discuss specific criteria related to the condition of Iowa's forest resources as well as the importance of trees to Iowa. A section prior to chapter 1 provides some history about European settlement and its affect on the state's natural resources. Chapter 8 shows where priority areas are for rural, urban, forest legacy and multi-state projects. Chapter 9 summarizes the issues that were derived from chapters 1-7 and proposes strategies for how to resolve those issues in the upcoming years.

Geospatial referenced data is provided whenever possible throughout the document. Maps showing priority forest areas are displayed when enough geospatial data is available for a variety of issues. Some issues are not quantifiable using geospatial data but are still priorities that need to be addressed.

Before reviewing the condition of Iowa's forest resource, a comparison of funding priorities for the state is given in the table on the adjacent page. The amount of tax dollars allocated to a particular state department is a direct reflection of the value of that department to lawmakers, politicians and constituents. The Department of Natural Resources represented just 0.34% of the overall state budget in 2008, and the department experienced further cuts in 2010. Within the Department of Natural Resources, the Forestry Bureau portion of the general fund was $2,045,015 or 0.0328% of the state budget for fiscal year 2010.

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Overview of Iowa's State Budget

Agency	2008	2009 Estimate	2010 Recommended
Total General Fund	$5,898,436,938	$6,041,831,511	$6,230,500,000
Education	3,443,461,756	3,595,337,116	3,552,725,869
Human Services	1,279,674,010	1,321,081,108	1,578,046,645
Justice System	477,816,750	484,879,576	496,514,517
Administration and Regulation	377,627,745	333,139,306	294,581,998
Judicial	148,396,285	155,843,637	163,527,936
Economic Development	96,053,181	71,191,761	68,574,476
Legislative Branch	33,837,880	37,125,646	37,814,194
Agriculture	21,324,509	21,695,023	19,889,964
Natural Resources	20,244,822	21,538,338	18,824,401
Forestry (witihn Natural Resources	**2,599,288**	**2,680,010**	**2,045,015**

Source: www.dom.state.ia.us/state/budget/FY10_Gov_Rec.html, January 2009.

Approximately 1,337,266 Iowans filed a 2007 tax return in 2008. Individual tax returns during this time amounted to $3.1 billion.[1] There are other taxes that the state collects that are earmarked for specific programs, so those taxes were not included for this comparison. Evenly dividing the income tax brought in on a taxpayer average equates to $2,300 for every taxpayer. Applying this same principle to services received shows that each Iowa taxpayer contributes $7.82 of their tax bill to Iowa's natural resources each year; of this, $0.84 goes to the DNR Forestry Bureau. For every $685 collected in income taxes, $0.25 will go towards Iowa's forest resource. These figures show that perhaps the biggest challenge to Iowa's natural resources is lack of funding.

Trees provide many economic and other benefits. Those found in recreational settings enhance camping, hunting, nature study, relaxation, bird watching, mushroom hunting and fishing opportunities for people of all ages. They also provide financial benefits from logging, wood product production, tourism, fruit production, Christmas trees and wreath production and wind, cold and heat protection for buildings and roads. If trees continue to be taken for granted, such benefits could be lost for future generations.

[1]"Comprehensive Annual Financial Report (CAFR) for the Fiscal Year Ended June 30, 2007." Iowa Department of Administrative Services-State Accounting Enterprise. Dec. 14 2007. pp. 138-139.

Why Trees Are Important in Iowa

Forests provide many benefits to Iowans, most of which we take for granted in our busy daily lives. As you read about the past, current and future conditions of Iowa's forests, think about some of the benefits that you have enjoyed from a tree or a forest. Then contemplate how you are ensuring there will be magnificent trees and beautiful forests to ensure that a legacy for future generations to enjoy is secured, so they get to experience the wonders and awe we see and feel today.

Iowa grown trees and shrubs provide many benefits. The single plant that is a tree seedling soon becomes an ecosystem unto itself, with animals and other plants living in and on it. When many trees are closely spaced on many continuous acres, you have the beginnings of a forest. Many different animals and plants will live throughout the changing forest providing many benefits along the way. When planting trees it is always best to utilize native tree and shrub seedlings from a locally adapted seed source because:

- They are better adapted to Iowa's extremes in weather and to Iowa planting sites.
- They provide superior native wildlife habitat.
- They are less likely to be stressed than non-native plants.
- They are more resistant to insect and disease attacks.
- They are a link to Iowa's natural heritage.
- Non-native plants can invade natural areas and potentially displace native plants and habitat critical to native wildlife.

Generally, people plant trees to grow forest products, to increase or improve wildlife habitat, to protect the site from soil and water erosion and to improve the intrinsic beauty of a landholding, leaving a legacy for future generations to enjoy and benefit from. The nice thing about tree planting is that even though a person may be focused on one of these goals, they receive some of the benefits of the other goals as a bonus. That is, when trees are planted for forest products, aspects of wildlife habitat, beauty and environmental protection come right along with the products. Still, a person should pick and choose the species they plant according to their land management objectives and the planting site capabilities.

Spring is a time for trees to bloom with a palette of colors flowering from vibrant flowers that will eventually produce seed. Some of this seed is covered by a hard shell or nut enabling storage of food, while others are soft berries, making it easier for wildlife to feed on immediately. In urban areas hundreds of different types of crabapple trees brighten neighborhoods as the grass turns green. Out in the country, redbuds are blooming and spring ephemerals are taking advantage of sunlight before the overstory tree leaves expand to capture most of the sunlight.

Dutchmen's breeches blooming on a forest floor in early spring. Photo by Brandy Sobczak.

A few of the wildflowers found on a forest floor in the spring include: Dutchmen's breeches, spring beauty, trillium, bluebells, buttercups, violets, yellow bellwort; and others that brighten the forest floor, enticing people to explore more of the forest.

Many people search the woodlands in the spring for mushrooms. Song birds like rose-breasted grosbeaks, various warblers, orioles, finches and sparrows are busy building nests and fill the air with their musical tunes.

American Goldfinch, Iowa's state bird, in the Spring.
Photo by Brandy Sobczak.

Wild turkeys begin their annual mating rituals as hunter's set-up to try their luck at bagging a gobbler. Fish begin feeding again as the insects hatch with the brighter sunshine warming the water.

Spring is also a time for planting more trees. Communities replace lost trees from the previous year or add more trees to areas that would benefit from additional shade for various reasons. Conservation tree planting is underway in the countryside as permanent vegetation is established for future benefits that both people and wildlife will enjoy.

Campers begin returning to parks, state forests and recreation areas to visit new places or to return to favorite camp sites, cabins or lodges and get away from the hectic pace of work at home. Trails take visitors through forests to secluded lakes or streams for solitude or fishing, enjoying the calming effects of the natural surroundings.

The strong roots of a tree holds stream banks together after heavy rains fill streams. This reduces erosion compared to stream banks that are bordered by exposed land. Trees along streams provide permanent buffers that intercept sediment and trap nutrient runoff that would otherwise go directly into the stream. Trees also shade the water below, moderating stream temperatures, which reduces stress on fish living in that water.

Summer weather accelerates people's desire to enjoy nature through camping and getting away for a relaxing time in a natural setting. After all, how many people would go camping if there were no trees in the campground? Aren't the first sites to fill up the ones with the best shade? Within the 57,700 acres of state owned parks, 31,700 acres are covered by trees.

Trees have fully leafed-out and are filtering the air for pollutants, storing more carbon and releasing a fresh supply of oxygen for everyone to breathe. Besides the eye pleasing beauty of a forest, there is refreshing air to rejuvenate the body and clear the mind. Trees have an important role to play within our communities as well. Studies have found that communities with more green space have less crime.[2] The shade trees provide lower energy demands for cooling to homeowners and businesses during the warm summer months.

[2]Kuo, Frances E., Sullivan, William C. "Environment and Crime in the Inner City: Does Vegetation Reduce Crime?" Environment and

An acre of Iowa forest on a summer day can transpire over 1,600 gallons of water. This cools the surrounding area by as much as 5 to 15 degrees. This effect, when combined with placement of trees around homes for shade, can reduce air conditioning demands from 10 to 43 percent.[3]

Fall gives everyone a second chance to experience the beautiful colors trees can provide. Many small communities benefit from tourism generated by the annual changing of the leaves. A lot of festivals occur this time of year to celebrate the harvest of crops and to prepare for winter.

Some animals migrate before the cold weather becomes permanent. The wildlife that remains seeks shelter from brutal winds and cold temperature by moving into the woodlands. Hunter's set-up for another turkey season and have multiple deer seasons to hunt in.

Tree seeds fall to the ground to provide food for wildlife or to hopefully find a favorable place to grow. This is especially important for those forests that will be harvested that winter. Harvesting provides income for landowners, changes habitat for wildlife and allows sunlight to get to the ground, allowing a new stand of trees to become established. Harvesting timber from forest land is necessary to provide wood products like construction materials, furniture and firewood for people to benefit from.

White oak seed germinating in the fall. Photo by Mark Vitosh.

Apple trees and nuts from hickory, walnuts and hazelnuts offer lots of food opportunities that can be used throughout the year for baking or snacking.

Fall is the last chance for campers to take advantage of pleasant temperatures and spectacular surroundings before winter sets in.

The transition time of late fall to early winter offers opportunities to cut firewood when the weather has cooled down and the bugs have died off. The smell of smoke and the sound of a crackling fireplace create a similarly relaxing feeling indoors as a campfire provides during the summer months of the year.

Winter decreases recreational activity in the woodlands to cross-country skiing and snow-shoeing when there is snow on the ground. Snow on the ground tells many stories about what wildlife in the area are eating and where they are going by the tracks they leave behind.

Frozen ground provides opportunity for loggers to remove trees and minimize damage done to the soil. Forestry consultants are actively managing forest areas by thinning stands to create a healthier and more productive forest. Both loggers and foresters are influencing the future stand composition by their activities in the woods. Sawmills turn the logs into products that we can use in our home for flooring, trim, cabinetry and furniture.

[3] Stone, Larry A., ed. Iowa-Portrait of the Land. Iowa Department of Natural Resources, 2000.

Community trees serve as windbreaks, which eases demand for energy to heat homes and businesses. Windbreaks of conifers can reduce heat loss from 5 to 40 percent around farmsteads and rural residences.[4] These windbreaks also provide nesting habitat such as holes for woodpeckers, owls and squirrels, conifers protect chickadees and dark-eyed juncos.

Out in the countryside, windbreaks provide shelter to homes and reduce drifting on roads to allow safe passage for people to travel during snowy weather.

Trees clean the air by using and storing carbon dioxide and by trapping dust and other airborne particles in their foliage.

Annual traditions of finding a Christmas tree and decorating it in our homes provides a local business for rural landowners and a fresh smelling tree for consumers during December. In 2007, over 39,000 Christmas trees were cut and sold from the 196 Christmas tree farms in Iowa.

Throughout the year, trees clean water in two ways; by preventing soil erosion, either by holding soil in place or by trapping it as it is borne overland by wind or water and by trapping nitrogen and phosphorous, thus reducing the occurrence of these two elements in drinking water. Trees planted along waterways can be very effective in reducing the amount of soil washed into streams and rivers.

Trees protect the environment by easing summer and winter temperatures, by cleaning water, by reducing soil erosion, by reducing noise and by filtering air. Where water quality is improved, better fishing and other recreational opportunities are possible.

The capacity of trees to reduce noise is often used in cities and towns to diminish highway and other noise.

Trees clean the air by using and storing carbon dioxide and by trapping dust and other airborne particles in their foliage.

I think that I shall never see a poem as lovely as a tree...." So begins a poem by Joyce Kilmer that expresses the ways trees add beauty to their surroundings. Understanding how trees improve the quality of our lives is the first step to appreciating the many benefits that trees provide for all Iowans.

[4]Stone.

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Appendices

Purpose

The 2008 Farm Bill[5] requires each state to complete a Statewide Forest Resource Assessment or "State Assessment" and Statewide Forest Resource Strategy or "Resource Strategy" to receive federal funds under the Cooperative Forestry Assistance Act. State Assessments are intended to identify key forest-related issues and priorities to support development of the long-term Resource Strategy.

The State Assessment and Resource Strategy address forest-related issues of importance to Iowa and are complementary to the following three national priorities:

- Conserve and manage working forest landscapes for multiple values and uses
- Protect forests from threat
- Enhance public benefits from trees and forests.

This document identifies landscape areas where national, regional, and state resource issues and priorities converge. This is meant to be a working document that utilizes the best current data available, works with stakeholders, and adequately considers other state assessments, plans, and priorities. In this way, Iowa's State Forest Resource Assessment and Strategy document is a valuable source for communicating forest-related issues, threats, and opportunities in the state and serves as an important strategic document for the Iowa Department of Natural Resources Forestry Bureau to use for planning and funding purposes.

This document was created using a variety of sources, including:

- An overview of the national requirements and guidance for state assessments with regional clarification and sideboards
- An overview of the national requirements and guidance for the resource strategies,
- Stakeholder involvement
- State Wildlife Action Plan, Forest Legacy Assessment of Need, and Community Wildfire Protection Plans
- geospatial data

To ensure that Federal and State resources are being focused on important landscape areas with the greatest opportunity to address shared management priorities and achieve meaningful outcomes, the Iowa DNR Forestry Bureau has worked with key partners and stakeholders to develop this document. Stakeholder groups coordinated with include Iowa DNR Wildlife Bureau, State Forest Stewardship Coordinating Committee, State Technical Committee, Urban and Community Forestry Council, along with dozens of other conservation groups and individuals interested in the management of the forest resources in Iowa. Topics covered in the document:

- An analysis of past and present forest conditions and trends on all ownerships in the state, including analysis of market and non-market forces;
- Threats to forest lands and resources have been identified in Iowa consistent with the national priorities;

[5] The Food, Conservation, and Energy Act of 2008, commonly referred to as the Farm Bill, was enacted June 19, 2008.

- Explanation of forest related benefits and services;
- Priority forest landscape areas in the state have been delineated across themes and pro grams, ownerships, and the urban to rural continuum, to be addressed by the Resource strategy;
- Identification and delineation of Multi-State areas that are a regional priority.

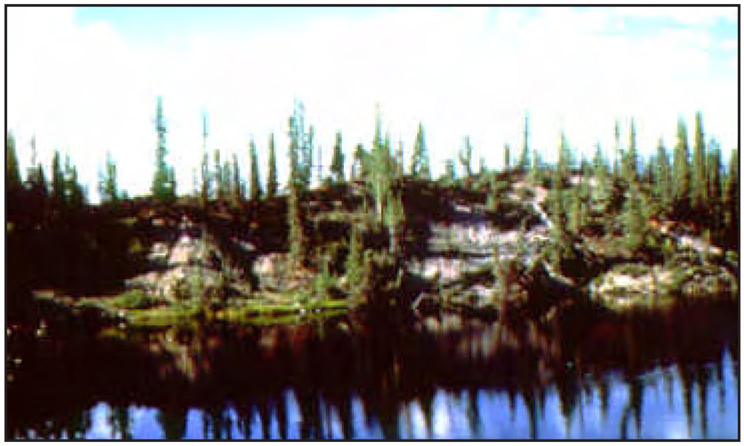
This assessment is divided into nine chapters, with the first seven are modeled after an international system of criteria and indicators known as the Montreal Process. These criteria address biological diversity, the productive capacity of the forest, ecosystem health, soil and water resources, global carbon cycles, socioeconomic benefits from forests and the legal institutional and economic systems that can impede or enable progress in sustainability. The Montreal Process provides a data driven template for reporting information, discussing trends and highlighting forestry issues that are relevant in Iowa. For detailed information on the Montreal Process, visit their website at www.mpci.org/. Not all parts of the Montreal Process had data or were relevant to forestry issues for including in this assessment. In addition, including program specific data that would not otherwise be captured by the framework developed by the Montreal Process has been added where necessary.

Chapter 8 shows priority forest areas, priority community areas, forest legacy areas, and areas that could potentially offer multi-state partnerships to work on common issues related to the forest resource in that area.

Chapter 9 is where the issues, that have been developed by the first seven chapters, are listed with the accompanying strategies required to address them.

Iowa Background History

The following background history is an excerpt from <u>Iowa-Portrait of the Land</u>:



This glacial scene resembles the wasting ice sheet present in north-central Iowa 13,500 to 12,000 years ago. The melt water lake and its bordering coniferous trees are perched on the surface of glacial debris still underlain by whitish layers of ice (Klutlan Glacier, Yukon Territory, Canada). Photo by H. E. Wright Jr.

The first Iowans came from Siberia, a nomadic people that crossed into North America perhaps 15,000 years ago, no doubt following herds of caribou, musk oxen, and mammoths. They traversed a land bridge exposed when expanses of glacial ice had captured enough seawater to lower the ocean level. By 13,000 years ago, those Paleo-Indian people had found their way to Iowa, where they lived in what must have been harsh conditions alongside the remnants of glaciers. The warming climate eventually halted the glacial advances, however, allowing plants and animals to quickly reoccupy the damp, dark, stony soils that formed on top of and at the edges of the decaying ice.

Those early Iowans moved about in cool, moist, spruce and fir forests interspersed with open meadows and wetlands. Hunters pursued mastodons, giant bison, and other big game, often working together to drive the animals over cliffs or into boggy mires where the prey could be attacked more easily. The Indians killed and butchered their quarry with effective stone spears and sharp tools painstakingly crafted from flint. People's lives were short, and populations were sparse, perhaps never reaching more than a few hundred at any one time.

As the climate continued to warm about 10,000 to 8,000 years ago, more hardwood forests grew up, with prairies gradually pushing in from the south and west. People followed the resources, camping near rivers to gather wild plants and hunt small game and often traveling to hunt bison. But the innovative native people also began using the atlatl, or spear thrower, to increase their hunting efficiency. They learned to grind and chip stone into tools, such as axes, knives, scrapers, and plant-milling devices. Evidence at numerous archaeological sites suggests that populations were growing, perhaps into the thousands.

From about 2,800 to 800 years ago, prehistoric Woodland Indians inhabited an Iowa landscape much like that visited by the first European explorers. Eastern forests met western prairies, with scattered trees on the savanna in between. The trees and shrubs marched out into the grasslands during wet cycles, and then retreated to the valleys during droughts. Native Americans also set fires to kill the woody plants and improve prairie wildlife habitat. The population in what would become Iowa grew to an estimated 10,000 people.

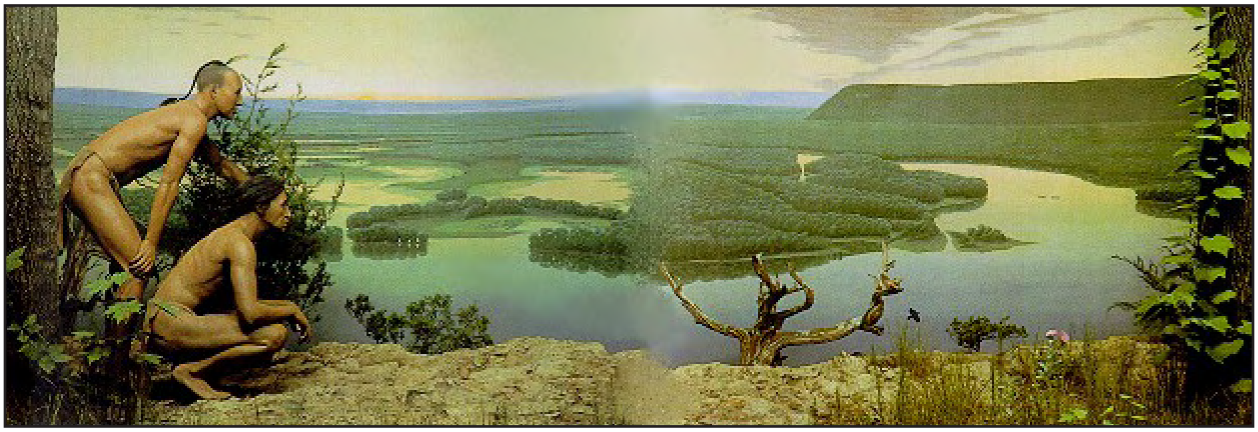
The best-known legacy of the Woodland people may be their intriguing mounds of earth. The earliest conical mounds apparently were for burials, but these and later mounds also may have served ceremonial functions. Effigy Mounds National Monument, near Marquette, protects nearly 200 mounds, including several in the form of bear or bird effigies built between 450 B.C. and A.D. 1300.

Indian burial mounds were built on high bluffs or on terraces overlooking river valleys. The mounds also may have marked hunting territories, served as ceremonial centers, or embodied spiritual links with the earth (Fish Farm Mounds State Preserve, Allamakee County). Photo by Jean C. Prior.

Native American populations in Iowa grew to tens of thousands by about A.D. 1600, but then numbers dropped, apparently due to deaths from warfare and the spread of European diseases. Before the population decline, however, large villages thrived in several parts of Iowa. One encampment ranged across the Big Sioux River valley at Blood Run in northwestern Iowa and southeastern South Dakota. Some communities included elaborate earth lodges, palisade fortifications, large storage pits, and log houses.

Great bird mounds take clear shape when outlined with lime as part of a special study done in the 1970s. Iowa's effigy mounds represent creatures from the land, water, and sky. "The mounds and their builders have a message for us today - the human race must integrate itself with the rest of the living world." - R. Clark Mallam, 1986. Photo by R. Clark Mallam.

On a misty morning, when the floodplain trees fade in and out of the fog, it's easy to picture the scene more than 300 years ago when Iowa Indians may have watched some of the first Europeans to visit Iowa. Explorer and fur trader Louis Joliet, along with missionary and Jesuit priest Father Jacques Marquette, paddled down the Wisconsin River, and then entered the Mississippi on June 17, 1673. Sent by the Canadian Governor to search for a route to the Pacific Ocean, they had begun at the Straits of Mackinac, and then paddled across Lake Michigan, through Green Bay, and up the Fox River. After portaging overland to the Wisconsin River, they headed downstream to the Mississippi, where they found an imposing promontory we now know as Pike's Peak.



This panoramic view shows the historic entry of Marquette and Joliet (in two canoes) into the Upper Mississippi Valley via the Wisconsin River on June 17, 1673. Visitors to Pike's Peak State Park in Clayton County can see the same magnificent view today. This diorama is the centerpiece of Iowa Hall at the University of Iowa Museum of Natural History. Photo by Kay Irelan.

Marquette and Joliet barely touched the west bank of the Mississippi; just enough perhaps, to marvel at the abundant wildlife, forested bluffs, hilltop prairies and savannas, and diverse vegetation along the tributaries. Other Europeans would explore across what is now Iowa in the next 150 years.

The Louisiana Purchase of 1803 was followed the next year by Lewis and Clark's "Voyage of Discovery" up the Missouri River along what would become Iowa's western border. Although European traders, trappers, and explorers already had been prowling the land for years, the Louisiana Purchase marked the "official" beginning of Iowa's connection to the new nation that was emerging on the North American continent.

In stark contrast to the Mississippi River forests in eastern Iowa, trees were scarce along the Missouri River valley. At a site near the present Iowa-Missouri border, Clark described today's Loess Hills as " a range of Ball [bald] Hills parallel to the river and at from three to six miles distant from it, and extends as far up and down as I can see." The short prairie grasses, predominantly little bluestem, made the hills look bare. "This prairie I call Bald pated Prairie," Clark wrote, suggesting emptiness. But the party later went hunting along a stream the Indians called "Neesh-nah-ba-to-na" (today's Nishnabotna River) and found the region far from barren. They killed four deer, and saw "oak, walnut & mulberry" trees.

All along the Iowa border, the explorers marveled at the bounty of wildlife in the valley. The hunters sometimes killed as many as five deer a day. The travelers caught their first channel catfish near present-day Council Bluffs, where they found the creatures "very common and easy taken." Around Onawa, Lewis didn't even try to count the number of pelicans, except to exclaim that their numbers "appear almost incredible." Near Sioux City, Clark commented on "very plentiful" beaver, "very fat ducks," and plovers "of different kinds."

Geologists are piecing together Iowa's Ice Age history, and archaeologists teach us about the 600 generations of people who were here before Europeans arrived. But the explorers of the 1700s and 1800s not only made history, they began to record it. Iowa was poised on the brink of change. Native Americans, who had harvested the fish and wildlife, farmed, quarried, built, and traded throughout the region, were about to be displaced. The Indian people had lived on and worked the land for 3,000 years. Yet they sketched their legacy lightly on the landscape. Soon their subtle portraits would be painted over by the heavier hands - and greater numbers - of explorers and *settlers. The new "artists" looked at the earth differently than the native peoples had, and the newcomers would change that landscape forever.*

In the 1800's, Iowans reworked the face of their new state with a speed and to an extent perhaps unparalleled in human history. At the beginning of the century, a blanket of prairie cloaked three-quarters of this "land between two rivers." Pothole marshes dotted the flatter north-central part of the state, while a network of streams laced the rolling hills elsewhere across Iowa. Dense forests engulfed some valleys in the east and groves of bur oaks climbed out of the river corridors and onto the ridges to form savannas. Thousands of Native Americans lived on the land, harvesting wild plants and animals, growing crops, and managing the vegetation with fire. By 1900, however, Euro-American settlers had claimed nearly all of Iowa's 36 million acres as farmland.

Non-Indian settlement officially began on June 1, 1833, when pioneers first were allowed to claim new land in the 6 million acre Black Hawk Purchase along the west side of the Mississippi River. By 1846, when Iowa became a state, census records listed 96,088 people. The population doubled to 192,914 by 1850 and topped one million before 1870. In 1900, Iowa had 2.2 million people, compared to 3 million people today. Most lived on the state's 200,000 farms, working land where 95 percent of the prairie, two-thirds of the woodlands, and most of the wetlands had been converted to agriculture.

The earlier settlers may have preferred to stay close to forest edges, where they could cut trees for building materials, fences, and fuel. But the lack of trees on the expanses of prairie only briefly delayed the rush of settlement to the more open lands of northwest Iowa. Especially after the Civil War, there was a major push onto the prairies. And once the farmers came to an area, it took less than ten years for the "frontier" to become agricultural land.

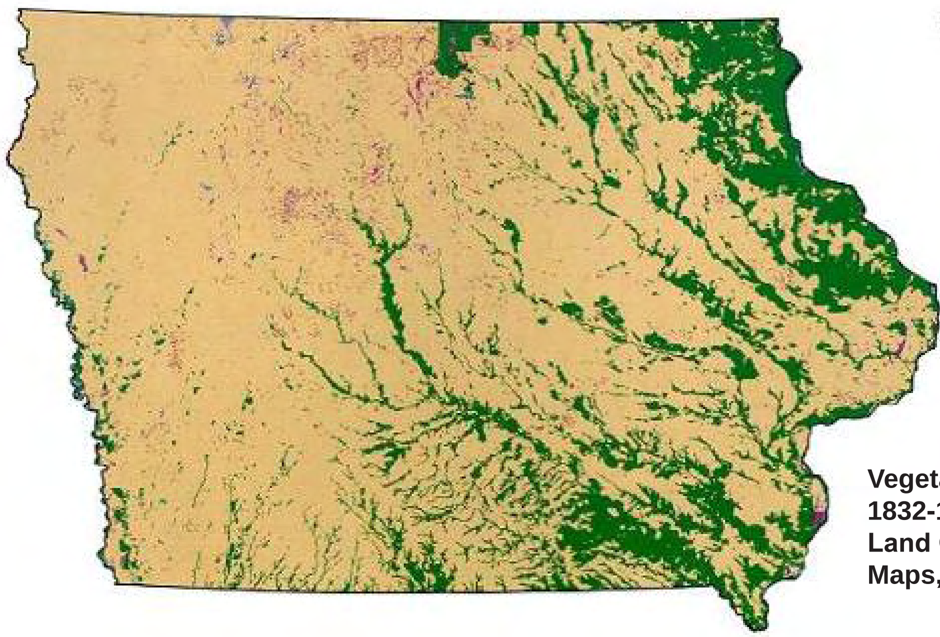
The dramatic, swift, almost complete change of diverse prairie to a monoculture of cropland profoundly altered the ecosystem. Twenty-eight million acres of bluestem, dropseed, compass plants, coneflowers, gentians, and 200 other species were transformed, in a relative eye blink, into a patchwork of corn, wheat, oats, hay, and pasture. Those plots have expanded to the huge roadside-to-roadside corn and soybean fields that we see today.

At the same time, although to a lesser degree, the loss of forests also reshaped the state's landscape. Naturalist Bohumil Shimek described Iowa's pre-settlement forests: "There were still miles upon miles of almost undisturbed timber, fine white oaks predominating on the uplands, the hard maple occasionally dominating the river bluffs, and the red cedar finding an anchorage on the limestone ledges, while the black walnut and various softwood trees occupied the narrow bottom lands. The upland woods were carpeted in early spring with hepaticas and the rue anemone, while the ravines were decked with beautiful ferns, interspersed with pink and yellow ladies'-slippers and many other wild flowers, all in great profusion."

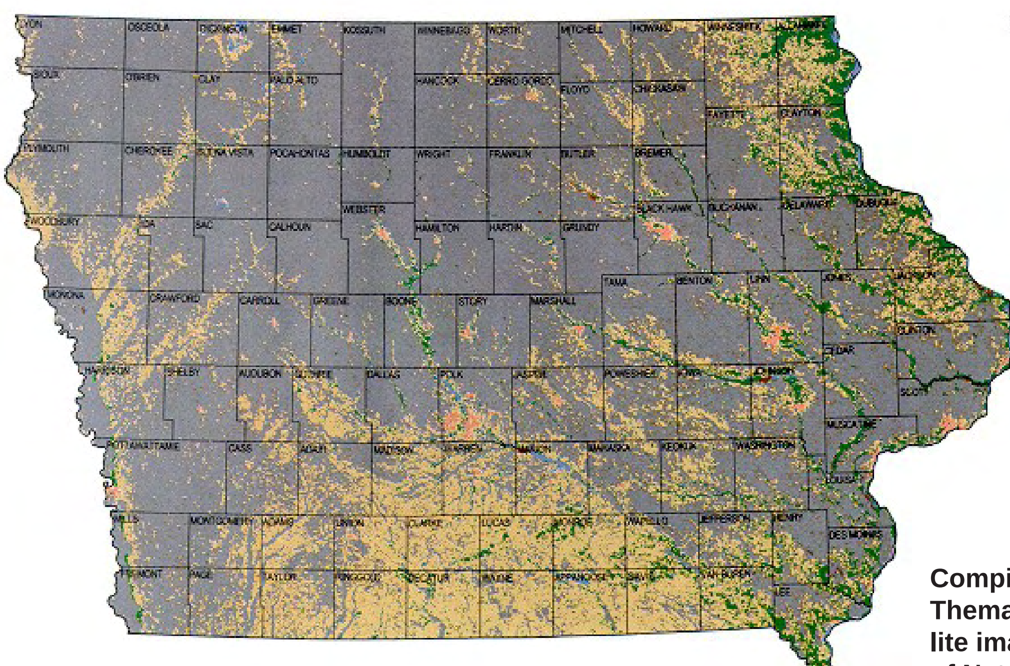
Early surveyors' notes suggested that trees covered about 6.7 million acres or 19 percent of Iowa around the time of statehood in 1846. As settlers began to grow crops for themselves they began to realize the potential of the nutrient rich black soil. Settlers steadily cleared the forests, however, as they removed trees for agricultural fields, rail fences, log buildings, and lumber. By 1857, the Iowa State Agricultural Society had issued a plea calling for more careful use of timber resources. Steamboat crews, who regularly stopped to cut trees to burn for fuel, decimated some forests along major rivers.

The next two maps compare vegetation from the 1850's to the 1990's showing the dramatic, swift, almost complete change of native vegetation to a monoculture of cropland profoundly altering several native ecosystems.

After Iowa became a state, the natural resources were critical for making a living. When railroads came to Iowa in 1855, they brought another assault on the woodlands. The state's eventual 10,000 miles of rail lines needed about six acres of oak woods, perhaps 800 trees, to make ties for every mile of track. Railroad ties usually had to be replaced every five to seven years. Railroad cars, trestles, and fuel for some steam engines also required wood from the forests.



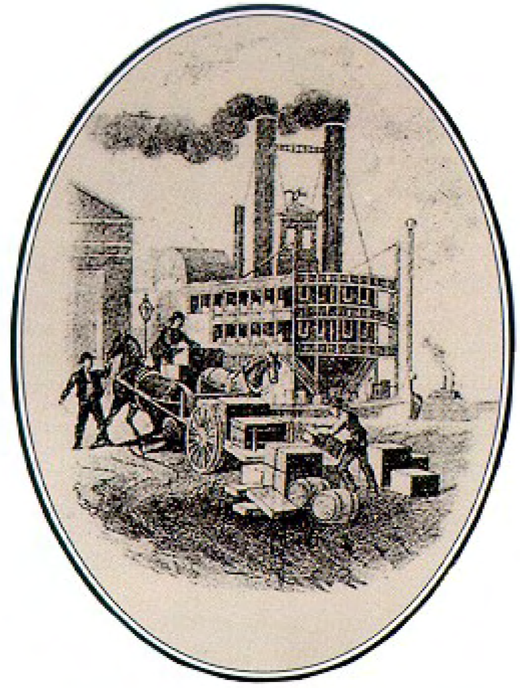
Vegetation Maps of Iowa 1832-1859, from Government Land Office Township Plat Maps, Iowa State University.



Compiled from Landsat Thematic Mapper satellite imagery, Iowa Dept. of Natural Resources.

Source: Landsat Thematic Mapper Satellite Imagery (TMSI), Iowa DNR

Often, trees grew back rapidly after they were cut. But with the invention of barbed wire in 1873, the forests faced another threat, as farmers found it easier to use woodlands for grazing. Although livestock didn't always destroy the forests, these animals compacted the soil, ate or trampled seedlings and forbs, which changed the character of the woodland community. Coal mining also took its toll on forests as trees were cut to shore up mine shafts. By 1900, more than 4 million acres of Iowa's original 6.7 million acres of forests had been lost to other uses.



As much as they cut trees, however, nineteenth-century Iowans liked to plant them. Many farmers started windbreaks and shelterbelts around their farmsteads for shade and protection from the prairie winds. As people controlled wildfires, and with roads and fields as firebreaks, tree growth expanded into what once had been grasslands. When cities grew, urban residents also planted trees along streets, around houses, and in parks.

In the process, people transformed the sponge-like character of the land, where water once had soaked into the ground. The farmers' artificial drainage ditches began to expand, forming water courses that grew and eroded with more runoff. New tile lines diverted more water to the channels.

Right: Riverboats carried settlers into the country's interior. The steamboats burned enormous amounts of wood, cut from the timber along Iowa's river valleys. This image was printed from an engraving on lithographic limestone quarried in Floyd County and published in Clement Webster's 1915 issue of Contributions to Science to illustrate the high quality of this Iowa stone for printing.

Photo by of Clay Smith.

Steam dredges cut drainage canals to further speed the water away. The picture below shows a straightened channel of the Little Sioux River in Monona County. This "river" now quickly drains highly productive agricultural fields after rain events.

Instead of seeping gradually into the land, the water is hurried away downstream through a new network of surface connections.

Elsewhere in Iowa, landowners often shortened or altered rivers. On the more rolling *land, thousands of miles of rivers and streams had developed over thousands of years, as water found its way gradually downstream to the sea. If those sometimes-meandering rivers ran where people wanted to put farm fields or highways or other structures, engineers frequently used machines to straighten, or channelize, the waterways. The process started in the late 1800s but reached its peak in the early 1900s, after heavy equipment became more common. By some estimates, Iowa lost more than 3,000 miles of streams to channelization before government restrictions curtailed the practice. Channelization also sped the flow of floodwaters onto the land of downstream neighbors, lowered the water table, and encouraged the drainage of some lakes, sloughs, and river backwaters.*

Draining the wetlands, plowing the prairie, clearing the forests, and mining the land also destroyed or significantly altered the habitat for wildlife that once lived there. Iowa's wildlife populations declined dramatically through the nineteenth century. The first white explorers marveled at the bison, elk, wild turkeys, deer, prairie chickens, bears, wolves, waterfowl, shorebirds, and other birds and animals that thrived in the fertile prairies and scattered woodlands. "I had never rode through a country so full of game," declared Joseph Street, an Indian agent who traversed the Turkey, Wapsipinicon, and Cedar rivers in northeast Iowa with a survey party in 1833.

The first non-Indian settlers killed game almost at will. They easily took deer, turkeys, and prairie chickens for food. In wetlands, people gathered duck, goose, and swan eggs in the spring and shot the birds virtually year-round for food and feathers. Market hunters also slaughtered shorebirds and waterfowl by the hundreds, often shipping the birds to restaurants in eastern cities.

River otters and beavers initially thrived in most rivers, streams, and marshes and trappers sought them for fur during the heyday of the fur trade in the late 1700s. During the nineteenth century, trapping pressure, habitat loss, water pollution, wetland drainage, and stream channelization gradually took their toll. Beavers and otters were essentially gone from Iowa around 1900.

The combination of hunting, a growing human population, and the conversion of prairies and forests and wetlands to farm fields spelled doom for many species. By 1867, the last Iowa mountain lion had been killed. Bison vanished from the state in 1870, elk in 1871, black bears in 1876, wolves about 1885, and whooping cranes by 1894. Passenger pigeons were mostly gone from Iowa by the 1890s, and they would become extinct by 1914.

It was a time of transition. In the nineteenth century, we changed our state from a place controlled by natural forces to a landscape dominated by human handiwork. A pioneer child might have ridden in a covered wagon on a trackless prairie, watching elk and prairie chickens. That same person could have greeted the twentieth century with a ride behind a steam locomotive, on tracks linking urban industrial centers, passing neat farmsteads built on a mile-square grid of roads.

Incredibly, this astounding transformation from a natural landscape of wild places teeming with wild creatures to a checkerboard of manicured crop fields, cities, and roads, took place in barely 60 to 70 years, less than a lifetime.

A conservation plan published in 1933, 100 years after Iowa was opened to settlement, bluntly listed the losses of the past century: "the waste of Iowa's greatest asset, the soil; the unwise destruction of surface waters by drainage, pollution and silting; the heedless stripping of woodlands; the almost wanton destruction of wildlife; the irrational use of funds for recreation in several forms; the patent failure to capitalize the state's fine potentialities all along the line."

Rather than dwell on negatives, the plan spelled out details for work that would not only "call a halt" to the abuse, but also might rebuild the resource base for future generations. Decades later, we still must commend the extraordinary foresight of proposals to fight soil erosion, improve fish and wildlife habitat, build parks, preserve forests and prairies, and beautify roadsides.

All told, the planners estimated the costs of the proposals, including land acquisition and improvements, at only $2 to $3 per person, or $9 to $12 per family. The cost could be paid by hunting and fishing license fees, park concessions, gasoline or automobile taxes, cigarette taxes, or special levies, the document said. Significantly, the plan also suggested legislation and governmental reorganization to benefit conservation.

1933 Conservation Plan Highlights

- Provide state aid to landowners to fight erosion.
- Clean up and provide access to state lakes and rivers.
- Help landowners with forest management. Set aside state forests.
- Restore wildlife with habitat improvement, research, and refuges. Help landowners and provide habitat along roadsides and other public lands.
- Make Iowa's fishing "better than it ever has been." Stop pollution, build artificial lakes, protect natural lakes and streams, and restock many waters.
- Establish a state park within forty miles of every Iowan, and set aside a network of at least seventy-five state preserves to protect unique natural areas.
- Integrate scenic highways and roadside parks into the conservation plan.
- Preserve remnants of Iowa's prairie, nearly gone in 1933.
- Combine Board of Conservation with Fish and Game Commission.
- Protect fishing and hunting license fees from diversion to other uses.
- Add easements for public access and to protect scenic areas.
- Restrict commercial use near state lakes, parks, and preserves.
- Give counties planning and zoning authority.
- Regulate timber cutting with zoning.
- Give counties authority to organize park districts.
- License billboards.
- Authorize Highway Commission to build roads in state parks.

Many of the plan's components came to pass, some sooner and some later. Iowa's county conservation board system, which was a model for many states, began with legislation passed in 1955, some 22 years after the idea was formally proposed.

Some other ideas in the plan have changed considerably or become blurred through the years. For example, the plan's definition of a park, preserve, wildlife refuge, and sanctuary is not always clear today. "The 1933 plan emphasized the need for roadside management, but has taken decades for us to recognize the potential of highway corridors as refuges for wildlife and native plants. Statewide zoning of everything from billboards to timber cutting did not catch on. County zoning in many cases drew a similar negative response. And the concept of protecting the land or natural features by easements has not gained popularity, as the 1933 planners had hoped it might.

Still, the plan became a catalyst for conservation. Several groups, both public and private, that today lead Iowa's conservation movement can trace their roots to the dedication of those early leaders. The ambitious recommendations, presented nearly seven decades ago, set goals that *shaped Iowa's conservation accomplishments for the rest of the 20th century. And the authors laid down a challenge that may apply equally to the 21st century: "Let every citizen of Iowa catch and hold* that vision of the economy and the enrichment of human living to be achieved only through state-wide, far-sighted development plans. Not for too visionary, but for too meager-minded planning shall we be held to account."

Today we work this land, or perhaps it should be said that the land works for us. It grows our food, supports our buildings, provides raw materials for our industries, absorbs our wastes, and stores our water supplies. Therefore, we need to understand what this ground beneath us is like - *what holds it up, what gives it shape and texture, what finite resources lie within its depths, how vulnerable it is to contamination sources, and whether it can heal itself if we damage it. Armed with this basic geological information, we can begin to comprehend how much the land and its characteristics affect our daily lives. We can also let the land guide the sensible use of its many resources and our quest for solutions to environmental problems.*

Prehistoric people lived and farmed along the streams and on the hilltops. Newly arrived settlers and their descendants tucked cities beside the rivers and built farmsteads on the uplands. Farm ponds and reservoirs, like Red Rock and Rathbun, now supplement the region's scarce groundwater supplies. Despite the rolling terrain, careful farmers learned to protect the land. They trim their crop fields with terraces and waterways, grow hay on the steeper slopes, raise cattle on the grasslands, and protect the oak-hickory forests. Without such vigilance, landowners might lose their topsoil to erosion and their woodlands to trampling by livestock.

Pioneers brought cattle to graze on the native grasses and worked tirelessly to drain and plow the river bottoms. Later, in an effort to tame the floods along the Missouri and its tributaries, engineers straightened some streams and built levees to confine their flows.

As human engineering sped the water along, the riverbeds cut deeper and banks eroded. Wetlands dried up as their water seeped away through the sandy underground connections between the river and surrounding land. Still, the aquifers hold ample water to supply wells for industry, irrigation and drinking water.

Iowa is one of the most intensively used and frequently disturbed landscapes in the world. Even farmers, who turn over only the upper few inches of most of our landscape every year, have assumed earth-moving powers. Thus, while we live on an earth fashioned by nature and time, we've often used our machines, and our whims, to alter the environment around us.

Meander loops and oxbow lakes along the Iowa River in Tama County indicate porous floodplain materials and a shallow water table. Knowing the composition of Iowa's earth materials is essential to understanding the capacity of the land to transmit contaminants and to protect water supplies. Photo by Gary Hightshoe, Iowa State University.

Ancient Iowans were drawn to places where the land speaks in scenic eloquence (Turkey River). Photo by Gary Hightshoe.

Iowa's land is a rich mosaic of cropland, pasture, timber, and a long rural heritage (Saints Peter and Paul Church in northeast Johnson County). Photo by Drake Hokanson.

The landscape is where all human activity takes place, and learning to live with it is essential. If we understand its building blocks, however - the bedrock, the soil, the water, the air, and their inherent relationships - then we can protect the land and its heritage, our heritage.

An Amish farmer and his draft horses work the land together near Sharon Center in southern Johnson County. Photo by John M. Zielinski.

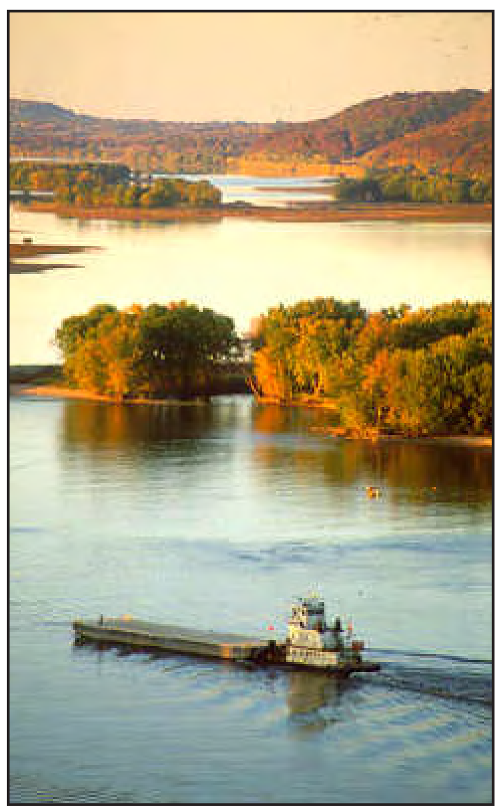
Iowa Today

In autumn, thousands of people make the pilgrimage to northeast Iowa to savor the spectacle of the changing leaf colors. At Effigy Mounds National Monument, some tourists watch barges and bass anglers on the Mississippi River, while they listen to the calliope music from an excursion boat. But other visitors may feel the centuries-old spirit of Indian families sculpting a bear effigy from the soil of a bluff top, honoring the earth that sustains all life.

But most Iowans cling to another legacy as well. Instinctively, we're drawn to the shade of a bur oak, a gnarled veteran that survived long-ago prairie fires only to be caught up in the ceaseless battle between woodland and prairie. We pile bird seed on our windowsills, reaching out to the creatures whose homes and habitat we may have disrupted in our attempt to harness the land. Picnickers and swimmers and boaters and anglers crowd close to our precious lakes and rivers. We prize our woodland trees - some for their beauty, some for their lumber, and some for the solitude we find beneath their canopies. With childlike wonder, we delight in the

Gentle slopes, extraordinarily productive soils, and timely rains enable a bountiful soybean harvest. Photo by Photographic Services, University of Iowa.

Above: Tiling wetlands transformed the prairie pothole region to highly productive agricultural land. Photo by Lowell Washburn.



Right: The rivers that thread Iowa's land are important avenues of commerce as well as valuable wildlife habitat (Mississippi River, Jackson County). Photo by Clay Smith.

The question is not what you look at, but what you see. - Henry David Thoreau, Walden, 1854

grace of a monarch butterfly, the intricacy of a spider web, the promise of a northbound flock of geese, the aroma of a wild rose, and the antics of a fox squirrel.

We name our rivers, streets, subdivisions, shopping malls, truck stops, sports teams, and even pesticides for the plants and animals that make up our natural and cultural heritage. Some of us fish or hunt or trap because we feel a tie to ancestors who lived off the land. To some, it feels good to till a garden or grow flowers or plant trees.

More than 100 centuries, 10,000-plus years of time and cultural transition, separate us from the mastodon hunters. To be sure, the land has changed, and we, in turn, have left our indelible stamp upon the land. No, we cannot relive the times or recreate the places those prehistoric humans knew. Yet, in the ways of the Earth, their footprints have barely faded. In geologic time, we're only a heartbeat removed from people whose Iowa roots we share. We live on the same land, gaze over the same valleys, and bond to the same rich earth.

Each citizen is a thread in the fabric of the canvas on which our land's portrait is painted. But only we, as human beings, can choose the tints, textures and brush-strokes to bring that portrait to life. For our children's sake, we must not make those choices lightly.

With the benefit of 150 years of hindsight, we could bemoan the sometimes-flawed

Oak-hickory woods are Iowa's most common forest type. Photo by Jessica Flatt.

mural Iowans have painted on the land as we developed our state and used our resources. The push to build productive farms, cities, and industries probably overshadowed a concern for natural areas. People may have taken the forests, marshes, and prairies for granted and assumed rivers always would run clean. Who could imagine that abundant wildlife might disappear? The industrious people were too busy to notice the abuse of their natural resources or the scope of their loss.

With more than 92 percent of our woodlands in private hands, individual decisions will shape our future forests.

But there's hope. Developing a new ethic, a fresh outlook, with pride in our land stewardship, Iowans could live in a sustainable society. We're joining citizen groups that work effectively for conservation. We believe we can improve the quality of life in Iowa.

To meet that goal, we must assess the health of our land and realize that the diagnosis reflects our own attitudes and actions. We can be proud of our progress, but we must admit where we've fallen short. As we look ahead, we're thinking of our children and grandchildren and the community they'll have to build upon. Perhaps we need to repair parts of that foundation, to repaint some tarnished images, and to consider the well-being of all the citizens of that land community.

While heavily damaged, Iowa's forests escaped the almost complete devastation we imposed on our other natural systems. They were spared partly because they grow on land unsuited for other crops and partly because people prize trees for wildlife, shade, windbreaks, aesthetics, recreation, and wood products.

Early settlers saw trees as commodities to be used or as impediments to agriculture. Of the 6.7 million acres of forests in Iowa in 1850, nearly two-thirds, more than 4 million acres, had been lost to clearing, grazing, logging, or fuelwood cutting by 1900. The destruction continued with intensive crop and livestock farming. By 1974, only 1.5 million acres of woodlands remained in Iowa. Since then, our forests have rebounded to about 3 million acres, due to less grazing and more trees being planted. Some cities have even developed forest-like canopies.

These forests aren't just in public parks. With more than 92 percent of our woodlands in private hands, individual decisions will shape our future forests. People who own woods for hunting or other hobbies may manage the forest very differently than did the farmers who used the timber for grazing or firewood cutting. Iowa is a farm state, but farm fields don't preclude forests. People like trees, and they are welcoming their return to diverse green space.

(End of excerpt)

1.0 Conservation of Biological Diversity

Biological diversity describes the number and kinds of plant and animal life forms, the genetic make-up, and in the habitats where they live. Generally, greater diversity means a greater potential to adapt to changes. To preserve biological diversity, animal and plant species must be able to freely interact with one another and with the environment. Human activities can adversely impact biodiversity by altering habitats, introducing invasive species or reducing the population or range of species. Conserving the diversity of organisms should support the ability of ecosystems to function, reproduce and remain productive. There must be food, water, and shelter with sufficient space and light spread across the landscape for animals and plants to survive.

This chapter begins with background information about climate, land usage, forest land changes, stocking levels, the impacts from settlement on surrounding forests and the efforts to conserve and protect forests in Iowa. There will also be discussion about the role trees have within urban communities; this is particularly important because so many communities were settled along rivers, which usually contain at least a riparian forest component for building materials and fuel wood.

The forest types, size classes, age classes and successional stages show how the forest resource varies across the state. The USDA Forest Service Forest Inventory Data describes the impacts that people have on the forest resource, and shows trends whenever possible.

Also within this chapter geospatial analysis is used to show the extent of forest land conversion, fragmentation, and parcelization. Finally, the status of forest communities and wildlife species of special concern that depend on the different forest types, age classes and successional stages is described.

Climate

Before looking at the forest types growing in Iowa, climate variations must be considered in order to understand why certain forest types dominate different areas of the state. Climate also helps to partition the state into different eco-regions, which act as a baseline for comparison for the different issues and threats facing Iowa forests.

Iowa is located in the heartland of the United States and is bordered by the Mississippi River on the east and the Missouri and Big Sioux Rivers on the west. Iowa has a relatively low relief - elevations run from a high of 1,670 feet above mean sea level in Osceola County in northwestern Iowa to 480 feet above mean sea level in Lee County in the southeastern corner of the state.

The climate of Iowa is influenced by its mid-continental location and the sheltering effect of the Rocky Mountains. A wide range of temperatures occur throughout the year, with hot summers and cold winters. Strong winds blow across Iowa throughout the year, which makes any exposed soil vulnerable to windblown erosion. This is most obvious by the creation of the Loess Hills, which are located along the state's western boundary.

The average temperature in the summer ranges from 71 degrees Fahrenheit in the northern part of the state to 73 degrees in the southern part. December to February winter temperatures average 22 degrees Fahrenheit with an average winter difference of 6.5 degrees between north and south. Temperature minimums of -25 degrees Fahrenheit are not uncommon in northern Iowa.

These climatic factors combine to influence the length of the growing season across the state. Late frosts in the spring and early freezes in the fall result in a reduced growing season of 135 days in northeastern and northwestern Iowa. The longest growing season is in southeastern Iowa, with an average of 175 days. The state average growing season is 158 days long.

Statewide winter snowfall averages 32 inches. Northern Iowa (defined here as the region of the state north of U.S. Highway 30) receives frequent, often blowing and drifting snow typically associated with strong winds. Southern Iowa may experience substantial snowfall but has more frequent ice storms because its average temperature is 6-7 degree higher than in the northern part of the state. This results in a snow cover that is often covered by a surface crust of ice or hard snow. Harsh conditions seldom last for more than a few weeks in most of the state, particularly in the southern half.

The average annual precipitation is 34 inches. The northwest part of the state is the driest with an annual precipitation of 28 inches while the southeast is the wettest with an annual precipitation of 36 inches. Iowa often experiences seasonal extremes and frequent local, rapid weather changes due to the convergence of cold, dry Arctic air, moist maritime air from the Gulf of Mexico, and dry Pacific air masses.[6]

Like most states, periods of severe drought and periods of excessive precipitation can have a dramatic impact on terrestrial and aquatic vegetation as well as their associated fish and wildlife species. Every 30 years or so there is a long drought period which lasts for several years. The most famous drought was in the 1930s, when the Plains states were called the “Dust Bowl”. There have been two “100 year” floods in 1993 and 2008 causing billions of dollars in damage to private property and wiping out habitat for a variety of wildlife species. Tree mortality increased for riparian species like silver maple, cottonwood and black walnut in the 1990’s and it is expected that trend will regain momentum in the upcoming decade as a result of the 2008 flooding.

[6]<www.crh.noaa.gov/images/dvn/downloads/Clim_IA_01.pdf>. Feb. 5 2009.

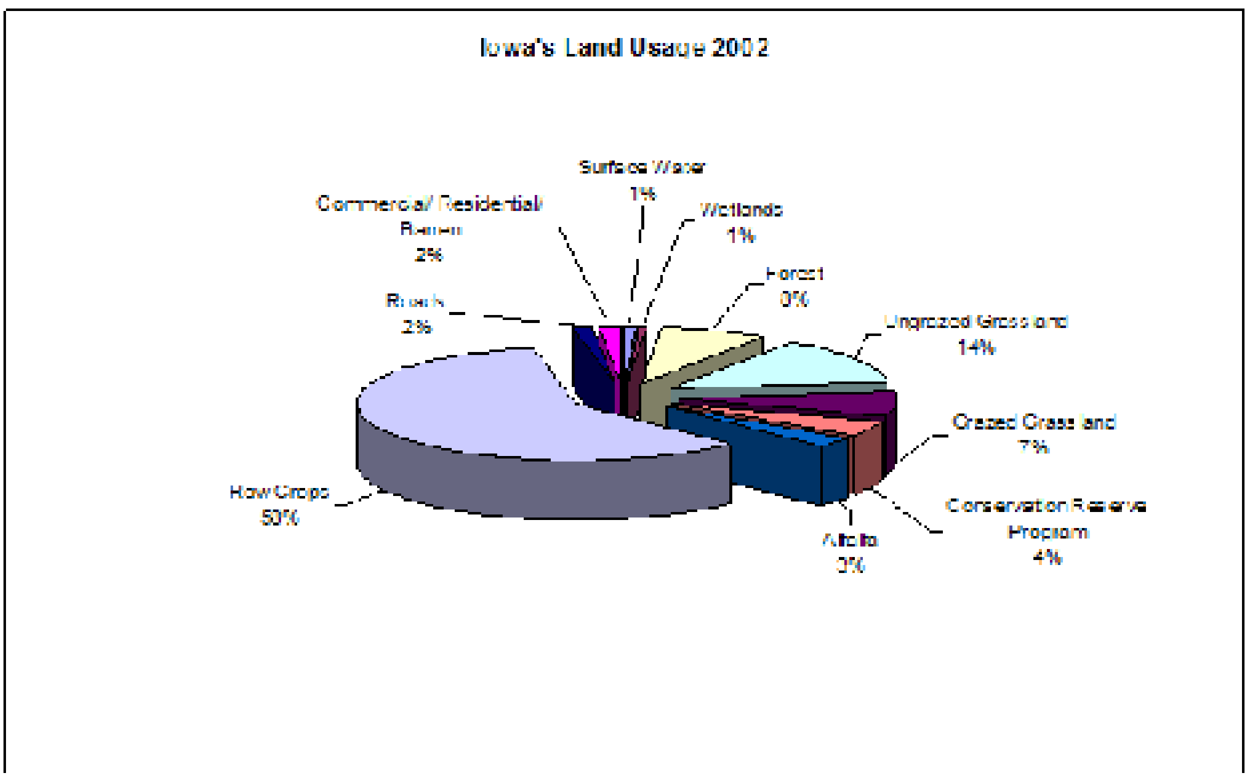
1.1 Area of Total Land, Forest Land and Reserved Forest Land

There are 36 million acres of land in Iowa. Once it was discovered that Iowa contained extremely productive soil, the transformation of native permanent vegetation resulted in one of the most altered landscapes in the world. When Iowa was discovered by European settlers, it was described as having 76% prairie (27,360,000 acres), 18% forest (6,700,000 acres) and 5% water and wetlands (1,800,000 acres). There is now less than 1% of the original prairie and wetlands left in small isolated areas and about 8% of the forest cover. Over time, these habitats have been fragmented and dramatically reduced in size, which has led to population losses for wildlife.

Figure 1.1 shows that forests made up about 8% of Iowa's 36 million acres in 2002. Trees provide multiple benefits for wildlife, shade, windbreaks, beauty, recreation, clean air, clean water and wood products to everyone living in Iowa. Land used for agricultural crops represent 58% of the land usage with an additional 4% being idled in the Conservation Reserve Program. Out of the 58% of agricultural land, 53% is classified as prime farm land. Prime agricultural farm land is primarily located in the northern half of the state, much of it along river valleys.

Iowa has lost over half of the forest it had in the 1840's.

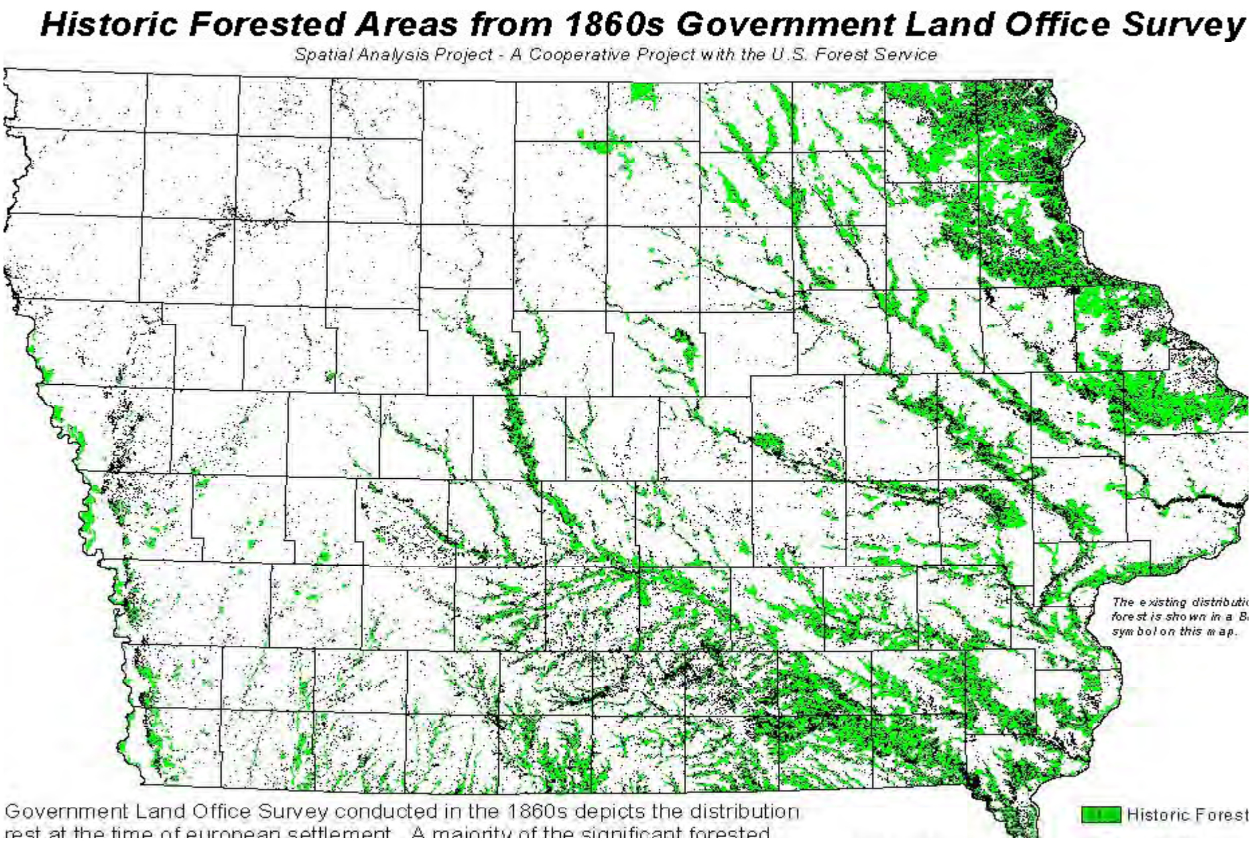
Figure 1.1 Iowa's Land Usage, 2002.



Souce: Landsat TMSI.

Figure 1.2 shows spatially where Iowa's forests were documented during the initial land survey of Iowa. Historic forests provide a footprint to begin prioritizing areas to improve the quality, quantity and connectivity of existing forests today.

Figure 1.2 Historical Forest Cover.



Source: Kathryne Clark, Iowa DNR GIS using General Land Office (GLO) Maps as Surveyed from 1836-59.

Iowa opened for settlement in 1833 and by 1910 most of the land had been converted to agricultural production. Early settlers used trees for lumber or other wood products or cleared areas to grow agricultural crops as they learned how productive the soils were for growing food. As local populations increased, growing demand for housing materials led to greater utilization of Iowa's forest resource in the later half of the 1800's. This combination of recognizing the soil producing capabilities for agricultural production and a growing human population placed a lot of pressure on Iowa's natural resources. The conversion of Iowa's native ecosystems allows it to produce a tenth of the nation's food supply.[7]

Iowa ranked 45th among all states for number of acres covered in forest in 1987. In 2007 Iowa ranked 40th among all states in the number of acres of forest.[8] Between 1987 and 2007, Iowa experienced the largest percentage increase (84%) in forest land of any state in the U.S. While many states are losing forest land, Iowa actually gained 1,317,000 acres of forest during this time period. For comparison, this was the 8th largest increase among all 50 states during this time frame.

Though Iowa ranks 40th in the nation in number of acres of forest land, this does not mean that the importance of the forest and its resources are any less important than in other states. The diversity

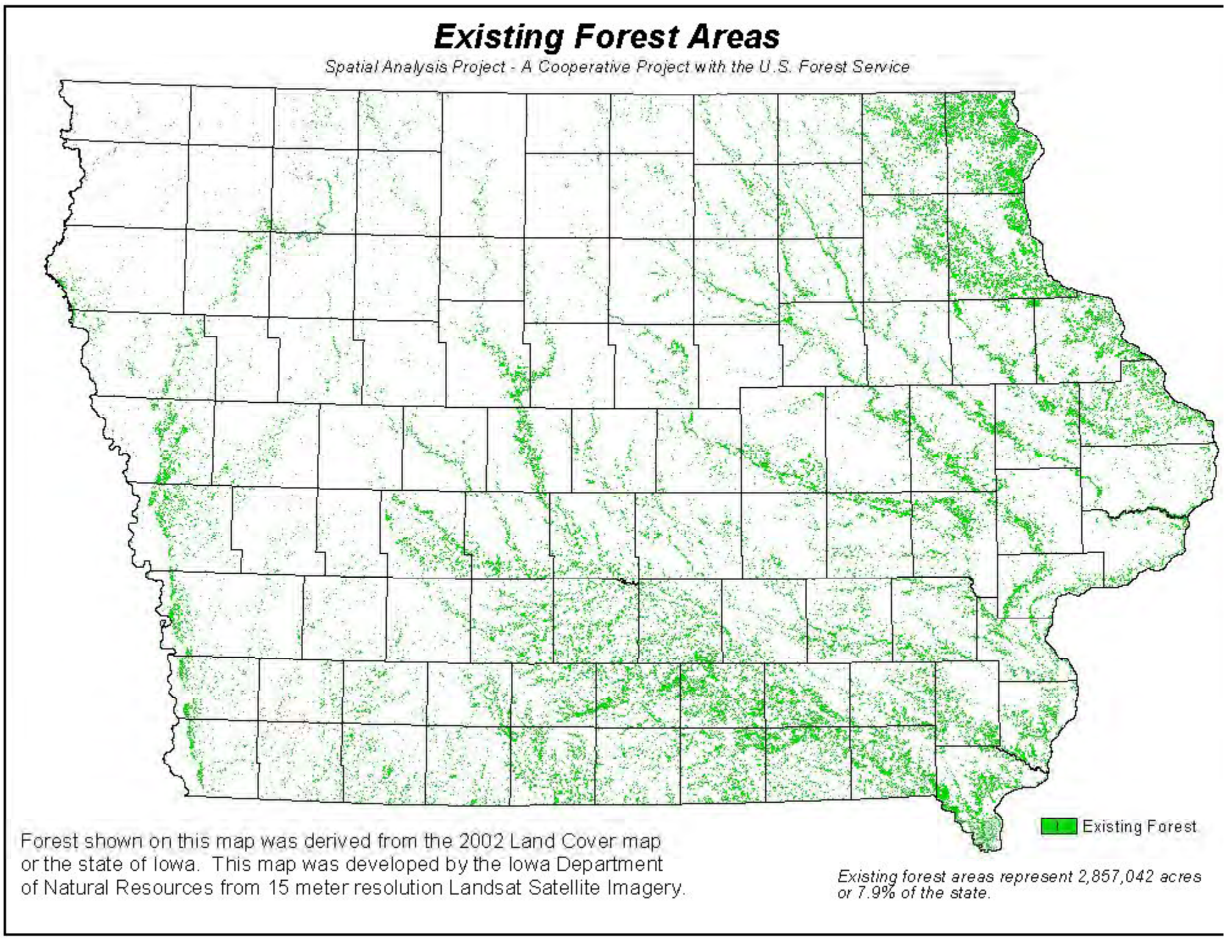
[7]Stone.

[8]Smith, W. Brad et al. Forest Resources of the United States, 2002. Gen. Tech. Rep. NC-241. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station, 2003. p. 137.

of habitat within the state provides for a wide variety of wildlife that has had to adapt to fewer acres of available permanent vegetation. Most of Iowa's forests are located on steep slopes with sensitive soils or within riparian zones. The forests provide a wide range of uses for people today, just as they did during settlement. Natural resources have helped Iowa grow a strong manufacturing base to complement the agriculture industry, which has provided a diversity of job opportunities in both rural and urban areas.

The map in Figure 1.3 shows where Iowa's forest cover is located based on 2002 satellite imagery. Forests made up 2,857,042 acres or nearly 8% of the land in 2002.

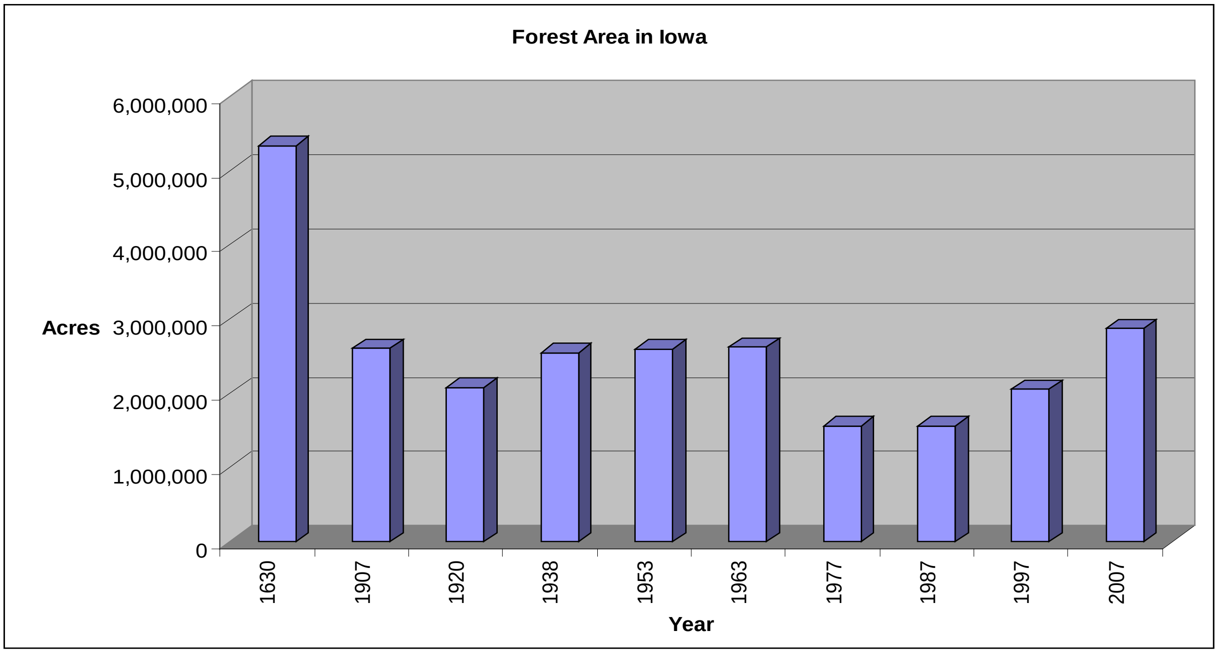
Figure 1.3 Existing Forest Cover in Iowa.



Source: Kathryne Clark, using satellite land cover from 2002.

Figure 1.4 shows the trend for forest area in Iowa through time based on the best information available. The year 1630 is included as an estimate for general reference purposes only to convey the relative extent of forest land at the time of European settlement. As the graph below shows, Iowa never has returned to growing as many acres of forest as it had 380 years ago.

Figure 1.4. Acres of Forest in Iowa.



Source: Smith, Brad. "Forest Resources of the United States", 2007.

In 1974 a United State Department of Agriculture, Forest Service, Forest Inventory Analysis (USDA-FS-FIA) inventory found that Iowa had reduced the forest land cover to its lowest level ever recorded at 1.5 million acres. At that time every county in the state had some forest land, from 25% in Allamakee to less than 1% in 31 of the state's 99 counties. Farmers owned 66% of the forest with another 24% owned by industrial and other non-farm landowners. Public entities owned 8% as state forests, parks, wildlife areas, watershed protection areas, flood prevention areas, recreational areas and military lands.[9]

Figure 1.5 shows the recent increasing trend of forest cover throughout Iowa. In 2007, U.S. Forest Service Forest Inventory and Analysis (FIA) data showed Iowa had 3.054 million acres of forest land. Allamakee County once again led all counties in Iowa at 42% forest cover while the number of counties with less than 1% forest cover dropped to only 14. Appendix A has a complete lisitng of the number of acres of forest for every county. Public entities have increased the number of acres of forest ownership to 9%.[10]

Figure 1.5. Forest Acres for Selected Years in Iowa.

Year	Acres of Forest Land (USFS FIA)
1990	2,054,794
2003	2,665,150
2004	2,748,717
2005	2,878,942
2006	2,993,267
2007	3,054,000

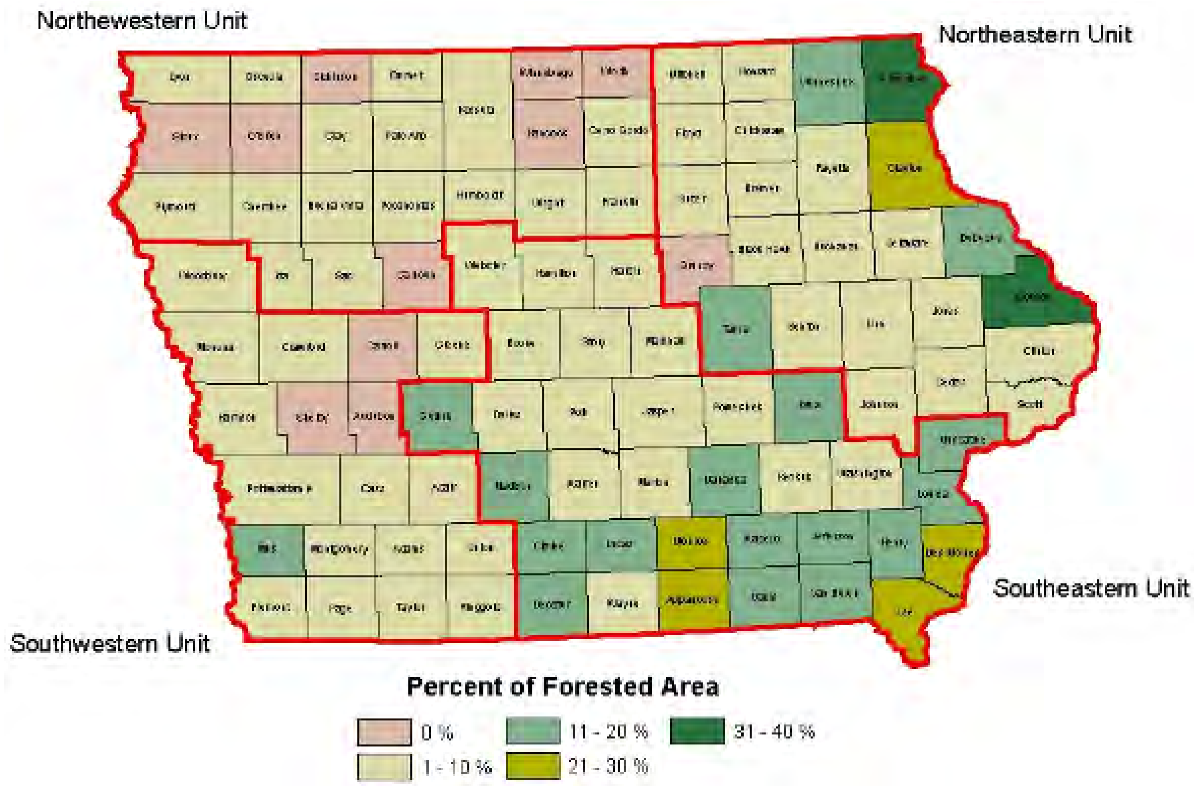
[9]Leatherberry, Earl C. et al. Iowa's forests 1999-2003, Part A (Resource Bulletin NC-266A). St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station, 2006.
[10]Miles, P.D. Forest Inventory EVALIDator web-application version 4.01 beta. St.Paul, MN:U.S. Department of Agriculture, Forest Service, Northern Research Station. Jan 13 2010 < fiatools.fs.fed.us/Evalidator 4/tmattribute.jsp>.

Forest Area by County

Iowa's forest acreage has been steadily increasing since the low point in the early 1970's. Figure 1.6 shows which counties in Iowa have the largest percentage of their available land in forest. The darker green counties have the largest percentage of forest, while the pink colored counties have the least.

Allamakee County had both the highest number of acres (176,000) and the largest percentage (42%) of its county covered with forest in Iowa in 2006 based on USDA-FS-FIA data. Most of Iowa's forest resource is located in the northeast part of the state and the bottom 2 tiers of counties in the southeast area. Appendix A has a complete listing of the number of acres of forest for every county.

Figure 1.6: Change in Forest by County as a Percentage of Total Land Area, 1990-2003



Source: Leatherberry et al., p.19, 2006.

There are 9 counties in Iowa that have both the highest amount of forest within them and have the highest percentage of forest in their county when compared to the total amount of land for that county. These 9 counties represent over 894,000 acres of forest or 30% of Iowa's total forested acreage based on 2006 USDA-FS-FIA data. Figure 1.7 lists the most heavily forested counties showing their acres and percent forested.

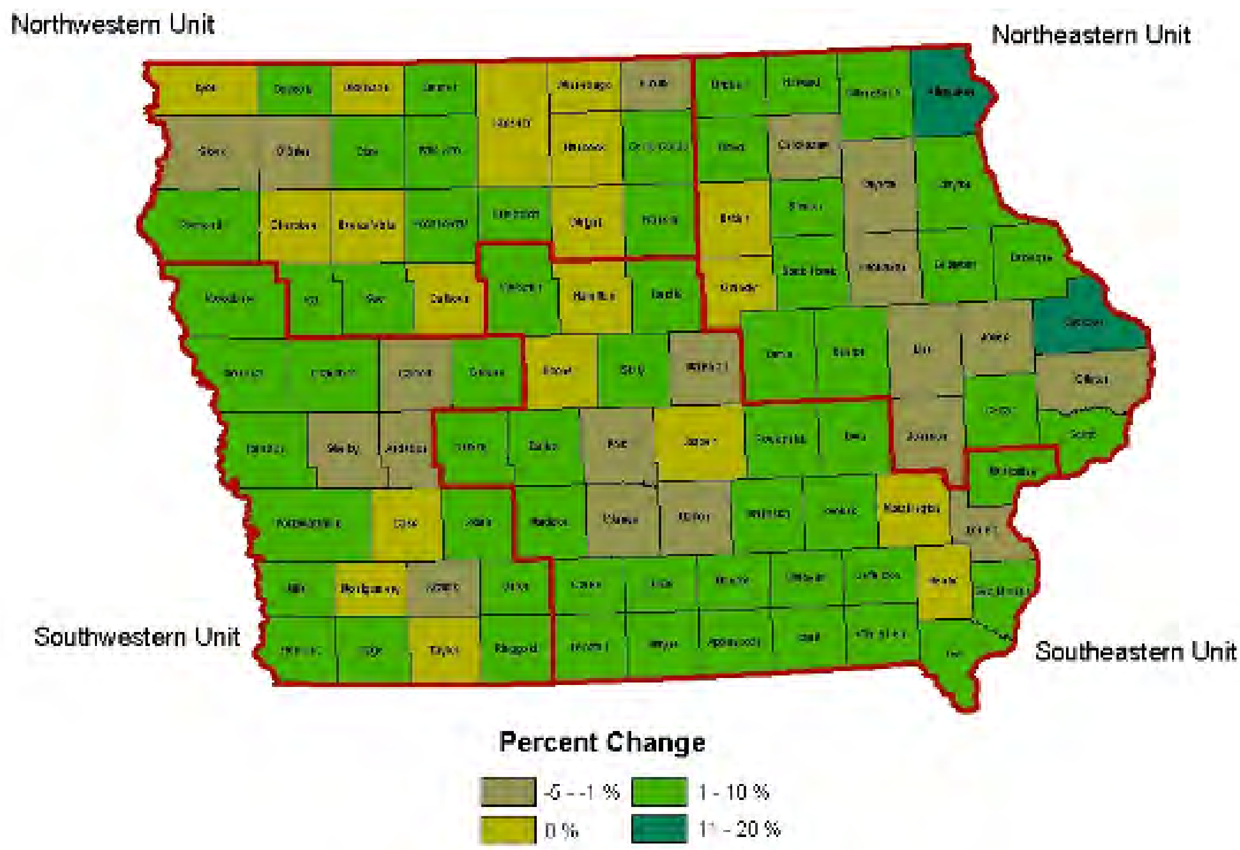
Figure 1.7 Counties with the Most Forest in Iowa in 2006.

County	Land in County	Acres of Forest	Percent of Forest
Allamakee	420,318	176,675	42.03
Clayton	518,960	142,133	27.39
Jackson	415,252	108,807	26.20
Decatur	338,921	92,369	27.25
Lee	340,189	84,507	24.84
Van Buren	311,995	76,275	24.45
Des Moines	284,172	72,632	25.66
Monroe	286,085	71,498	24.99
Wapello	274,560	69,717	25.39
Totals		**894,612**	**29.89**

Source: Miles, P.D.

Figure 1.8 shows that Iowa gained forest land in 62 of its 99 counties between 1990 and 2003. Most of the gain is probably from pastured woodlands now being inventoried because the livestock has been removed. Consolidation of the livestock industry to feedlots is a big benefit to Iowa's natural forest vegetation, native wildlife, soil structure and riparian corridors.

Figure 1.8 Percentage Increase in Forest Land by County 1990- 2003.



Source: Leatherberry et al., p.19.

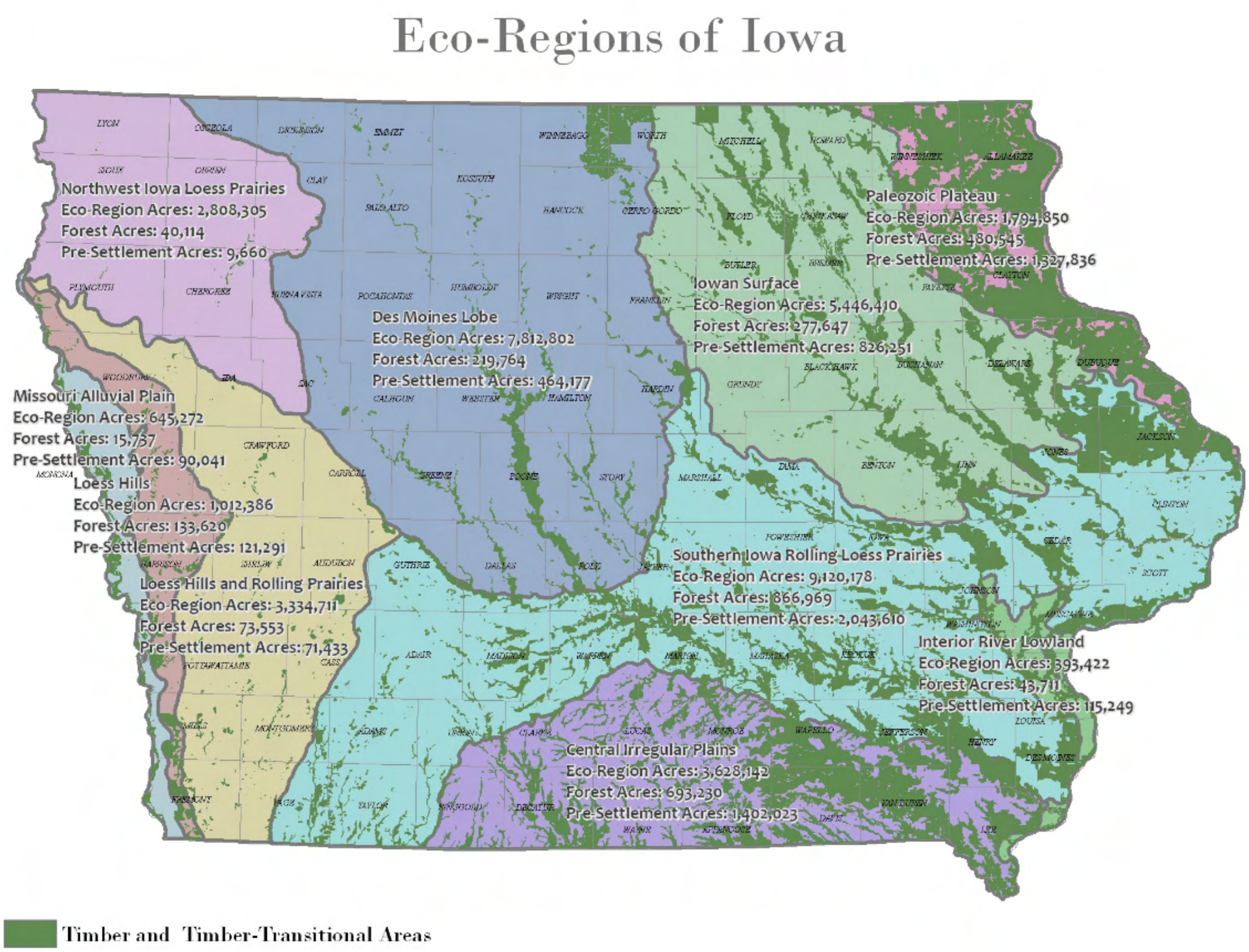
Forest Area by Eco-regions

There are 36 million acres of land in Iowa. When the last glacier, called the Des Moines Lobe, melted about 12,000 years ago and flattened wet, boggy forests of spruce and tamarack, Iowa's vegetation was comprised of 76% prairie, 18% woodland and 6% wetlands and river waterways.

Figure 1.9 shows boundaries for the state's nine eco-regions. These regions were determined by climatic conditions, underlying bedrock and glacial and loess deposit locations.

There are 36 million acres of land in Iowa — 3 million acres are classified as forest.

Figure 1.9 Eco-region Boundaries for Iowa.



Source: Kathryne Clark.

Figure 1.10 shows how Iowa's forested acres have changed within each eco-region from the time of statehood to the present era. The eco-regions are listed from largest in total area (Southern Iowa Rolling Loess Prairies) to the smallest (Interior River Lowland) and acres for each eco-region are listed on the map in Figure 1.9. Column 1846 is based on original land surveyor notes taken between 1832 and 1859 that describe the trees growing in the area.

The 2002 column is based on satellite imagery technology that does not account for land use. The USDA-FS-FIA does take into consideration land use when determining if an area qualifies as forest. Pointing out this distinction in definitions is important to avoid direct comparison between USDA-FS-FIA data and this aerial imagery. The satellite imagery counts areas as forest even if the area is grazed, whereas the Forest Service doesn't include these areas in their surveys. Definitions along riparian areas would not allow all of these areas to qualify as forest land that a satellite image may collect.

Figure 1.10 Comparison of Forested Acres in Iowa from Statehood (1846) to 2002.

Eco-Region	1846	2002 Satellite Imagery	Acreage Change	Percentage Change
Southern Iowa Rolling Loess Prairies	2,043,610	866,969	-1,176641	-58
Des Moines Lobe	464,177	219,764	-244,413	-53
Iowan Surface	826,251	277,647	-548,604	-66
Central Irregular	1,402,023	693,230	-708,793	-51
Loess Hills and Rolling Plains	71,433	73,553	2,120	3
NW IA Loess Prairies	9,660	40,114	30,454	315
Paleozoic Plateau	1,327,836	480,545	-847,291	-64
Loess Hills	121,291	133,620	12,329	10
Missouri Alluvial Plain	90,041	15,737	-74,304	-83
Interior River Lowland	115,259	43,711	-71,548	-62
Total Acres	6,471,581	2,846,892	-3,624,689	-56

Source: Kathryne Clark.

Certainly we will never know exactly how Iowa's forests have changed since the beginning of statehood, but using the best data available allows for discussion of some general trends. The Southern Iowa Rolling Loess Prairies region has lost the greatest amount of forest land (1.1 million acres) while the Paleozoic Plateau has lost the greatest percentage (47%). The Loess Hills eco-regions are the only eco-regions to have gained forest, from 3% to 315%. The forest cover gain in these regions combined totals under 45,000 acres, or less than 1% of total land area. **Overall, Iowa has lost more than 3.6 million acres (56%) of forest land since it became a state.**

Characteristics of Each Eco-region

A brief description about the geology, area of forest cover, forest types, rivers, wildlife and human impact on each eco-region is provided, beginning with the eco-region covering the greatest area in the state and ending with the eco-region covering the smallest area..

Southern Iowa Rolling Loess Prairies

Geology

This region is dominated by glacial deposits left by ice sheets that extended south into Missouri over 500,000 years ago. The deposits were carved by deepening episodes of stream erosion so that only a horizon line of hill summits marks the once-continuous glacial plain. Numerous rills, creeks, and rivers branch out across the landscape, shaping the old glacial deposits into steeply rolling hills and valleys. A mantle of loess drapes the uplands and upper hill slopes.

This is the largest eco-region in Iowa; it is composed almost entirely of glacial drift, which was deposited earlier than for the Des Moines Lobe. Instead of poorly drained and relatively level landscapes such as those found in the Des Moines Lobe, streams have had time to erode the land surface and form well-defined drainage systems. The rolling wooded terrain adjoining the well developed stream valleys creates many scenic and recreational areas for people and wildlife to settle within.

Area of Forest and Forest Cover Types

This region had 2,043,610 acres of forest at the time of statehood but now contains only 866,969 acres (a loss of about 58%). On the uplands the forest cover is mainly oak-hickory with some conversion to shade tolerant species. The dominate shade tolerant tree is sugar maple, followed by hackberry, bitternut hickory, American elm and boxelder. A mix of hackberry, elm, bitternut hickory, black cherry, oak and black walnut can also be found on upland areas. Silver maple and cottonwood are the primary forest types along rivers, some of which also contain ash and boxelder.

Typical Oak-Hickory forest type. Photo by Joe Herring.

Wildlife

Wildlife that benefits the most from the forests in this area includes deer, turkey and a variety of songbirds. For a more detailed description of wildlife that prefer this forest habitat refer to the Wildlife Action Plan.

Rivers

Almost all of the forest cover is adjacent or close to large rivers such as the Mississippi, Wapsipinicon, Cedar and Iowa. Existence of rivers is strongly correlated with relatively large, high-quality forests, as steep river valley slopes are not suitable for farmland and are therefore not sought after for such a purpose. Forest stands located within the actual confines of the valley walls are characterized by greater tree diversity, rarer species (sycamore, coffee tree, butternut, wahoo, etc.), higher quality herbaceous and shrub layers, and more structural diversity than those located on lands that are flatter and further away from rivers. Larger river systems generally exhibit these trends in greater magnitude than smaller rivers such as the Skunk and English. Only on the richest, north-facing slopes of the Iowa River can true maple-basswood forest types be found. Along the larger rivers, wind-blown (eolian) sand deposits can be found on the east sides of the valley, which translates to local diversity in species composition and habitat structure.

Human Impact

Agriculture has reduced the total number of forest acres by simple conversion to row crop and by grazing systems in the timber. Grazing has reduced understory diversity, regeneration capacity, soil quality, tree health and environmental quality. Harvesting of timber products from the forest has been done unsustainably in many cases and has led to reduced stand quality and decreased genetic value. Parcelization resulting from construction of new housing developments and other activities has also had a tremendous impact on the forest resource of this region.

Unique Forest Type

The picture is from a unique site called Swamp White Oak Preserve, a Nature Conservancy site near Muscatine. Thanks to a high water table and frequent flooding, this 372 acre preserve is one of the best remaining examples of the oak woodlands that were once common in Iowa's floodplains. Now rare, these woodlands are considered to be the most biologically diverse forest type in all of Iowa. The oak woodland type is classified as a G-1 woodland community, meaning it's one of the rarest of woodland areas. Most forests like this have either been altered by lack of fire or have been cut down for agricultural purposes.

Swamp White Oak Preserve in this eco-region. Photo by Mark Vitosh.

Des Moines Lobe

Geology

In north-central Iowa, the terrain offers a whole new set of challenges and opportunities. Here, farmers praise the flat, black, productive soils, while naturalists tout the pothole marshes and glacial lakes. It is a young landscape with dry, knobby mounds (of sand and gravel) and shallow, wet bowls (depressions) - the "tracks" of glaciers that melted just 13,000 to 12,000 years ago. Valuable deposits of gravel and sand lie where they were strewn by the glaciers or melt water streams. Those pulses of water from the decaying ice also formed wide valleys that now carry much smaller rivers.

But the glaciers left much of north-central Iowa's land tabletop flat, without a distinct natural drainage pattern. To make the fields dry enough for farming, people built a series of drainage ditches, fed by clay and plastic tile lines to hurry the water off the land. For more than a century, landowners have tiled, ditched, and drained the region to convert its marshes to some of the world's premier farmland. Water now runs off this productive land instead of being absorbed by wetlands or other areas with permanent vegetation with a stable soil structure.

Area of Forest and Forest Cover Type

This eco-region contained an estimated 464,177 acres of forest when Iowa became a state but now contains only 219,764 acres. Forests are predominantly oak-hickory, succeeding to hackberry, basswood, and bitternut hickory. Oak species include bur oak, red oak and black oak, and hickory species include bitternut hickory and shagbark hickory. Hackberry, green ash, cottonwood, Siberian elm, black walnut, ironwood, coffee tree, mulberry, red elm and American elm are also associated with forests in this region

Along second and third order streams, deep alluvial soils support rich walnut-hackberry stands. Along larger rivers with well-established floodplains, forests are mostly even-aged stands of silver maple, cottonwood, willow, ash, and boxelder.

Wildlife

Along second and third order streams, deep alluvial soils support rich walnut-hackberry stands. Along larger rivers with well-established floodplains, forests are mostly even-aged stands of silver maple, cottonwood, willow, ash, and boxelder.

Rivers

Forested areas cover the main river channels and adjacent drainages. Erosion into large river systems caused steep slopes to develop, exposing underlying glacial till soils. The aspect of these slopes determines which tree and shrub species will survive and thrive.

Typical Oak-Hickory forest type in this eco-region. Photo by Joe Herring.

Human Impact

Due to past management, which has included selective harvesting of high value trees followed by grazing, many stands are two-aged, with older, widely spaced trees that were of too poor of quality to be logged. These forests were often oak and hickory with a younger generation (30-50 years) of mixed species (cherry, hackberry, hickory, elm) that evolved when grazing ceased. Another common stand type seen on floodplains is two-aged bur oak/soft maple, which contains mature bur oaks widely scattered among second generation bottomland hardwoods.

Unique Forest Type

The deep ravines and north facing coves have allowed black walnut and red oak to grow very well. Isolated pockets of butternut trees can sometimes be found as well.

Iowan Surface

Geology

The last period of intense glacial cold that occurred 21,000 to 16,000 years ago had pronounced effects on northern Iowa, which was not far from the glacier front. Tundra and permafrost conditions persisted while hilly landscapes succumbed to vigorous episodes of weathering and leveling as materials were loosened and moved. This process created the gently rolling terrain of northeastern Iowa.

The stones, carried from the north during an earlier glaciation more than 500,000 years ago, lie scattered in pastures or piled by farmers in fencerows. Abundant groundwater reaches the surface in springs, rivers and peaty wetlands, called fens, which also support rare plant and animal communities. Heavily wooded flood plains grew along water corridors.

The Iowan Surface has a higher amount of sandy/sand loam soils than the eco-regions to the south, which results in random patches of forest across the otherwise largely agricultural landscape. Moving further northeast in this eco-region, small quantities of aspen can be found within the other forest types.

Area of Forest and Forest Cover Type

This eco-region currently covers over 5.4 million acres of land and contains 277,647 acres of forest; the region contained 826,251 acres of forest cover when Iowa became a state, which means that roughly two-thirds of the forest cover has been lost. Tree species found along ridge-tops include white oak, bur oak, red oak and shagbark hickory; red oak, white oak, basswood and hard maple are common on north-facing slopes while bur oak and red cedar are common on the warmer, drier south-facing slopes. Benches and valleys are favorite spots for walnut, elm and ash. Floodplain tree species include silver maple, green ash, river birch, elm, and cottonwood.

Oak hickory forest type. Photo by Bruce Blair.

Wildlife

Forests in this region serve as habitat for deer, turkey and ruffed grouse (for a more detailed description of wildlife that prefer this forest habitat refer to the Wildlife Action Plan).

Rivers

The major rivers in this eco-region are the Upper Iowa, Cedar, Wapsipinicon, Winnebago and Shell Rock rivers. As with the Southern Iowa Rolling Loess Prairie eco-region, forests surrounding rivers in this region provide a number of benefits and contain a variety of wildlife and tree species. Larger river systems such as the Cedar River generally exhibit these trends in greater magnitude than smaller rivers such as the Wapsipinicon. Only on the richest north-facing slopes of the Cedar River can true maple-basswood forest types be found. On the bigger rivers, wind-blown (eolian) sand deposits on the east sides of the valley can be found, which translates to local diversity in species composition and habitat structure.

Bottomland forest type typical of woodlands along rivers in this eco-region. Photo by Joe Herring.

Human Impact

Conversion of timber to row cropping and grazing systems has reduced the total number of forest acres. Grazing has led to a decrease in under story diversity, regeneration capacity, soil quality, tree health and overall environmental quality. Harvesting of timber products from the forest has been done unsustainably in many cases and has therefore led to a reduction in stand quality and value.

People have made a large impact on the forested resource in this region. Pastures and woodlands have been tiled and cleared to make way for farming, and landowners are less willing to take land out of production to plant permanent vegetation like trees because of the loss of income they would otherwise be able to receive by farming the area.

Unique Forest Type

The most distinguishing characteristic of this region is the elongated, diagonal Paha ridges that are forested remnants of the former Southern Iowa Drift Plain surface.

Central Irregular Plains

Geology

The Central Irregular Plains eco-region covers over 3.6 million acres in south-central Iowa. Major rivers within the eco-region are the Chariton, Des Moines, Grand, Missouri and their tributaries. The topography ranges from flat to moderately hilly. Glacial till forms the parent material for most of the soil, while Loess deposits increase toward the western part of this region.

Stephens State Forest. Photo by Jessica Flatt.

Area of Forest and Forest Cover Type

Land in this region is used for contour farming, as pasture for livestock and as both private and public forest. The region has lost roughly half of its forest cover in the last 150+ years, and now contains 693,230 acres. The oak-hickory forest type is the most common on uplands, which are composed of species like white oak, red oak, black oak, bur oak, ash, black cherry and shagbark hickory. Along riparian areas, silver maple, elm, hackberry, basswood, bitternut hickory, cottonwood, swamp white oak, bur oak, red oak, green ash, river birch, shellbark hickory, sycamore and basswood can be found in varying amounts. Black walnut exists on properly drained bottomlands, second bottoms, and benches and may be mixed on upland sites.

Wildlife

Wildlife that depends on forests in this region includes deer, turkey, woodcocks, grouse and other non-game bird species. Secondarily, quail management is important near woodland edges. For a more detailed description of wildlife that prefer this forest habitat refer to the Wildlife Action Plan.

Example of oak-hickory forest type in this eco-region. Photo by John Byrd.

Rivers

Well-defined drainage systems have improved the overall quantity of forest land in this eco-region by isolating some areas from destructive activity. The remaining forested areas are usually on highly erosive soils; furthermore, livestock grazing has negatively impacted both commercial forest product quality and the ability of forest land to naturally regenerate desirable tree species.

Human Impact

Many forested areas have been grazed, which causes erosion along cattle trails. When livestock is removed, young hickory stands will typically begin to grow. Ridge tops that may have been dominated by either woodland or prairie (before 1850) are now grazed, hayed, or cropped. This can cause erosion as more water runs off of agricultural land through steeper wooded terrain, leading to gullying problems. Bottomland areas may also be used for agricultural crops because of their rich, productive soils.

Unique Forest Type

At Stephens State Forest, plantations of white pine, red pine, jack pine, mixed pine and mixed conifer that were established to reclaim unproductive agricultural fields have come to provide habitats not normally seen in this part of the state, including tree species such as blackjack oak, mockernut hickory and chinkapin oak. One unique characteristic of this area is its ability to re-forest idled land in a relatively short period of time; lower oak site indexes coupled with an abundant and aggressive mixture of pioneer tree species seed sources like elm and red cedar make this possible. Even oaks seem to regenerate naturally and easily, likely because they have relatively little competition from understory plants.

Loess Hills and Rolling Prairies

Geology

The Rolling Loess Prairies eco-region is characterized by well-drained plains with loess deposits and low, open hills. Loess deposits in this eco-region, which are generally less than 25 feet in depth, tend to be thinner than those found in the Loess Hills eco-region just to the west.[11]

[11]Griffith, Glenn E. and James M. Omernik (Lead Authors); Mark McGinley (Topic Editor). 2008. "Ecoregions of Iowa and Missouri (EPA)." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [First published in the Encyclopedia of Earth October 16, 2008; Last revised December 11, 2008; Retrieved January 6, 2010]. <www.eoearth.org/article/Ecoregions_of_Iowa_and_Missouri_(EPA)>.

Area of Forest and Forest Cover Type

This eco-region covers an area of slightly more than 3.3 million acres, of which just 73,553 are forest. Despite its relatively small amount of forest cover, it contained only 71,433 acres of forest in the mid-nineteenth century, making it one of only three eco-regions in the state to have actually gained forest land since the beginning of statehood. Ridge top forests are dominated by bur oak and shagbark hickory. North-facing slopes contain a lot of black oak whereas south-facing slopes are dominated by bur oak and red cedar. Benches and valleys are favorite spots for walnut, elm, basswood and ash while silver maple, green ash, hackberry, river birch, elm and cottonwood are typically found in floodplains.

Wildlife

Forest wildlife in this region includes deer, turkey and a variety of songbirds. For a more detailed description refer to the Wildlife Action Plan.

Rivers

The three rivers in the region, the Nishnabotna, Boyer, and Soldier, are primarily used for agricultural field drainage, which increases the productivity of row cropping. Due to intense farming practices, very little bottomland forests remains within the region's riparian zones.

Human Impact

Agriculture dominates the landscape in this eco-region, pushing the forests to the least productive soils on steep terrain.

Unique Forest Type

The deep ravines and north facing coves have allowed black walnut, red oak, bur oak, basswood, hackberry, and Kentucky coffee tree to grow very well.

Northwest Iowa Loess Prairie

Geology

Evidence of the tundra and glacier that once made up this eco-region has been covered by layers of windblown loess and modified by erosion from a network of streams. Broad valleys and open uplands roll to the horizon, creating landscapes reminiscent of the ranch country of the Dakotas. Time and weather have exposed tips of the state's oldest bedrock, the Sioux Quartzite, which pokes to the surface in northwest Lyon County. The ancient reddish rock formed from sediments in coastal waters more than 1.6 billion years ago. The famous Pipestone quarries in southwestern Minnesota are in this same distinct red rock formation, which is regarded as sacred ground by Native American tribes. Ironically, the state's youngest bedrock - sandstone, shale, chalk and limestone, which are less than 100 million years old - lies directly against the oldest; these newer sediments formed in shallow seas confined by cliffs of the old Sioux Quartzite.

Area of Forest and Forest Cover Type

According to historical estimates from the 1850's, this eco-region contained the least amount of forest of any region in the state both in terms of total acres (9,660 acres) and as a percentage of total land (0.3%); though forest cover has grown to 40,114 acres (a gain of more than 300%), the region is still one of the least-forested areas of the state. Bur oak and hickory are found on upland sites while silver maple and cottonwood grow on bottomland sites.

Wildlife

Wildlife found in the region's forests includes deer, turkey and a variety of songbirds (see the Wildlife Action Plan for a more detailed description).

Rivers

As in the Loess Hills and Rolling Prairie eco-region, the two primary rivers in this region, the Rock and Floyd, are used to drain agricultural fields, and very little bottomland forest remains within the region's riparian areas.

Human Impact

Agriculture dominates the landscape in this eco-region, and the little forest land that remains is on steep slopes that are unsuitable for farming.

Paleozoic Plateau

Geology

The scenic eco-region is characterized by narrow valleys deeply carved into Paleozoic-era sedimentary rock as well as a near-absence of glacial deposits. Fossil-bearing strata in this region originated as sediment on tropical sea floors between 300 and 550 million years ago. Rock layers vary in resistance to erosion, producing bluffs, waterfalls and rapids. Shallow limestone, coupled with the dissolving action of groundwater, yields numerous caves, springs and sinkholes.

The bedrock of this region is primarily limestone, dolomite, sandstone and shale. The limestone and dolomite are relatively porous due to the affects of slightly acidic rain, which has, over the course of thousands of years, dissolved portions of this bedrock to create crevasses, caves and sink-holes.

Soils are shallow to non-existent on the numerous steep slopes. Exposed bedrock and outcroppings are common features. Most of this area consists of well drained uplands. The soils are primarily derived from accumulations of loess.

Now close to the surface in the Paleozoic Plateau, the ancient sediments in this region are subject to erosion from rain water and melting snow that seeps into cracks and fissures in the rock. This action has resulted in the presence of the sinkholes, springs and caves common in this area, which are collectively referred to as Karst topography (landforms for which rock outcroppings and sinkholes are common). Sinkholes can be problematic because they provide direct access for contaminated surface water to pollute the ground water. The existence of this Karst landscape accounts for the many unique microclimates in this area, as well as the cold water streams. Springs are also very common in parts of the region where limestone overlies less porous sandstone or shale and groundwater is forced to the surface as a result.

The Karst topography within this eco-region contains interesting geologic features called algific talus slopes. These slopes are usually rocky and typically occur on steep, north-facing slopes. In special situations, cold winter air will circulate through deep cracks in these slopes. Often there are sinkholes near the top of the slopes that directly connect with these cracks. This plumbing system can run from the top all the way to the bottom of the slopes, which in turn can cause frost to form deep into the hillside. In the summer, cool air spills out from the cracks in the side of the slopes from the still frozen ground and creates a micro-climate that can support plants that would otherwise perish in Iowa's hot climate. The endangered Iowa Pleistocene Snail (Discus macclintocki) and Northern Wild Monkshood flower (Aconitum noveboracense) exist only on these special sites. Other unique species which can be found on these slopes include Golden Saxifrage (Chrysosplenium iowenses), Mountain Maple (Acer spicatum), Yellow Birch (Betula alleghaniensis), Balsam Fir (Abies balsamea) and Canadian Yew (Taxus canadensis).

The eastern half of the Paleozoic Plateau is often referred to as the Driftless Area, which was thought to be untouched by the most recent periods of glaciation in the Pleistocene Era. Although this has been found to be untrue by geologists, there is a striking difference in landscape features between the Driftless Area and the remainder of the state, where glacial deposits heavily mask the effect of local bedrock.

Natural Features

Natural features in this region include limestone bluffs, cold water streams and algific slopes. The Mississippi River bluffs allow for spectacular views from 400 feet above the water's surface. Many small caves and rock outcrops can be seen from below. Traveling west from the Mississippi, the terrain becomes gentler everywhere except in the major river and creek channels, where abrupt changes in topography are prevalent.

Archaeology

Rich in prehistoric culture, this area of Iowa contains many known archaeological sites. The presence of Native American Effigy Mounds (burial mounds in the shape of animals) was one of the reasons that parts of the original Yellow River State Forest were transferred to the National Park Service in 1949 and became Effigy Mounds National Monument. Other sites that have archaeological significance can be found within the borders of Yellow River State Forest, including Paint Rock, numerous Native American camps and the site of the first Native American Mission school west of the Mississippi river (located in the Yellow River unit of Yellow River State Forest).

An algific slope. Photo by Gary Beyer.

Area of Forest and Forest Cover Type

This eco-region has traditionally been, by percentage, the most heavily forested area of the state and it continues to maintain that distinction today. The combination of topography, forest cover and increased precipitation creates rich diverse communities of plants and wildlife. Of the 1,327,836 acres of forest that existed when Iowa became a state, only 480,545 or 36% still remains.

White pine in northeast Iowa. Photo by Bruce Blair.

This eco-region is dominated by upland forest types, with bottomland forests making up a small percentage of the total forest area. White oak and red oak trees dominate the ridge tops, with more red oak occurring on the north and east aspects. Bur oak, black oak and, in some cases, chinkapin oak are common on the steeper south and west aspects. The trees on these slopes tend to be short and scrubby in appearance, producing poor quality timber but providing important wildlife habitat.

A larger mix of central hardwoods can also be found on upland sites throughout this region. Species like hard maple, basswood, black cherry, black walnut, butternut, white ash, black ash, hackberry, shagbark hickory, bitternut hickory, white elm and red elm are common along with the oaks. This mix of tree species reflects the randomness caused by years of past disturbances from pasturing, harvesting and abandonment.

Along narrow bottomlands species like white elm, rock elm, black ash and hackberry are typical. On wider streams and river valleys more bur oak, swamp white oak, green ash, willow, cottonwood, boxelder, silver maple and some black walnut can be found.

The forest of the Paleozoic eco-region has been dominated by oak species especially red, white and bur oak. Most of the mature trees are over 120 years old and are being replaced by maple species, primarily sugar maple, and bitternut hickory. Flood plains in the Paleozoic Plateau are usually narrow with abrupt vertical rock walls as boundaries, and they typically contain bottomland hardwoods such as soft maple and cottonwood.

Most of the woodlands are found along or adjacent to rivers. There are some larger blocks (greater than 2,000 acres) that are not near rivers and many small blocks of 5 to 100 acres that are the remnants of the large timber blocks that have been cleared away for agricultural production.

Wildlife

Most forest landowners manage their lands for white tail deer and wild turkey, and since the oak-hickory forest type is common here, not much effort is needed to maintain these wildlife species. Some landowners manage for early successional habitat that is typically comprised of young, dense cover and that contains a heavy component of aspen. This creates habitat for game birds like ruffed grouse and American woodcock. Edge feathering is encouraged to create brushy habitat on the forest borders, which helps limit the impact of parasitism to song bird nests by brown-headed cowbirds.

Important wildlife species living in the forests of this region include deer, turkey, ruffed grouse, bald eagles and migratory birds. For a more detailed description, refer to the Wildlife Action Plan.

Rivers

Most of the river bottoms tend to be narrow; where the rivers widen, the bottomlands are usually cleared off for row crops. Today, many of these bottomland fields are being abandoned due to damage caused by frequent, severe flooding.

Human Impact

Prior to European settlement, the diverse landscape in northeast Iowa supported a variety of plant and animal communities. With plenty of rock caves for places of shelter and fertile soils to support agriculture, the area was ideal for the development and survival of prehistoric societies and cultures. The very earliest Native American activity in the area dates about 12,000 years ago to the Paleo-Indian period, as evidenced by archaeological finds of primitive tools. Over the next few thousand years, moderating climate allowed nomadic hunter-gatherer tribes to settle and develop agricultural practices. The archaeological record of Allamakee County is rich with sites containing ritual burial mounds, encampments and petrogylyphs. Early natives in this area included tribes in the Hopewell Interaction Sphere. Famous for their extensive trade networks, the sophistication of the Hopewell is evidenced by their conical burial mounds, which date to over 2000 years ago and which are still visible today. In the following Woodland Prehistoric period, mounds in the shapes of birds, mammals, and even humans were common in this area. Many of these mounds are still on display at Effigy Mounds National Monument.

Over time, the late woodland period cultures were replaced by the more agrarian Oneota peoples, of which little is known. The Oneota society probably developed into the Iowan, Sauk and Fox, Winnebago, Oto, and other Siouan speaking tribes that inhabited the Midwest when the Europeans arrived. Throughout the early period of fur trade, Europeans exploited the route traveled by Marquette and Joliet in 1673 (up the Fox River from Lake Michigan then down the Wisconsin River to the Mississippi). Much of the early activity of Europeans in this area involved their interaction with these native tribesmen, first in the fur trade industry and then later in the enforcement of treaties and hunting zones between warring tribes.

By 1837, steamboats traveling up the Mississippi were bringing settlers and facilitating trade in the new Iowa Territory. Many forests along the river were decimated in the quest for fuel to feed the boilers on these boats, and a boat's deck was often stacked with as much cordwood as it could carry. Many old photographs depicting early river towns show the hillsides virtually denuded of timber.

Most of the earliest settlers moved west of the rough country near the Mississippi to more suitable agricultural lands already devoid of trees. There was very little farming in Allamakee County before 1850, but eventually the abundant wildlife and diverse landscape began attracting settlers to the county. Primarily of German and Norwegian descent, these settlers built mostly on the edges of forests, where there was protection from the elements and a source of fuel and building materials.

In 1857, the main line railroad was opened between McGregor and Harpers Ferry, putting further strain on the forest resources of the area. By 1900, there was a farmstead on nearly every 160 acre parcel in northeast Iowa and most of the local towns were established. Farming was confined to the flatter ridge tops and bottomlands near rivers and streams. Often, these lands were cleared of timber to make way for corn, potatoes, and wheat. The Yellow River was the site of several sawmills and grist mills during this time period.

The mining of coal eventually took the strain off local timber as a source of fuel for boats and trains, and forests began to grow back in areas not being used for farming. Prairie fires which once burned unchecked were a relic of the past, gone with the Native American culture. The landscape had changed dramatically in a span of about 65 years.

While early riverboat traffic was instrumental to local development, it also consumed a lot of fuel from forests adjacent to the Mississippi River. As settlement continued, the railroads expanded into the area with even greater demand for fuel wood, and forests along the Mississippi and its tributaries were cut heavily to supply this demand. Many of the earliest settlers preferred to build close to forests for a source of fuel and building materials, further increasing the demand on local forests. Much land was also cleared for farming.

Today, local land use is mostly agricultural, with farming on the flatter ridge tops and on the bottomlands next to creeks and rivers. Livestock grazing is prevalent on the steeper open grounds. Agriculture has heavily impacted the forests in this region, mostly due to land clearing and grazing. During the 1990's forests were squared up by planting trees in agriculture fields, and with the high commodity prices between 2006 and 2009, bulldozers were used to remove forest cover to straighten out fields.

Due to its rugged terrain, few places in this eco-region remain to be converted to agriculture. Land clearing is also slowing down because landowners are beginning to realize the value of timber and to see forests as an important part of a healthy farm operation. More recreational users own land within this region as well, and these owners tend to value the forest land that they have. However, the region's forests are still threatened by community growth and construction of new homes.

Major communities in the area include Waukon, Lansing, and Marquette, as well as nearby Prairie du Chien, Wisconsin. The smaller communities of Harpers Ferry, Waterville, and Rossville account for most of the local population.

Unique Forest Type

There are several unique tree species types, including white pine, yellow birch, paper birch and butternut.

Loess Hills

Geology

Here, uncommonly thick deposits of loess create a distinct landscape. The silt, ground by glaciers, was carried down the Missouri River by seasonal melt water from winter snow pack and by spring and summer floods. During drier periods, especially between 28,000 and 12,000 years ago, vast quantities of loose silt were swept from the broad valley and re-deposited, with the deepest accumulation within 10 miles of the Missouri River. Subsequent erosion has sculpted the tan deposits into an array of peaked hills and narrow ridge crests with steep diverging side slopes.

The formation is only one to 15 miles wide but extends nearly 200 miles along the Missouri River from near Sioux City, Iowa south to St. Joseph, Missouri. Loess deposits are found in many parts of the world, but nowhere else, except in China, do they reach as high as in Iowa.

Area of Forest and Forest Cover Type

This eco-region is a thin sliver of land stretched from north to south covering an area just over 1 million acres of land. Today there are 133,620 acres of forest cover compared to 121,291 acres at the time of statehood, a gain of 10%. Forests along ridge-tops are dominated by bur oak and shagbark hickory. Black oak is common on north-facing slopes, while bur oak and red cedar are found on south-facing slopes. Benches and valleys are favorite spots for walnut, elm and ash. Floodplain tree species include silver maple, green ash, hackberry, river birch, elm and cottonwood.

Wildlife

Deer, turkey and a variety of songbirds benefit most from forests in this eco-region, while bald eagles nest in large trees along the Missouri River. For a more detailed description of wildlife in this eco-region, refer to the Wildlife Action Plan.

Rivers

The Floyd and Soldier rivers are used primarily for agricultural drainage, and little bottomland riparian forests exists in the region today.

Human Impact

Agriculture dominates the landscape in this eco-region, pushing the forests to the least productive soils on steep terrain.

Unique Forest Type

The deep ravines and north facing coves have allowed black walnut, red oak, bur oak, hackberry and coffee tree to grow very well.

Missouri Alluvial Plains

Geology

Rivers weave throughout Iowa, eroding and depositing sediment (alluvium) on their adjoining plains. Backwater sloughs and oxbow lakes on larger floodplains mark former channel meanders. Most rivers originated during melting of various ice sheets that covered all or parts of Iowa. Some alluvial plains (see map above) appear unusually wide for their river's size, owing to the large volume of melt water floods that once flowed through them.

Area of Forest and Forest Cover Type

This eco-region is a thin sliver of land stretched from north to south covering an area of 645,272 acres. Today there are only 15,737 acres in forest cover compared to 90,041 acres at the beginning of statehood, a loss of 83%. Ridge tops are dominated by bur oak and shagbark hickory. North-facing slopes contain black oak and black walnut while south-facing slopes contain bur oak and red cedar. Benches and valleys are favorite spots for walnut, elm and ash. Floodplain tree species include silver maple, green ash, hackberry, river birch, elm and cottonwood.

Wildlife

Game species that depend on the forest types in the region are deer and turkey, and non-game species include bald eagles, herons and songbirds. For a more detailed description, refer to the Wildlife Action Plan.

Rivers

The Boyer and Soldier rivers are used primarily for agricultural drainage, and very little bottomland riparian areas exist in the region today.

Human Impact

This region has lost its most productive forest soils to agriculture. Forests that remain are mostly found on steep or rolling terrain and are used for grazing livestock.

Unique Forest Type

The region's deep ravines and north-facing coves have allowed black walnut, red oak, bur oak, hackberry, and Kentucky coffee tree to grow very well.

Interior River Lowlands

Area of Forest and Forest Cover Type

This eco-region is the smallest in Iowa with a total land area of 393,422 acres. There were an estimated 115,249 acres of forest at the beginning of statehood compared to only 43,711 acres today, a loss of 62%. A mix of white oak, red oak, bur oak and shagbark hickory are most commonly found on uplands, which also contain some elm and ash. Along riparian areas species like cottonwood, silver maple, boxelder, bitternut hickory, ash, swamp white oak and black walnut are most common.

Young black walnut stand. Photo by Lisa Louck.

Wildlife

Game species in this region are deer and turkey, while non-game species include bald eagles, herons and songbirds. For a more detailed description of the eco-region's wildlife, refer to the Wildlife Action Plan.

Rivers

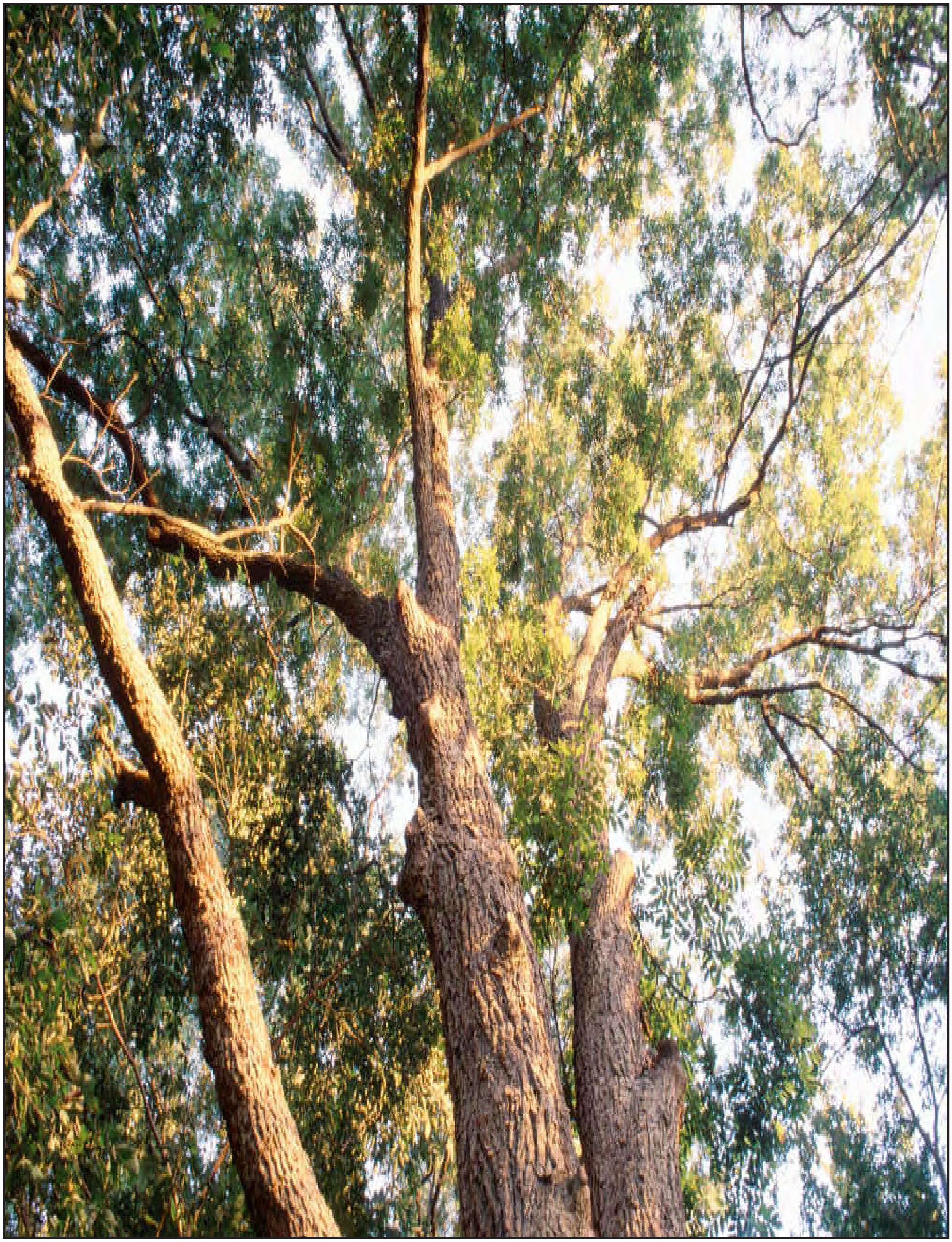
The majority of the forest left in this eco-region is along the rivers. Flooding over the past couple of years has caused significant damage to young tree plantings.

Human Impact

Nutrient-rich flood plains have been converted to agriculture while steep, rolling areas have been impacted by livestock grazing.

Unique Forest Type

Northern pecan, uncommon to the rest of Iowa, can be found within this eco-region.



Northern Pecan. Photo by Bruce Blair.

Iowa Forest Density

The Forest Inventory and Analysis (FIA) Program of the U.S. Forest Service conducts surveys within Iowa every year to collect information needed to assess Iowa's forests. There are both permanent and random plots that are measured during each year within Iowa. Since it takes one year to measure 20% of the total number of plots, it takes 5 years to complete an entire inventory cycle within Iowa. FIA reports on the status and trends in forested areas and locations; on the species, size, and health of trees; on total tree growth, mortality, and removals by harvest; on wood production and utilization rates by various products; and on forest land ownership.

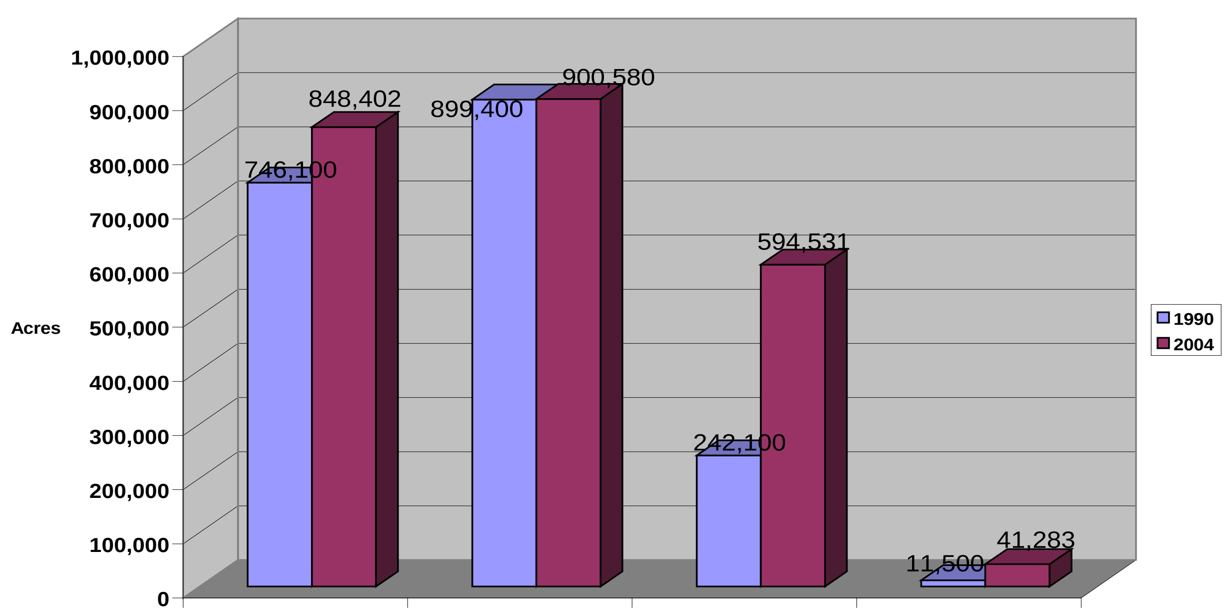
This data enables anyone to see how things have changed from past conditions as well as projecting how forests are likely to appear 10 to 50 years from now. This data helps foresters to evaluate whether current forest management practices are sustainable in the long run and to assess whether current policies will allow the next generation to enjoy Iowa's forests as we do today.

Stocking density is the comparison of growing space to the number of trees occupying that space. A fully stocked stand has 70% or more of its potential area growing trees, medium stocking refers to stands that are between 40-69% effectively utilizing the space available to them, poorly stocked are stands that are between 10-39% stocked with present or potential growing stock trees and non-stocked areas have less than 10% of their growing space with trees.

Figure 1.11 shows that fully stocked forest stands increased the most between 1990 and 2004. All other categories saw some increase, but there are still 30% more acres in the poorly stocked category and 34% more acres in the medium stock category compared to the fully stocked category. This information shows that 1.7 million acres of forest in 2004 could be more productive if those forests were better managed.

Figure 1.11 Comparison of Forest Land Stocking Levels, 1990 and 2004.

Area of Forestland by Stocking Class of Growing Stock (FIA 1990, 2004)



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

For comparison, in 1959 there were 500,000 acres of poorly stocked forests within the 2.5 million acres of forest land. During the 1950's, over half of Iowa's forest contained only 6% sawtimber volume. In other words, full forest stands did not grow in many areas, which hurt the productivity level of Iowa forests. In the years proceeding the 1950's, large areas of forest were overcut, neglected and poorly stocked. In 60 years, Iowa has improved the stocking levels within its forests, but there is still a lot of room for improvement. It is ironic that in a state that places so much emphasis on yield in agricultural production, yield within forests has continued to lag so far behind.
A poorly-stocked forest, like a sparsely seeded agricultural field, cannot approach either its biological or economic potential. Iowa forest landowners with poorly stocked stands of timber are losing money, wildlife habitat, and are suffering from declining soil and water quality. While there are farm and natural resource conservation service centers in each of Iowa's 99 counties, there are only 16 district foresters to serve the more than 150,000 forest landowners in the state.

Looking at forest stocking levels is one way to evaluate how well a stand of trees is growing relative to its potential. However, even a fully-stocked stand can paint a misleading picture because species and quality of the trees within it are not taken into consideration. For example, a bitternut hickory/ ironwood/ black locust stand may be considered fully-stocked from the perspective of timber volume growing potential, but it may have limited value from the perspective of timber, water quality, biodiversity and wildlife habitat.

Figure 1.12 shows that poorly-stocked and medium-stocked stands of timber have made up between 31% and 44% of Iowa's forests over the past 20 years. Meanwhile, fully-stocked stands have made up no more than 22% of Iowa's forest acres sine 1950.

Figure 1.12 Comparison of Stocking Levels on Iowa Forest Land, 1950-2007.

Year	Total Forested Acres	Poorly Stocked Acres	Percentage	Medium Stocked Acres	Percentage
1950	2,500,000	500,000	20		
1990	2,054,795	750,861	37	908,136	44
2003	2,665,150	858,046	32	878,148	33
2004	2,748,718	8958,607	31	932,292	34
2005	2,878,942	932,835	32	1,016,850	35
2006	3,008,399	1,013,837	34	1,030,913	34
2007	3,054,000	1,051,537	34	1,036,548	34
Year	**Total Forest Acres**	**Fully Stocked Acres**	**Percentage**	**Overstocked Acres**	**Percentage**
1950	2,500,000				
1990	2,054,795	242,346	12	11,500	0.5
2003	2,665,150	588,825	22	35,043	1
2004	2,748,718	596,412	22	42,977	2
2005	2,878,942	516,908	18	43,699	2
2006	3,008,399	513,950	17	35,750	1
2007	3,054,000	488,956	16		

Source: Miles, P.D.

In 2007, 1,051,537 acres were in the poorly-stocked category and 1,036,548 acres were in the medium category, meaning that Iowa forests did not produce 70% of their timber and carbon sequestering potential during this time.

Figure 1.13 shows that Iowa forests had 2.9 billion cubic feet of growth in 2007 under all stocking levels combined. Poorly-stocked forest stands underperformed by 1.6 billion cubic feet while medium-stocked forest stands underperformed by 1.0 billion cubic feet. This means that an estimate 2.6 billion cubic feet of growth was lost for all Iowa forest landowners.

Figure 1.13 Potential Growing Stock Versus Actual Growing Stock in Iowa in 2007.

Stocking Density	Acres	Volume of growing stock in 2007 (cubic feet)	Lost potential of growing stock volume (cubic feet)
Full Stocking	488,956	1,132,282,575	0
Medium Stocking	1,036,548	1,215,087,803	1,014,431,101
Poor Stocking	1,051,537	599,383,624	1,605,635,097
Totals	3,054,000	2,946,754,002	2,620,066,198

Source: Miles, P.D.

These growth values are enormous to comprehend, but they do demonstrate that Iowa forests can have a huge impact on the wood available for industry-level utilization. It also shows that Iowa's forests can grow a 47% greater volume of wood within existing forested areas if better forest management was exercised on the state's existing 3 million acres of forest.

Iowa forests are growing 53% of their potential based on stocking levles.

Population Trends

Iowa has 946 communities spread across the state, with the largest twenty accounting for approximately 50% of total population.[12] Between July 1, 2006 and April 1, 2000, 633 of these communities experienced some degree of population decline. Iowa's population increased by 666,074 between 2000 and 2007, and Des Moines, the capitol, is still the largest community with a population of 193,886. In 2006 there were 130 communities with populations greater than 2,500, up from the 127 communities in 2000. Communities with less than 2,500 people are defined as being rural. As with other Midwestern states, Iowa is feeling the effect of rural flight as more people are moving out of the countryside to urban areas with better job opportunities and greater conveniences. The migration of people from rural areas to cities increases pressure to build around urban centers; Polk County, for example, has lost 3,000 acres of open space to development annually since the early 1990s.

When people choose a home in Iowa, a place still uncluttered and livable, they often do so because they recognize what a treasure there is in this "land between two rivers." Individuals, business people, government leaders, and private interest groups all share a responsibility for making decisions about how the land is developed. Each generation determines whether the natural communities and human communities will prosper.

[12]U.S. Census Bureau, Iowa QuickFacts. <http://quickfacts.census.gov/qfd/states/19000.htm> February 18, 2009

The relationship between people and the land they own can be visibly seen as people drive through the countryside. As landownership changes hands from one owner to the next, land use can vary dramatically.

More Iowans are nearing retirement, and the population increase is slow. In the next twenty years, the state's 2008 population of roughly 3 million people may only grow by 3 to 6 percent. There are more residents age seventy-five or older than there are age five or younger.

As Iowa's population becomes more diverse, people of different cultural and religious backgrounds may look at the land and its resources in different ways. To some Iowans, the land is a resource to be exploited for profit, while others see it as a resource to be managed and conserved. New residents may bring nontraditional land ethics and customs. To many, land has spiritual and natural values and should be maintained for future generations.

The town of Marquette in Clayton County characterizes the numerous small communities that dot the Iowa landscape. Photo by Lowell Washburn.

More than 90 percent of Iowa's land is privately owned, often by older people. Two-thirds of the land belongs to individuals age fifty-five and older, while nearly 20 percent belongs to owners over the age of seventy-four. The average age for a person owning a farm has risen from 48 years of age in 1982 to 54 years of age in 2002.[13] A 2002 survey of Iowa woodland owners found that 86 percent were over the age of 45. As more farmers and forest landowners near retirement age, choices regarding land use will become more and more significant.

One property in five will likely change hands within the next ten to twenty years, as older landowners pass their land to the newer, younger generations. These new landowners may decide to use land differently from the older owners, who were more likely to have had their land rooted in state's agricultural tradition. The passing of this property to new owners may also lead to the further fragmentation and parcelization of an already fragile landscape.

Over the last ten years an increasing amount of forest land has been transferred from farmers to those who do not depend on farming for their living. Forest Service studies suggest that these new owners primarily own the land for recreational, aesthetic or spiritual reasons. Often these landowners have little or no experience with woodland management and are unaware that woodland management assistance is available. However, they may be more likely to implement forest management practices that improve the health, wildlife habitat and aesthetic quality of their woodland as well. Reaching these new types of forest landowners will require different approaches than were used in the past. Information on proper plant selection, identification and control options

[13]<www.nass.usda.gov/Statistics by Sunject/Demographics/index.asp> February 18,2010.

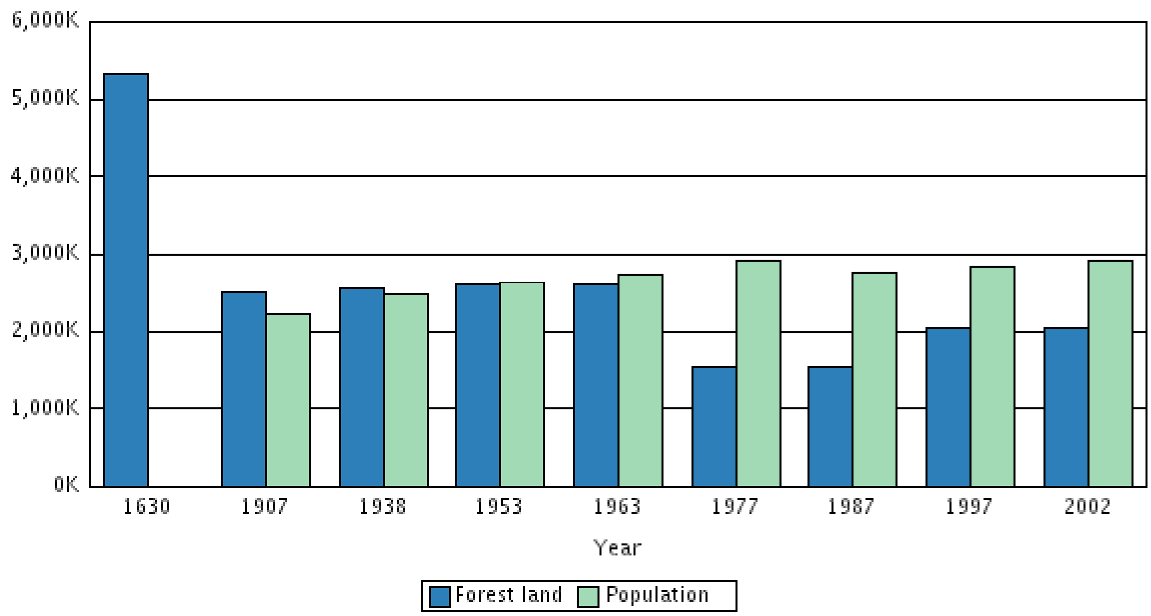
for invasive species, the importance of biological diversity, beneficial silvicultural techniques workshops and outreach campaigns can provide forest landowners with hands-on learning necessary to empower them to conserve and enhance their forest resources.

Ensuring that children are aware of natural resources and the benefits that trees provide will also be important as more people gravitate to urban areas. Engaging this audience in outdoor classrooms will give them hands-on experiences to help imprint knowledge that they can appreciate as they continue to grow.

Iowa's ratio of population to acres of forest is currently just over 1:1. This ratio has increased since the 1990 USDA-FS-FIA inventory and U.S. Census. In 1990 the ratio of forest land acres to residents within the state was 0.7:1. Iowa has a very slow growing population but has increased the number of acres classified as forest by 50% between 1990 and 2007. The amount of forest per person in Iowa is almost twice the national average of 0.56 acres per person (See Appendix B for a more complete listing of Iowa's population and forest acre trends since statehood).

A brief summary showing the trend of forest land and population through the years is shown in Figure 1.14. Using 2007 data shows that the number of acres of forest land per person has surpassed one acre for the first time since the 1930's (there were 3,002,555 people in Iowa in 2008 and 3,054,000 acres of forest in 2007).

Figure 1.14 Long-Term Comparison of Forest Land and Population in Iowa.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Another figure to consider is the number of district foresters available to service the needs of forest landowners. In 1990, there were 11 district foresters to service 55,000 landowners, while in 2006 there were 16 district foresters servicing 147,000 landowners. This means that prior to 1990 a district forester served an average of 5,500 or fewer landowners, while today a single district forester serves an average of 9,200 landowners.

The impact by people settling Iowa on the forest resource in Iowa has been significant. Most forests have been cleared, heavily grazed, overcut or high-graded at some time over the past 160 years, and those that remain are typically irregularly-shaped pieces on rough land or along water corridors. Woodlands are impacted the most during tough economic times, when landowners need to come up with additional sources of income or cheaper methods to heat their homes. In times of prosperity, these woodlands are usually not harvested. These reasons for harvesting do not allow for the sustainable management needed to adequately regenerate desirable tree species, and leads not only to the decline in forest habitat for wildlife but to declines in both income for future landowners and timber for the wood industry.

Public Forest Land

The Department of Natural Resources purchases land to manage and protect natural resources, to maintain unique ecosystems for future generations, to maintain a pool of biodiversity for future generations and to provide recreational opportunities to all the people of the state. Through their land acquisition program, wetlands, forests, scenic areas, prairies, wildlife and fish habitat, rare species habitat, and other resources are being protected and managed. Opportunities for hunting, fishing, bird-watching, and enjoyment of the outdoors are provided by these areas.

In 2008 Iowa had 816,000 acres of area in public ownership of which slightly less than 637,000 acres were classified as land. An additional 600,000 acres of roadside rights-of-way and more than 40,000 acres of railroad corridors could be managed to improve habitat and scenery. This area represents less than 4% of Iowa's total land area. Iowa added 6,150 acres of public land at a cost of approximately $11 million dollars during state fiscal year 2008.

Within the land category, 279,666 acres (44%) of public areas are classified as forest. In 2002 public agencies owned over 9% of the forest land in Iowa, just a slight increase from 8% in 1974. Public forest land allows for different management activities depending on which agency within the DNR (Forestry, Parks or Wildlife) oversees a certain property.

The Forestry Bureau manages 34,597 acres of forest on its 45,230 acres of public land, with the remaining areas in roads, lakes, prairie or cropland. State forest areas are subdivided into 10 state forests that represent all of the major forest habitat types of Iowa along with a range of ages. These forests are mainly managed for timber production, wildlife habitat and water and air quality.

The State Parks Bureau has 31,703 acres of forest on its 57,754 acres of public land. Some of these areas have some of the oldest trees growing on them. The State Wildlife Bureau has the largest holding of forest with 94,547 acres within its 347,852 acres of public land. Public areas are important for maintaining the state's native biological diversity, which is often much harder to preserve on private lands.

Forest management is allowed on areas managed by the Wildlife and Forestry Bureaus. Parks and Preserves generally do not practice active management, an approach that allows for natural selection on their properties. Salvage sales are an exception, and often take place after strong windstorms, flooding or tornados cause damage to their resources.

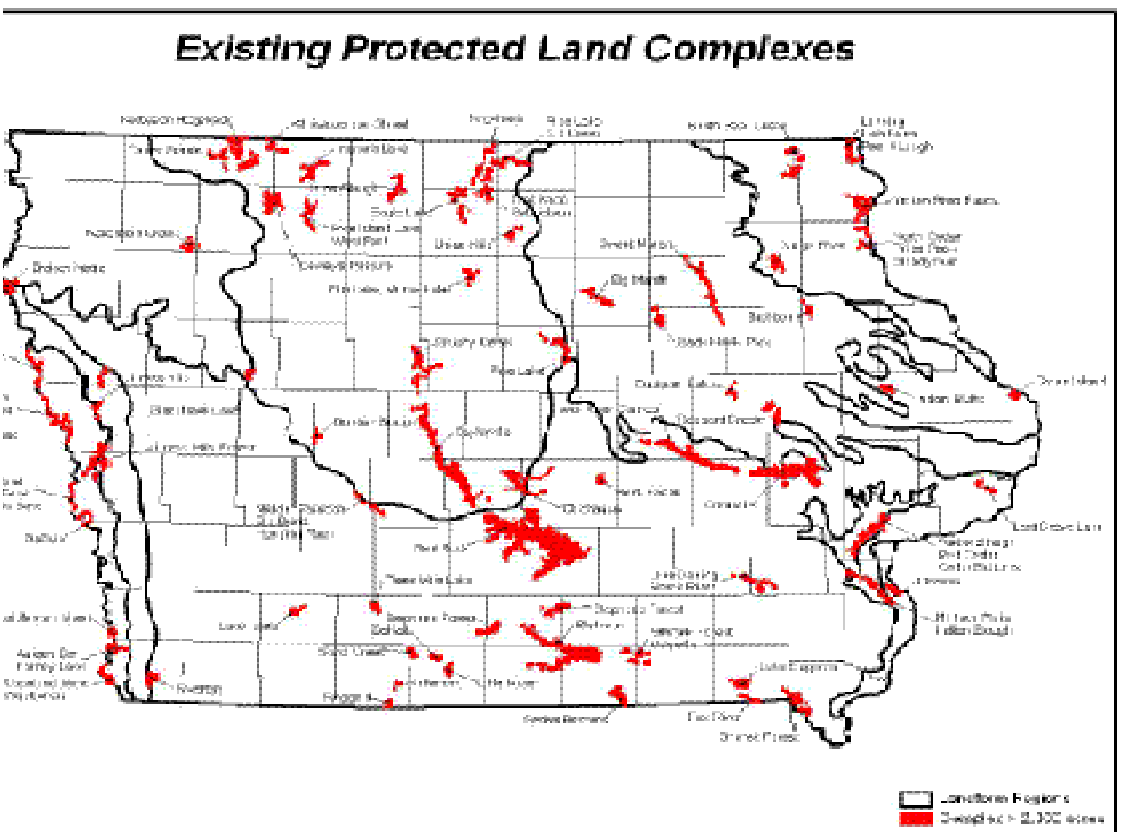
Legislation in 1965 created the Iowa State Preserves System to identify and preserve, for this and future generations, portions of Iowa's natural pre-historical and historical heritage, and to maintain preserved lands as nearly as possible in their natural condition. By 2007, 94 parcels had been dedicated into the Preserves System. These preserves range from less than 1 acre to 845 acres and incorporate a total area of almost 10,000 acres. Some sites are owned by individuals or private conservation organizations; others are owned by cities and counties, and still many more are owned by the State. Preserves are managed according to plans developed cooperatively by landowners, the Preserves Board, the preserve manager and DNR staff. Management may be handled by the owner or delegated to another group.

Another large pubic landowning body is the 99 County Conservation Boards, which collectively own the second largest amount of forest habitat. Counties own over 143,000 acres of property, of which 65,354 acres are covered in forest.

Federal agencies own 190,000 acres of land within Iowa, of which 37,632 acres are forested. The U.S. Army Corps of Engineers and the USDI Fish and Wildlife Service own the most land. Iowa still has a smaller proportion of public land than almost any other state in the country and has no National Forests. The federal agencies that do own property manage their land as wildlife refuges, flood control and navigational systems with accompanying recreation areas.

Figure 1.15 shows where there are contiguous areas of 2,000 acres or more public land in the state.

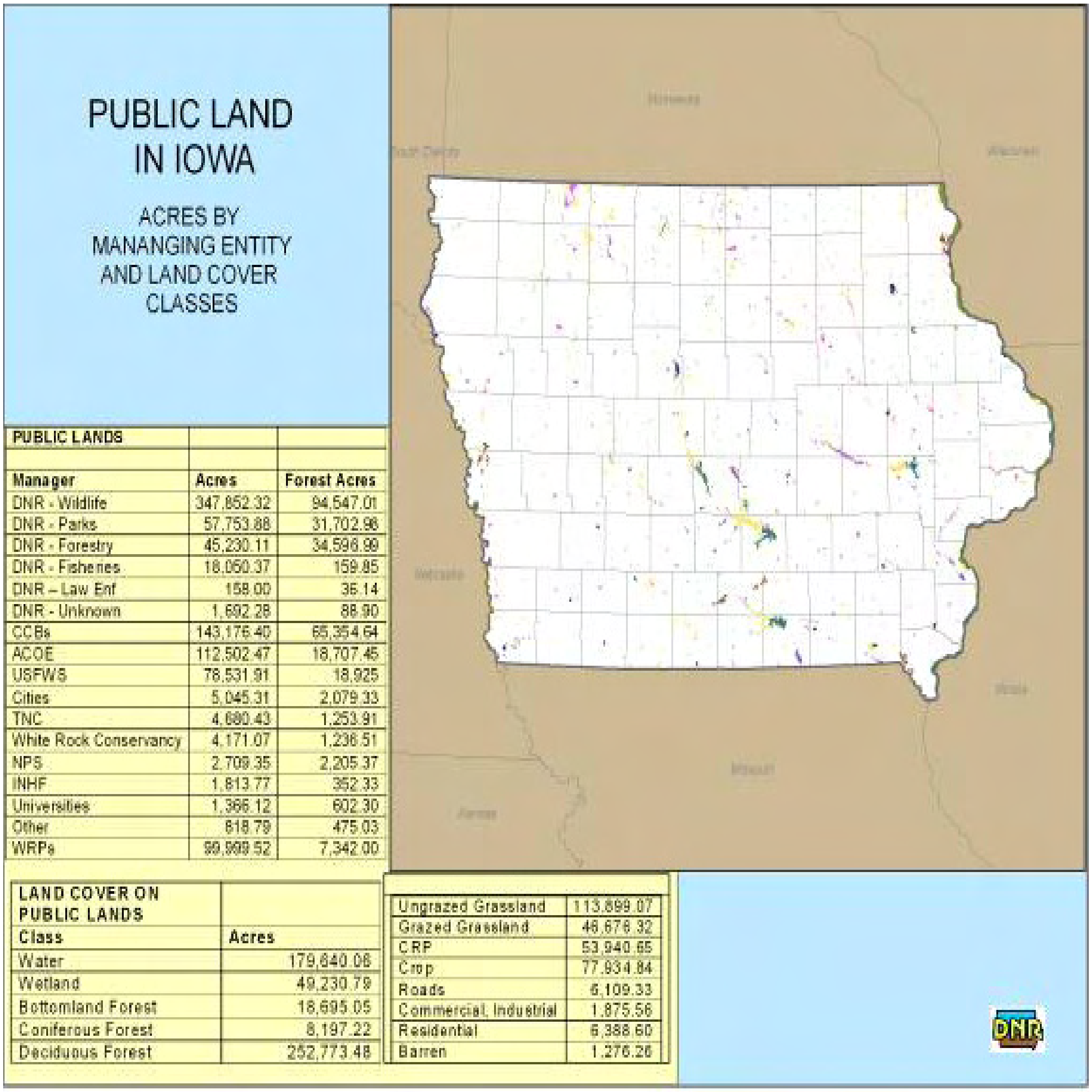
Figure 1.15 Public Land Locations with more than 2000 Acres.



Source: Kathryne Clark.

Figure 1.16 shows where public land ownership is located across the state with an adjoining table that breaks down the ownership by agency using land cover classes. The DNR Wildlife Bureau owns the most forest area of any public agency, followed by all of the county conservation boards combined and the DNR Forestry Bureau.

Figure 1.16 Public Land Ownership and Forest Acreage in Iowa, 2002.



PUBLIC LANDS		
Manager	Acres	Forest Acres
DNR - Wildlife	347,852.32	94,547.01
DNR - Parks	57,753.88	31,702.98
DNR - Forestry	45,230.11	34,596.99
DNR - Fisheries	18,050.37	159.85
DNR – Law Enf	158.00	36.14
DNR - Unknown	1,692.28	88.90
CCBs	143,176.40	65,354.64
ACOE	112,502.47	18,707.45
USFWS	78,531.91	18,925
Cities	5,045.31	2,079.33
TNC	4,680.43	1,253.91
White Rock Conservancy	4,171.07	1,236.51
NPS	2,709.35	2,205.37
INHF	1,813.77	352.33
Universities	1,366.12	602.30
Other	618.79	475.03
WRPs	99,969.52	7,342.00

LAND COVER ON PUBLIC LANDS	
Class	Acres
Water	179,640.06
Wetland	49,230.79
Bottomland Forest	18,695.05
Coniferous Forest	8,197.22
Deciduous Forest	252,773.48
Ungrazed Grassland	113,899.07
Grazed Grassland	46,676.32
CRP	53,940.65
Crop	77,934.84
Roads	6,109.33
Commercial, Industrial	1,875.56
Residential	6,388.60
Barren	1,276.26

Source: Kathryne Clark using satellite land cover from 2002 and public lands database.

About 40% of the acres of publicly owned land are on highly erodible soils, indicating that there is a need for permanent vegetation on these areas to improve water quality, stabilize soil and improve habitat for wildlife. The average corn suitability rating for the land owned by the DNR is 32 on a scale of 100, which shows that most DNR-owned land is not suitable for agriculture.

Forest Legacy

As part of the 1990 Farm Bill, Congress created the Forest Legacy Program to identify and protect environmentally important private forest lands threatened by conversion to non-forest uses. This program promotes the concept of protecting "working forests" and allowing continuation of traditional forest uses as long as it follows a state forester approved Forest Stewardship Plan.

Conservation easements are a voluntary, legal means to protect and preserve land. There are many types of conservation easements such as wetlands easements, angler and hunter access easements, trail and portage easements and forest, farm, ranchland protection easements. Conservation easements assist in protecting and improving water quality, wildlife habitat and natural resources in general. They are used to promote the personal desires of the landowner as well as to preserve, protect and improve the overall quality and character of the natural resources for future generations.

Goals of the Forest Legacy Program in Iowa

1. ***To protect environmentally important private forests that is threatened by conversion to non-forest uses such as agriculture, gravel pits/mining and residential or commercial development.***

2. ***To protect Iowa's publicly-owned or permanently-protected forested tracts from environmental threats caused by the development of nearby forest areas.***

3. ***To prevent and reverse the fragmentation/parcelization of Iowa's contiguous forests by reconnecting parcels of land and keeping forests in contiguous parcels.***

4. ***To preserve the beauty and public enjoyment of Iowa's forested landscape.***

Critical Issues/Definitions for Iowa's Forest Legacy Program

Iowa's land and its forest component is one of the most disturbed and altered landscapes in North America. Rare is the acre of Iowa forest that has not been impacted by agriculture from crop management or livestock grazing. In order to uniformly identify the critical impacts and management needs of Iowa's forests, the following uniform definitions of important Legacy terminology were accepted by the Iowa Department of Natural Resources and the State Forest Stewardship Committee.

Environmentally important forest – a forest that contains one or more of the following important public values:

1. ***Scenic or significant view shed values such as overlooks, vistas or is visible from main highways or public trails;***

2. ***Recreation opportunities for public access for such uses as hunting, fishing, hiking, biking etc.;***

3. ***Riparian areas that are adjacent to major waterways, drinking water supplies and public lakes;***

4. ***Unique and/ or contiguous fish and wildlife habitat;***

5. ***Known threatened and endangered plant and animal species dependent upon forest habitat;***

6. ***Known unique archeological, cultural and geological resources that could be los damaged; and***

7. ***Opportunities for the continuation of traditional forest uses, such as management, timber harvesting and other commodity use and outdoor recreation that benefit economic values in neighboring communities.***

A forested area will be considered environmentally important if it also contains one or more of the following public values:

8. ***Borders or enhances the natural values of existing federal, state or local government-owned or permanently protected forests or non governmental organizations forests NGOs) or other permanently protected forests;***

9. ***Protects and enhances water quality and watershed values of a public drinking water supply;***

10. ***Contains unique or isolated tree species and forest stand conditions (old growth or oak savanna);***

11. ***Key to minimizing local forest fragmentation; and***

12. ***Allows opportunities for continuation of traditional forest management and use.***

In order to better understand these criteria, it is important to clarify some key terms:

Traditional forest use is defined as utilization of the forest or its parts in a sustainable way for wood production, wildlife habitat, outdoor recreation, scenic enjoyment, watershed protection and erosion control.

Threatened forest is one that could be converted to non-forest or seriously altered forests due to ownership change, conversion to agriculture, gravel/mining and/or residential/commercial development. Forests could be threatened through non-native invasive plant introductions, which impact the survival of native vegetation.

Protection is the process of stopping conversion of forests to non-traditional forest uses or preventing serious forest alteration that prevents sustainability through legal means.

Forest management is the process of ensuring long-term sustainability through active silviculture and other forestry methods.

Forest Stewardship Plan is a management plan developed by a professional forester and approved by the Iowa DNR to examine all the values of the forests with the objectives of ownership to ensure a sustainable forest.

Eligibility criteria for a Forest Legacy Area

To be eligible as an Iowa Forest Legacy Area, an area's forest land must meet all of the following criteria:

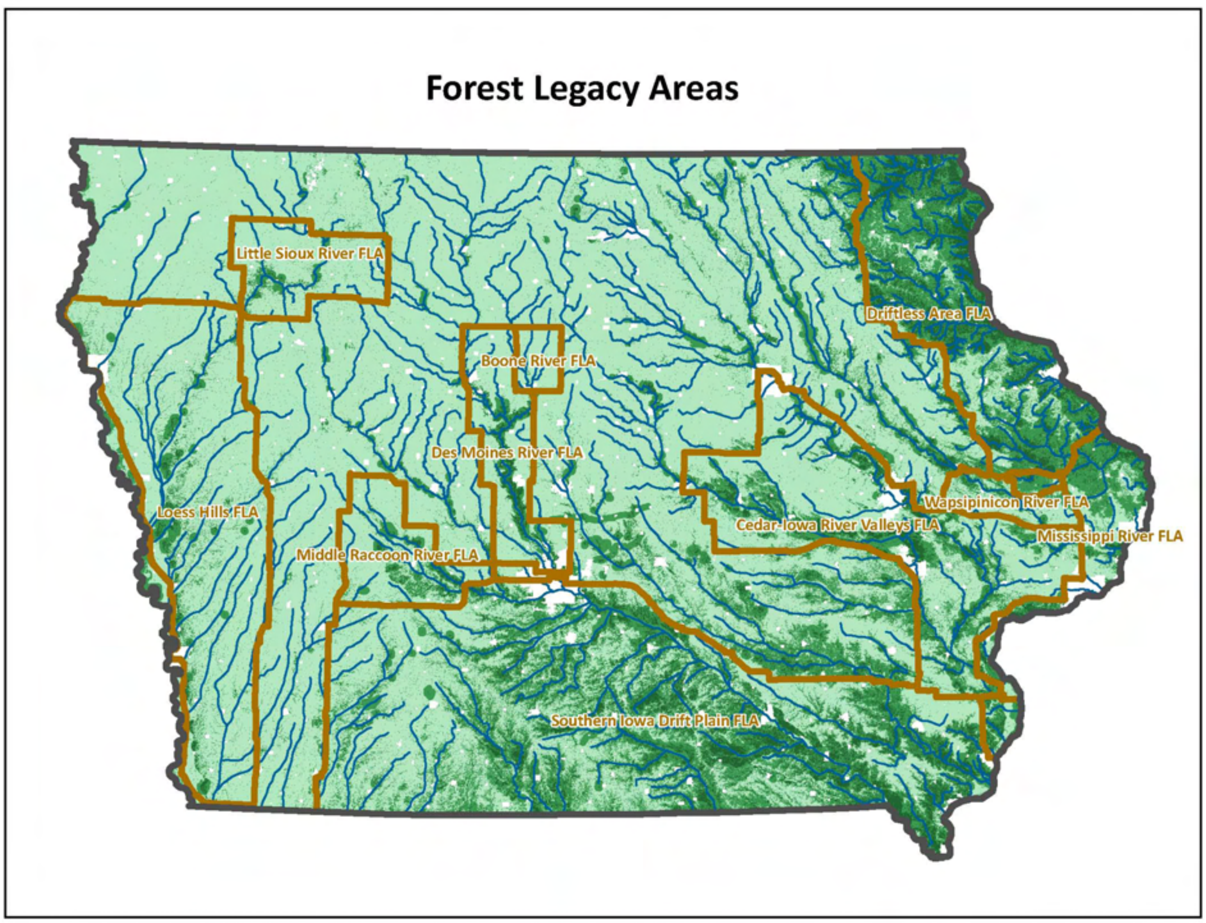
1.) Potential Forest Legacy Areas must be considered environmentally important forest according to the aforementioned criteria and must contain one or more of the following characteristics or public values:

- scenic resources;
- public recreation;
- riparian areas;
- unique, rare, threatened or endangered species;
- archeological, cultural or geologic features;
- borders or is close to existing public or permanently protected forests;
- unique or isolated tree species/stand conditions and provides opportunities for continuation of traditional forest uses (traditional/non-traditional forest products utilization, watershed protection and recreational opportunities such as hiking, bird watching, hunting and fishing).

2.) Forested areas could be threatened by present or future conversion to non-forest uses by ownership change, conversion to agricultural use, gravel pits/mining and/or residential/ commercial development. Forests could also be threatened by non-native invasive plants, which spread and replacing native vegetation.

Figure 1.17 shows designated Forest Legacy areas in Iowa. These areas were created from recommendations by the State Forest Stewardship Committee. For a description of each area refer to Appendix C (the assessment of need and Secretary of Agriculture's acceptance letter can also be found in Appendix C).

Figure 1.17 Forest Legacy Areas in Iowa.



Source: Kathryne Clark.

In Iowa, the Forest Legacy application process is open year-round to any interested forest owner, but priorities are given to the following: tracts that (1) possess a forest stewardship plan; (2) are close to or adjoin protected lands such as parks, forests, etc; (3) properties that are threatened by conversion to non-forest use, and; (4) landowners that are willing to contribute in-kind to the 25% match requirement.

Figure 1.18 shows where, when and how many acres of Forest Legacy easements have been successfully established.

Figure 1.18 Forest Legacy Program Easements.

Landowner	County	Year	Acres
Landsing Big Lake	Allamakee	2005	35
Effigy	Allamakee	2005	192
Cold Air Slope	Winneshiek	2005	165
White Water	Dubuque Jackson Jones	2005	417
Stephen's Forest	Clarke	2005	60
Caves	Jones	2007	140
Franklin	Allamakee	2008	209
Patterson Creek	Allamakee	2008	358

Source: Jeff Goerndt, State Forest Section Chief, Iowa DNR Forestry Bureau.

"Recreational development is a job not of building roads into lovely country, but of building receptivity into the . . . human mind."

- Aldo Leopold

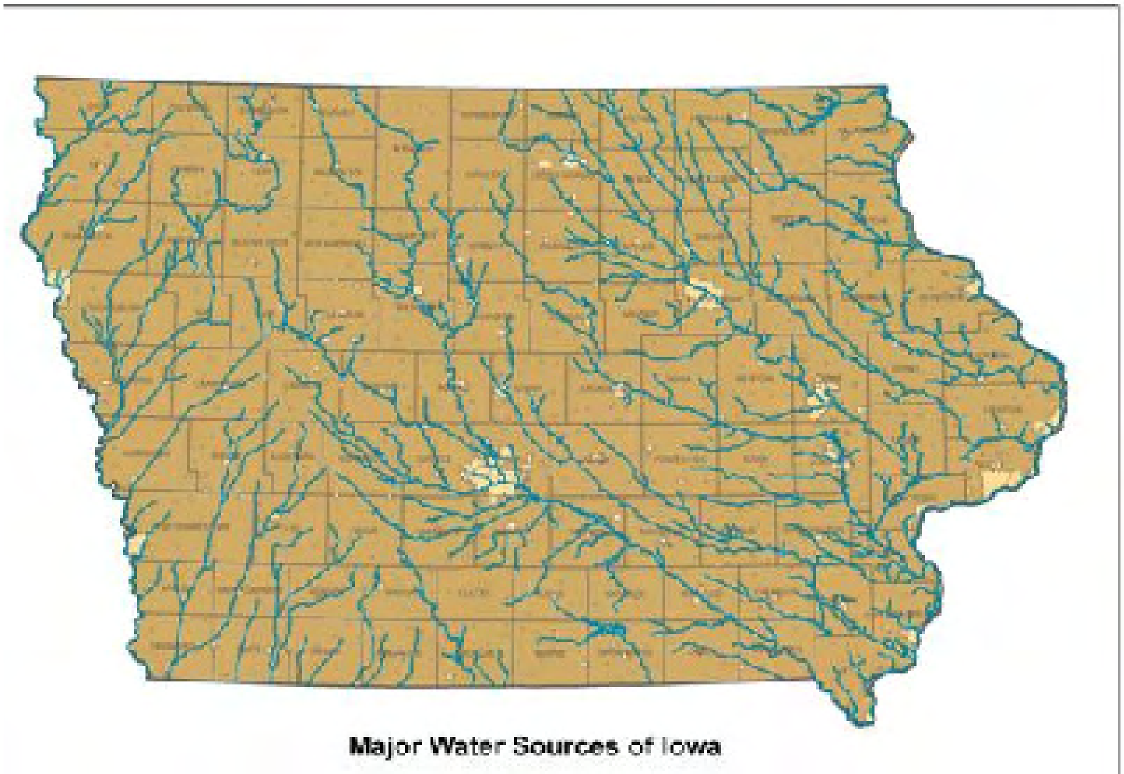
The Forest Legacy Program helps preserve permanent vegetation on properties whose owners have a strong desire to prevent any development on these areas. The landowners who enroll in these programs are not only looking beyond their lifetime, but ensuring that future Iowans will benefit from the beauty, serenity, wildlife and inspiration these properties possess.

The Iowa Forest Legacy Program will be implemented according the Iowa Forest Legacy Program Assessment of Need (AON), which was approved by the Secretary of Agriculture on March 7, 2002. A copy of the State Lead Agency designation letter, Forest Legacy Area descriptions, and the AON approval letter can be found in Appendix C. The AON remains unchanged since the approval in March 7 of 2002.

Urban Forests

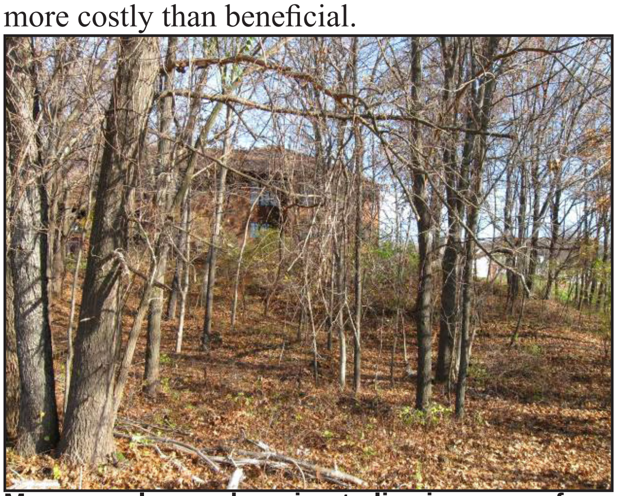
As the first non-indigenous people began to settle Iowa, population centers sprang up along the state's river corridor systems. These areas provided water for drinking, cleaning and powering equipment, and timber for building, heating, and cooking. Figure 1.19 shows just how important rivers are to communities in the state today, as virtually every major population center is located on or near a river.

Figure 1.19 Iowa's Major Rivers and Community Locations.



Source: Kathryne Clark using satellite land cover from 2002.

The rural heritage of most Iowans has historically The rural heritage of most Iowans has historically had an influence on land use priorities. However, as more people have gravitated toward cities, this connection to nature has been compromised. Land has been re-shaped to suit developer needs and increase community tax bases. Once paved or developed, a forest can almost never be restored to its original state, and in Iowa, green infrastructure and preservation is typically regarded as being more costly than beneficial.



More people are choosing to live in or near forests. Photo by Mark Vitosh.

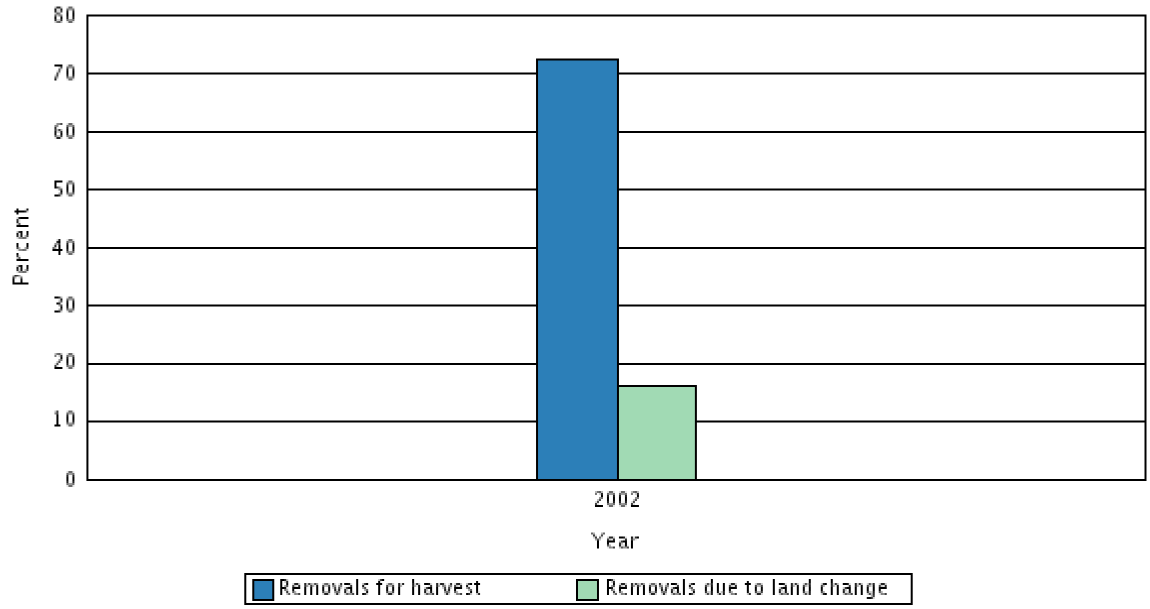
Census data shows that over 85% of Iowans are classified as "urban" because they live in communities of 2,500 people or more.[14] As Iowa's population continues to gravitate toward urban and suburban areas, increased pressure will be placed on the forest resources surrounding these areas. Though some trees may remain for aesthetic reasons, the forest ecosystem will be disrupted enough to make it unsuitable for the survival of many native plants and animals. Opportunities and challenges exist in developing strategies to work with small woodland owners, homeowners and developers in these urban/rural interface areas.

Iowa lost more than 18,000 forest acres per year from 1992 through 1997.

[14]U.S. Census Bureau, Iowa Quick Facts.

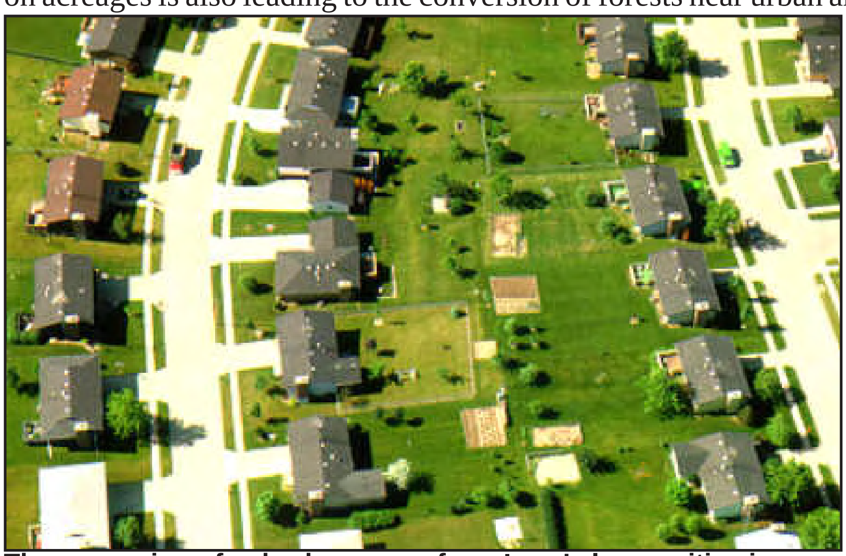
Figure 1.20 shows that in 2002, over 15% of Iowa's forest was harvested to accommodate land changes such as housing developments, agricultural expansions, new road systems and new businesses; what's more, shopping malls, highways, suburbs, and factories now cover three-quarters of a million acres of the state, the equivalent of two counties. Iowa lost more than 18,000 forest acres per year from 1992 through 1997.

Figure 1.20 Growing Stock Removals on Iowa Timberland based on Land Change.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

There is a need to continue to plant trees in core community areas to replace aging or dying trees and in new developments that have little or no existing tree cover. There is also a need to protect mature trees from urban sprawl and to plant a diversity of trees in new developments. Pressure to build homes on acreages is also leading to the conversion of forests near urban areas into smaller units, removing most of the functionality of those forests.



The expansion of suburban areas from Iowa's larger cities is one way in which Iowa's landscape is being transformed. Photo by Drake Hokanson.

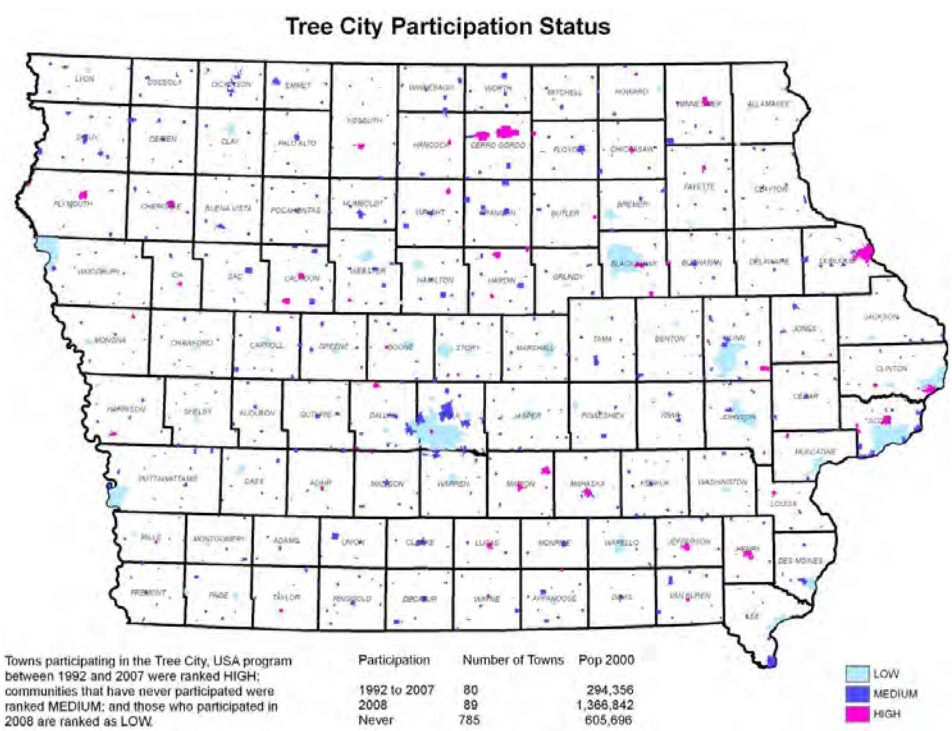
As emerald ash borer, bur oak blight, gypsy moth, and other pests continue to affect areas in and around Iowa, communities are going to have to look for ways to reduce their susceptibility to these problems. Unfortunately, inventory data does not exist for most communities in the state, which makes planning for such problems virtually impossible, and without planning urban forestry programs become reactionary rather than proactive. Good information, good planning and good maintenance are crucial for the reduction of future tree problems, and will save communities money in the long run.

The benefits that trees provide cannot be overlooked. Most people understand some of the benefits, such as fall color and relief from extreme weather, but are unaware of others, such as lower utility bills, habitat for wildlife, fresh air, carbon sequestration, soil protection and water quality enhancement. It is up to stakeholders and volunteers to hold city planners and leaders accountable to community forestry management plans so that these benefits are realized or maintained.

Most communities, including those with forest resources that are challenged by adverse weather and declining health, do not have a dedicated forester or arborist on staff to plan and care for their trees. As a result, they refrain from planting trees in public areas, and the only trees that emerge are those planted by private landowners. As these communities grow, this lack of new tree cover causes impervious material to absorb and emit more heat, which then raises utility bills for businesses and homeowners in treeless areas.

One way to determine which communities need the most assistance in managing their urban tree resources is to review participation in Tree City USA, which is one measure that demonstrates the importance that communities assign to their forest resources. In 2008, 89 communities representing over 1.3 million Iowans participated in the program; another 80 communities representing 300,000 Iowans have participated in the past but no longer qualify for various reasons. The remaining 785 communities, which account for roughly 600,000 Iowans, have never participated in the program; these numbers are reflected in Figure 1.21.

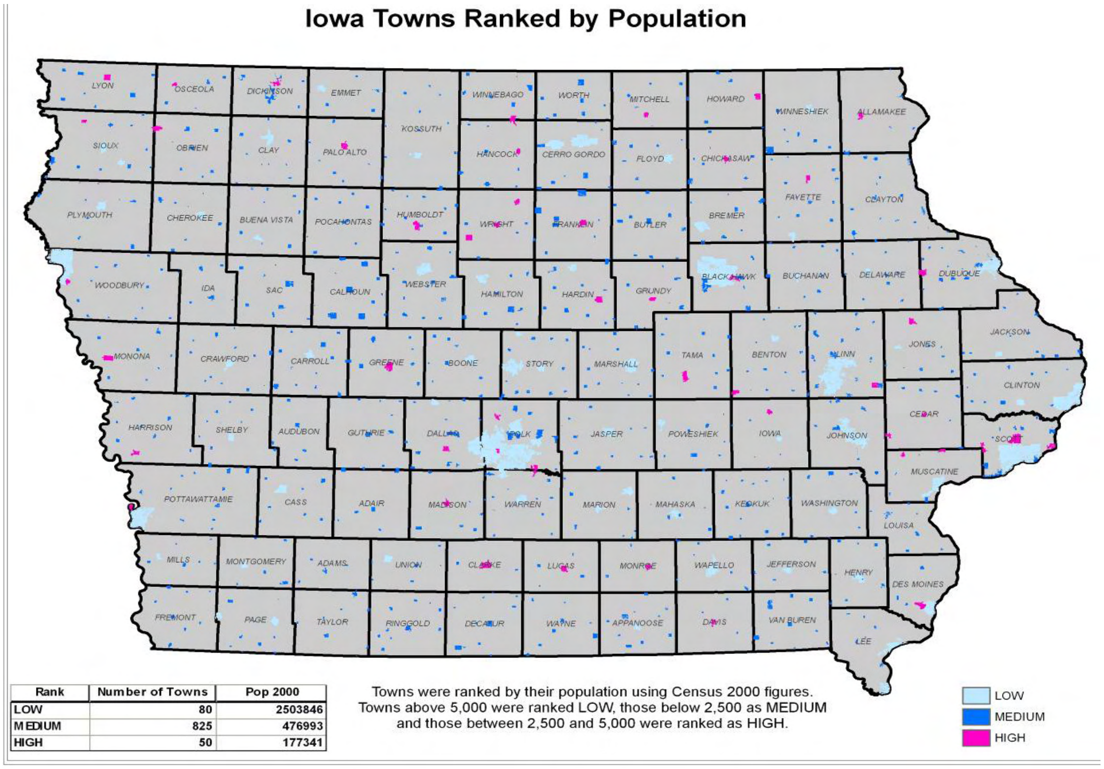
Figure 1.21 Communities Participating in Tree City USA.



Source: Arbor Day Foundation/ Kathryne Clark.

Figure 1.22 shows the size and distribution of communities throughout Iowa. Communities with smaller populations generally have fewer resources for tree care than those with relatively large populations; because of this, tree care is often put off, delayed, or ignored. This strategy often creates crisis situations when insect and disease problems or extreme weather events occur. Therefore, it can be advantageous for smaller communities to partner with larger communities nearby for their tree care work.

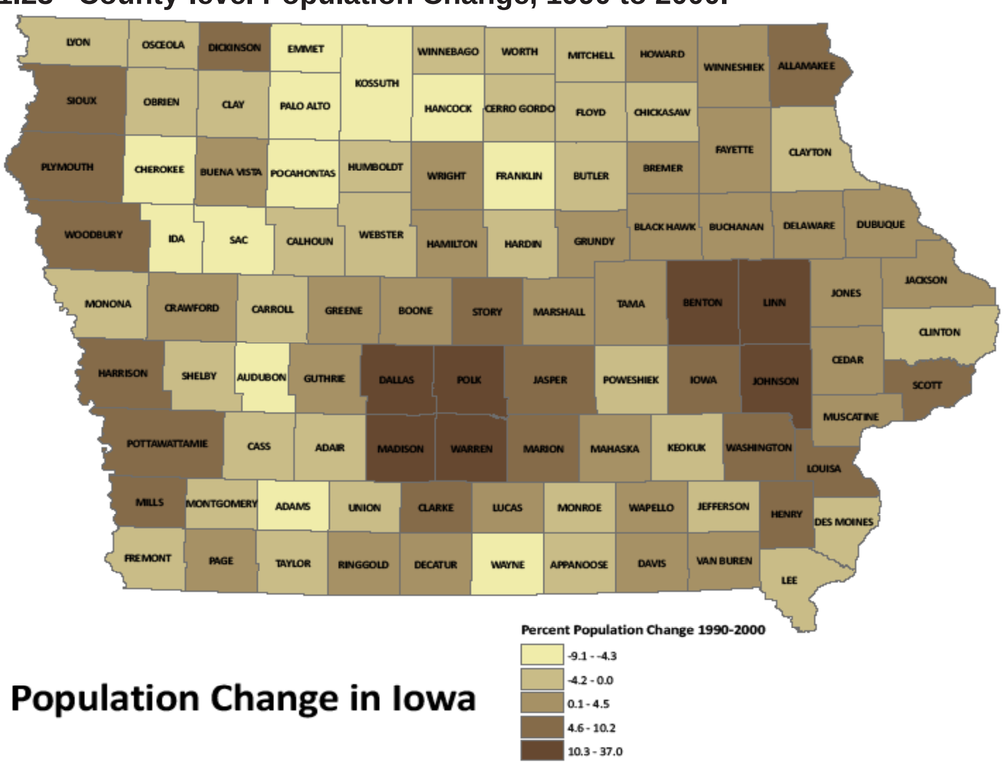
Figure 1.22 Iowa Towns Ranked by Population.



Rank	Number of Towns	Pop 2000
LOW	80	2503846
MEDIUM	825	476993
HIGH	50	177341

Source: Kathryne Clark using incorporated cities from the 2000 census by U.S. Census Bureau.

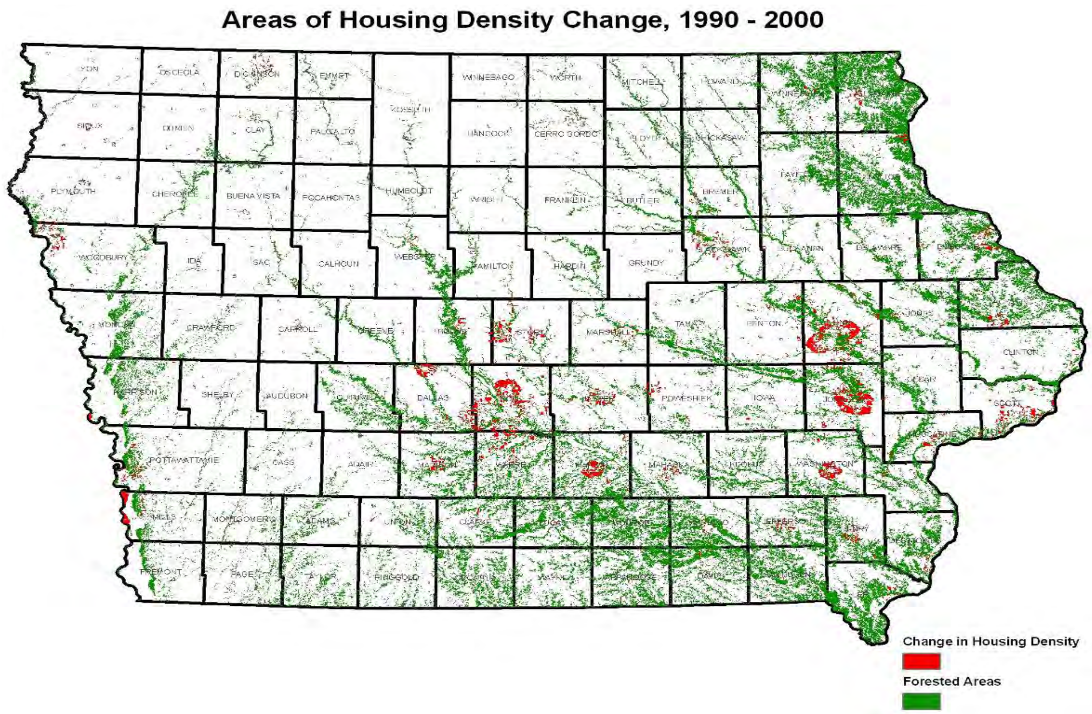
Figure 1.23 County-level Population Change, 1990 to 2000.



Source: Kathryne Clark using the 2000 census block group data by U.S. Census Bureau.

Figure 1.24 shows where community boundaries have grown into existing forested areas; roughly 48,000 acres of forest in the state have been impacted in this way between 1990 and 2000.[15]

Figure 1.24 Community Growth into Existing Forest Areas, 1990 to 2000,



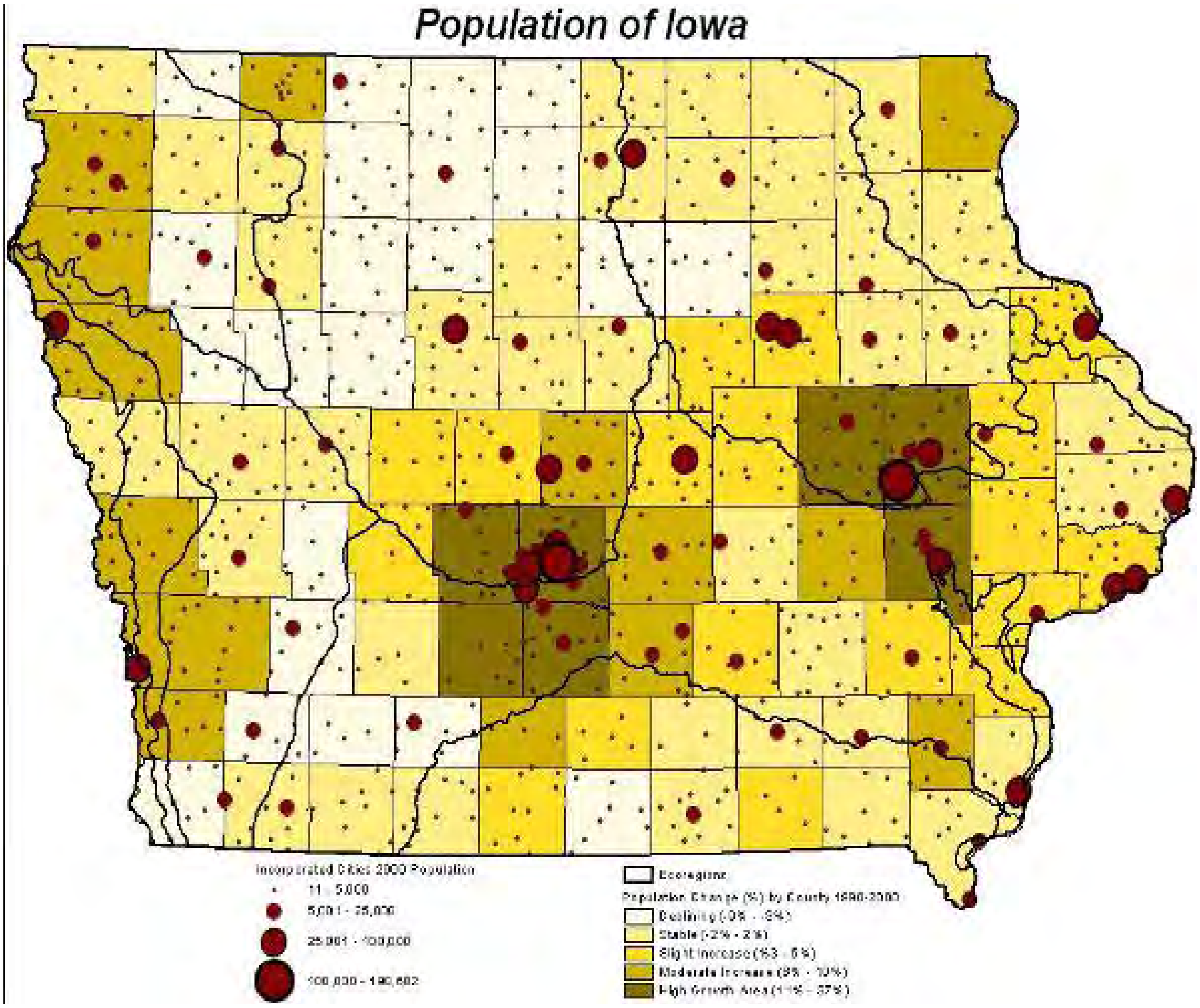
Source: Kathryne Clark using 9HD0030 housing density change provide by U.S. Forest Service and satellite land cover from 2002.

The black lines drawn on Figure 1.25 show the eco-region boundaries for Iowa. The Southern Iowa Rolling Loess Prairie, one of the biggest forest areas in the state, contains some of Iowa's largest communities and has experienced a relatively high level of population growth; it has also experienced the largest forest loss in the state with the decline of over 1.1 million acres, roughly one-third of the 3.6 million total acres of lost forest area for the whole state.

48,000 acres of forest were impacted by urban development from 1990-2000.

17. U.S. Census Bureau, Population Division, (301) 457-2422, Released June 28, 2007. <www.iowadatacenter.org>

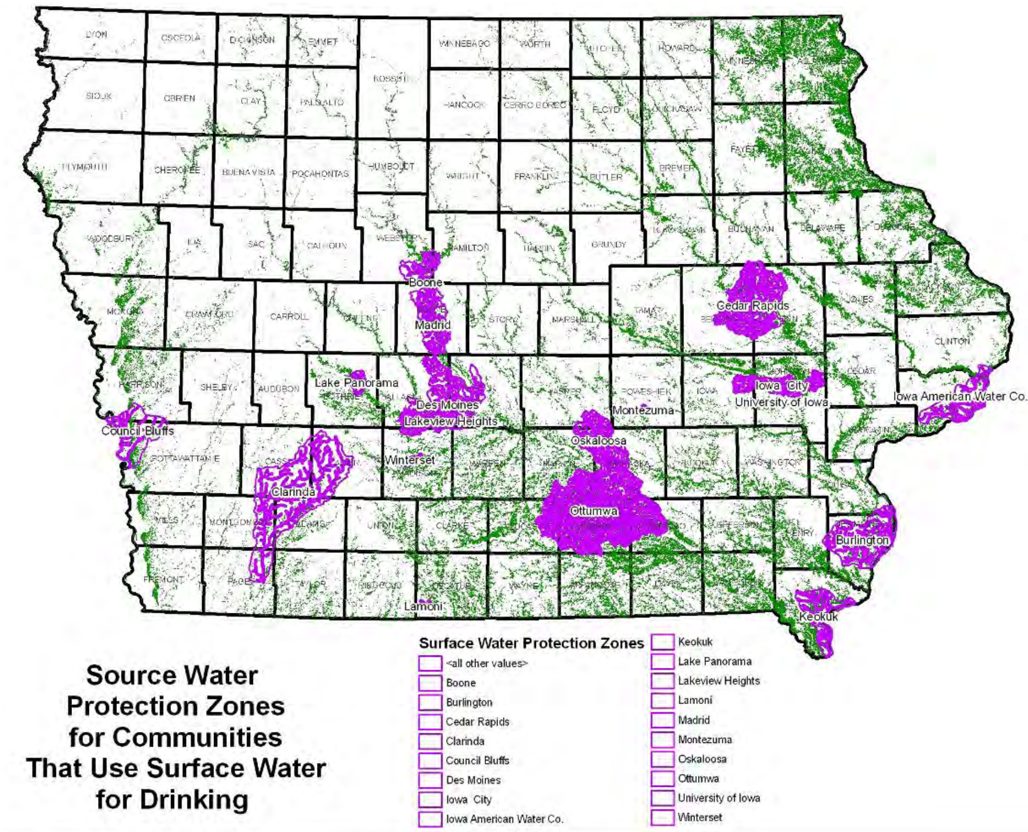
Figure 1.25 Community-level Population Growth Rates in Different Eco-regions, 1990-2000.



Source: Kathryne Clark using U.S. Census Bureau 2000 census, eco-region boundaries of Iowa, incorporated cities from the 2000 census by U.S. Census Bureau.

Over half a million people in 18 communities throughout the state depend on surface water for their drinking water supply; Figure 1.26 shows these communities and their water sources. It is crucial that the watersheds that drain into these water systems are kept in permanent natural vegetation if this drinking water is to remain safe and clean.

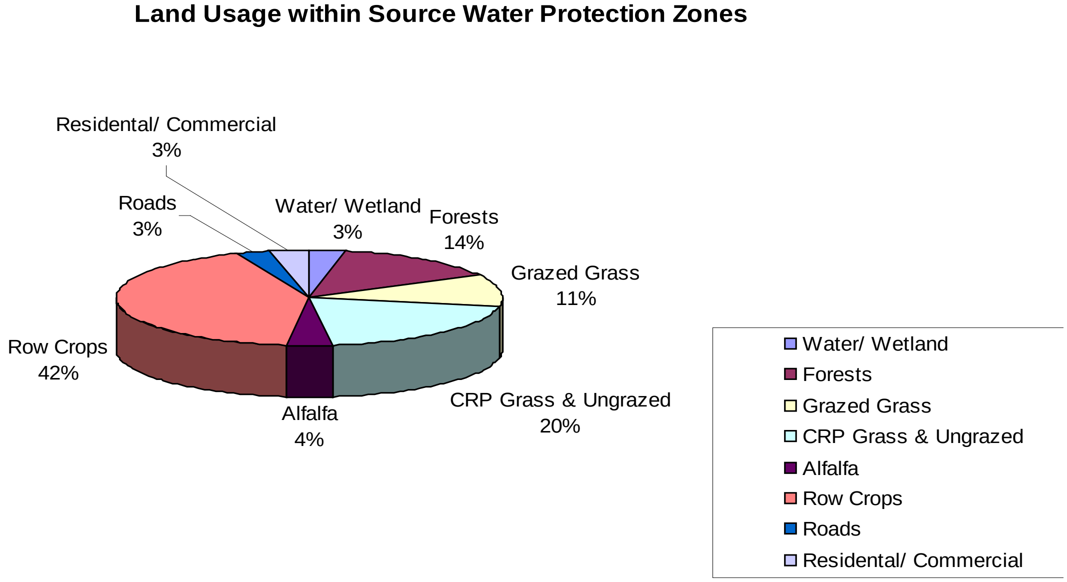
Figure 1.26 Source Water Protection Zones for Communities that use Surface Water for Drinking



Source: Kathryne Clark using source water protection areas- groundwater and satellite land cover from 2002.

Figure 1.27 shows the different categories of land use for the watersheds for the communities that depend on surface water for their drinking water supply. The primary land uses are row cropping (42%), CRP grass and ungrazed grass fields (20%), and forests (14%).

Figure 1.27 Land Usage within Source Water Protection Zones.

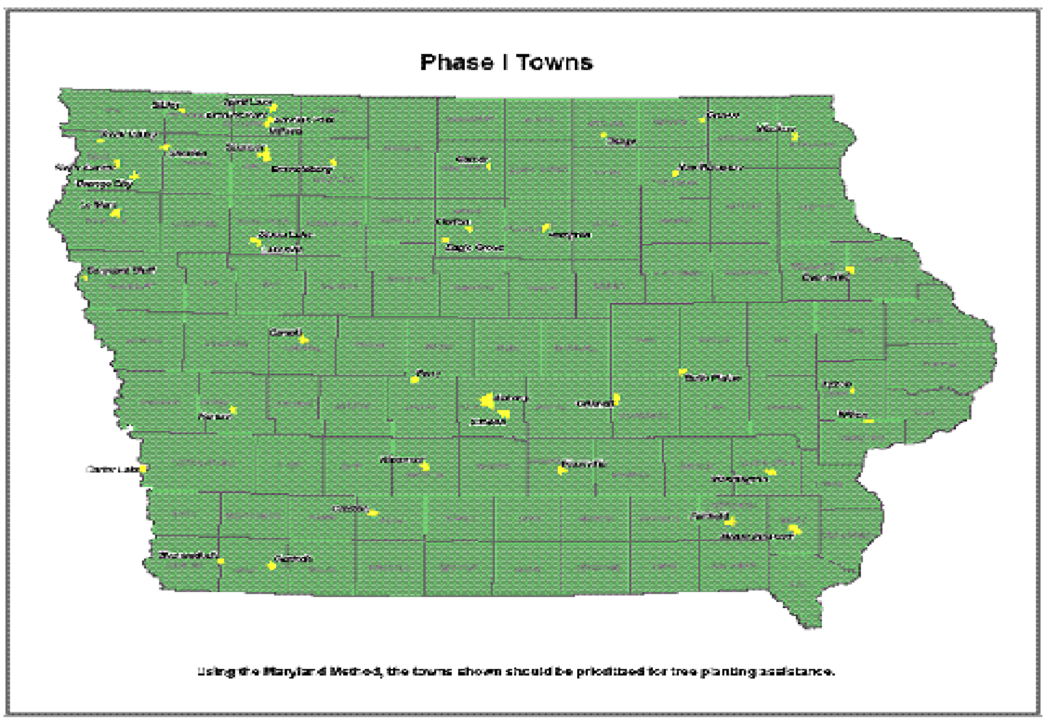


Source: Kathryne Clark using source water protection areas- groundwater and satellite land cover from 2002.

A viable nursery and tree-care industry is crucial for the maintenance and replacement of urban trees, including those damaged by storms and other natural disasters. Growing trees from Iowa native seed sources can provide long lasting, healthy tree material for homeowners. A tree's long-term performance depends upon the extent to which factors such as space, soil, drainage, and sun exposure are considered; furthermore, regular maintenance during a tree's early years can prevent such problems as cracking, limb breakage, and decay.

The map in Figure 1.28 shows the communities that would most benefit from increased tree planting; these communities have less than average tree cover and greater than average populations, urbanized areas and impervious surface areas. Increasing tree canopy in communities that have the most need provides many economic and environmental benefits, such as increased energy efficiency, local climate modification, improved air quality, water quality and quantity, decreased soil erosion, increased aesthetics, noise reduction and increased property values.

Figure 1.28 Communities that would Benefit Most from Tree Plantings.

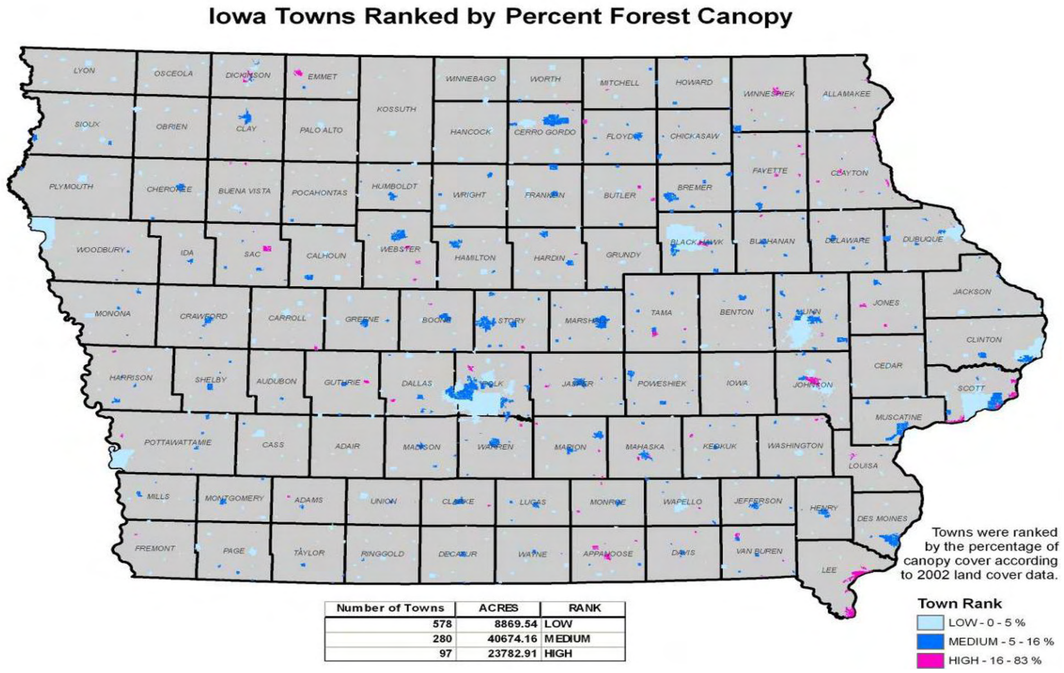


Source: Kathryne Clark using Maryland method and incorporated cities from the 2000 census by U.S. Census Bureau.

Residential tree planting programs provide homeowners opportunities to plant trees at reduced costs. A partnership between utility companies in Iowa, Iowa DNR Forestry and County Conservation Boards encourages the planting of five to ten thousand more landscape trees in Iowa annually. Nursery stock selection, poor insect and disease resistance and disturbed soil profiles are often limiting factors in a homeowner's ability to plant a variety of native local eco-type plants. Trees offered through residential programs could be better selected if the communities had good community forest inventory data.

Figure 1.29 shows the forest canopy cover for communities in Iowa. There are 97 communities with over 16% tree cover and 280 communities with 5 to 16% cover, but the majority of communities in Iowa have a tree cover of less than 5%; this reflects a need to improve tree canopy cover within these communities, especially if their citizens value the benefits that trees provide.

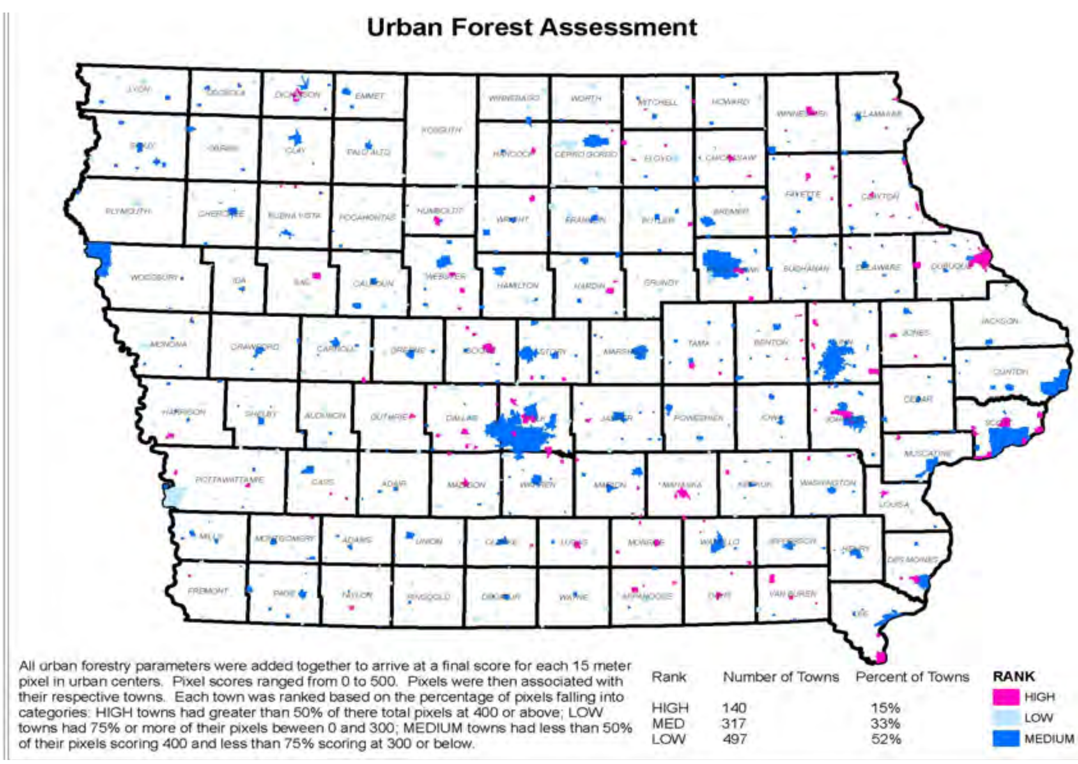
Figure 1.29 % Forest Canopy Cover of Iowa Communities.



Source: Kathryne Clark using satellite land cover from 2002 and incorporated cities from the 2000 census by U.S. Census Bureau.

There are many different issues to consider when setting priorities for communities. A composite map in Figure 1.30, which uses the data from Figures 1.21, 1.22, 1.24, 1.26, 1.28, and 1.29, shows which communities are most in need of tree inventories, management plans, focused residential tree plantings, and other types of planning (see Appendix D for a list of these communities). These areas typically have limited financial and human resources, which makes efficient resource allocation essential. Though the point is not to draw the focus away from other communities, it is important that the communities shown in Figure 1.30 receive the greatest attention, since they lack the numerous benefits that these other, more heavily-forested communities enjoy.

Figure 1.30 Community Priority Map.



Source: Kathryne Clark.

1.2 Forest Type, Size Class, Age Class, and Succession Stages

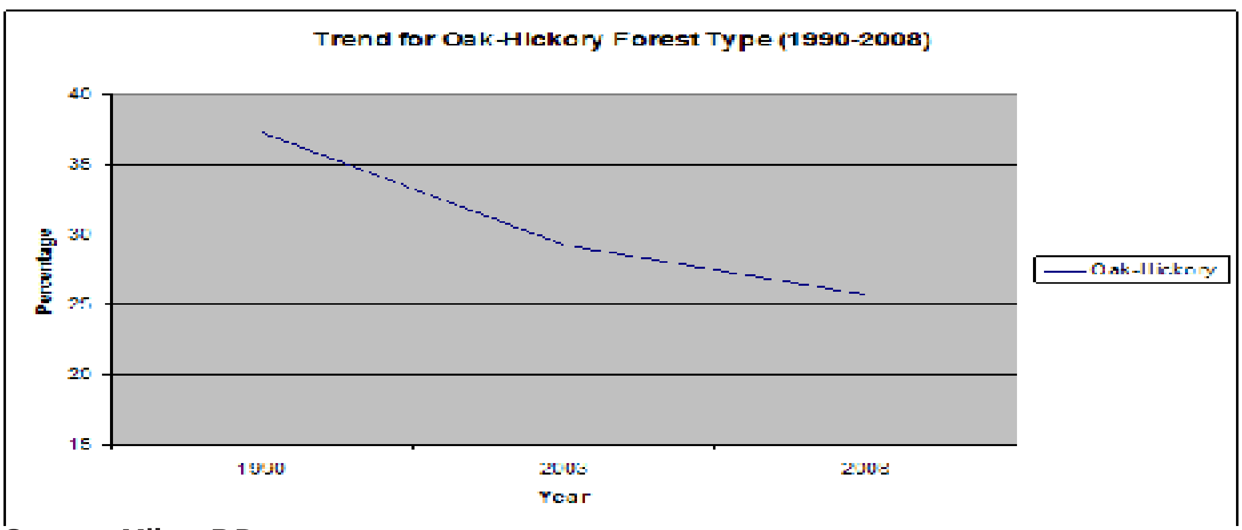
Forest Cover Type

Iowa forests are 98% hardwoods; white pine, eastern red cedar, and balsam fir are the only conifers native to Iowa, with white pine and balsam fir confined to the northeastern part of the state. Tree species diversity is highest in eastern Iowa and decreases as moving west. Due to the prevalence of wildfire prior to statehood, most trees in the state today are fire-adapted species; however, with the suppression of fire that accompanied Iowa's settlement, thinner-barked shade-tolerant trees have been able to grow within the dominant oak-hickory forest type.

The oak-hickory forest type is the largest in Iowa. However, there has been a decline in this forest type in recent years, from 37% of total forest area in 1990 to 26% in 2008.

Iowa's state tree is the oak, though it is not specific which of the eleven oak species native to the state the official type is. White and bur oak trees are typically the oldest living species, with some exceeding 400 years in age. Oaks are disturbance dependent species, meaning that they have a competitive advantage over other trees in areas susceptible to wildfire. The oak-hickory forest type is the largest in Iowa; however, as Figure 1.31 below demonstrates, there has been a decline in this forest type in recent years, from 37% of total forest area in 1990 to 26% in 2008 (See Appendix E for a complete breakdown of forest types according to USDA-FS-FIA inventories for 1990, 2003 and 2008). Lack of active management and disturbance on private and public forest lands are the leading causes of oak-hickory forest decline in Iowa.

Figure 1.31 Percentage of Oak-Hickory Forest Type in Iowa's Forests.



Source: Miles, P.D.

Oak Regeneration

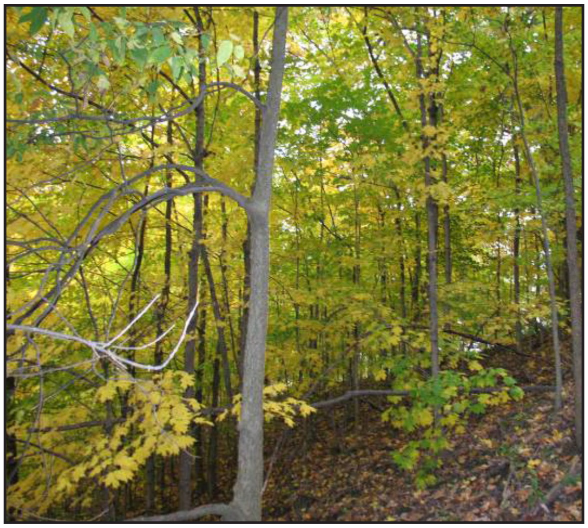
Figure 1.32 shows areas of the state for which oak-hickory management is a high priority. These areas are relatively easy to manage because of their high concentrations of oak trees; areas that used to be oak-hickory but have transitioned to other, mostly shade-tolerant, species are much harder to restore to oak-hickory. While it is important to ensure that the latter areas remain as forests, the sheer amount of resources that would be necessary to restore them to oak-hickory forests makes such a task virtually impossible.

Since 1954, Iowa has been losing over 7,000 acres of oak-hickory forest annually.[16] Managing native vegetation communities in Iowa is a challenge because of the state's highly fragmented forests and near-complete removal of historical disturbance regimes like fire. Active forest management is now needed to help oaks adequately regenerate in Iowa's maturing forests; whenever possible, the DNR Forestry Bureau actively manages oak in state forests using even-age silvicultural techniques.

Figure 1.32 Priority Areas for Oak Regeneration.

Source: Kathryne Clark using FIA data and satellite land cover from 2002.

[16]Miles.



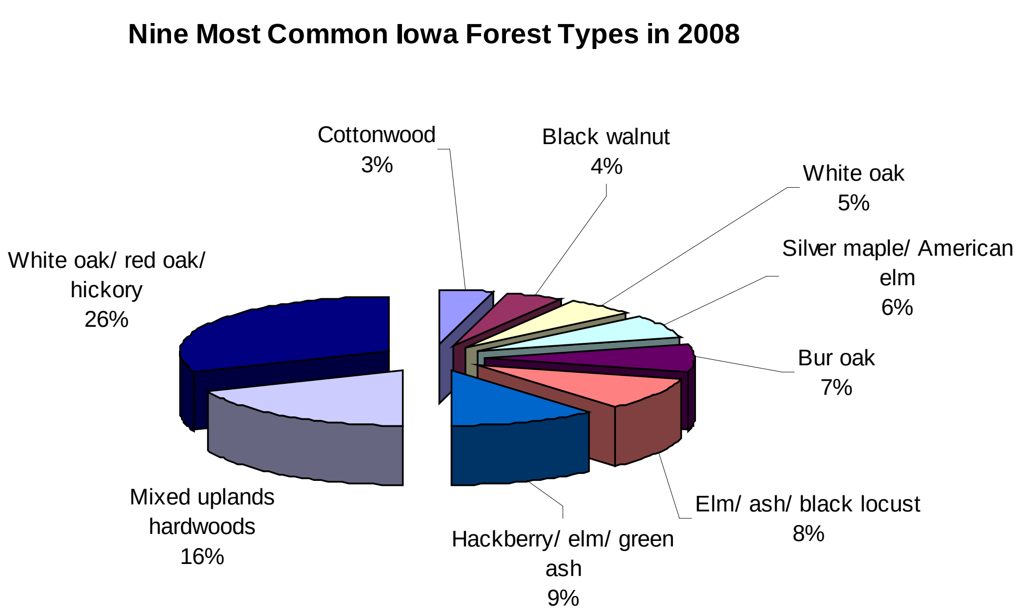
A mid-story sugar maple-basswood forest that has become established in place of an oak-hickory forest. Photo by Mark Vitosh.

Lack of oak regeneration is a concern across the state. Photo by Mark Vitosh.

Iowa forests contain over one billion trees from 68 species. Unfortunately, 25% of these trees are susceptible to fatal insect or disease problems such as oak wilt, oak decline, emerald ash borer, Dutch elm disease, and pine wilt. While most forests are relatively diverse, these threats will have a substantial impact on the composition of the state's forests and urban tree canopies in the future.

Figure 1.33 shows a breakdown of the major forest types in Iowa for 2008. The shade-intolerant white oak-red oak-hickory forest type represents the largest type of forest at 26%. The second most prevalent forest type is mixed upland hardwood, which accounts for 16% of the state's forests. At 4.5% of total forest land, shade-intolerant black walnut represents a small but economically important position in Iowa's forests.

Figure 1.33 Iowa Forest Types as a % of Total Forest Land.



Source: Miles, P.D.

An ecosystem's forest type affects the wildlife habitat, herbaceous cover, wood products, recreational opportunities, and economic value of that ecosystem. Wildlife that depends on oak-hickory trees for habitat and food may not be able to survive without them; many of the common herbaceous plants found in oak-hickory stands cannot tolerate heavy shade; outdoor recreation enthusiasts looking for enjoyment from the wildlife and plants usually found in an oak-hickory forest may not receive the same level of satisfaction from shade-tolerant forests; and finally, without oak trees, the livelihood of sawmills that depend on a steady source of oak logs will be threatened.

Roughly 90% of Iowa's forests are privately owned, and Iowa DNR foresters work with approximately 2,000 forest landowners annually.

Duplication of pre-statehood forest conditions is impossible even as forests age. For example, the loss of elm trees to non-native diseases will forever change the nature of Iowa forest and community ecosystems. Increased human activity within and around natural ecosystems prevents these native ecosystems from maintaining and regenerating themselves like they had before Iowa was settled.

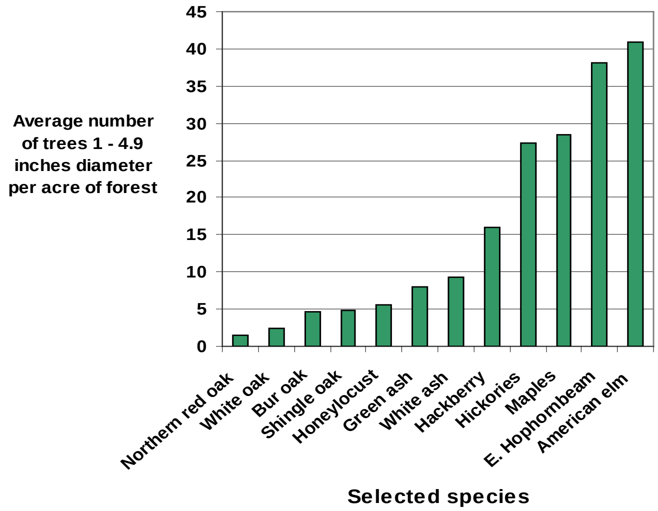
Roughly 90% of Iowa's forests are privately owned, and Iowa DNR foresters work with approximately 2,000 forest landowners annually. Interactions between foresters and landowners begin with evaluations of forest resources, discussions of forest landowner objectives, and consideration of forest management alternatives. Forest stewardship plans are then created to provide landowners frameworks for achieving their management goals and objectives in sustainable ways. Meeting with private landowners gives professional foresters the opportunity to provide education about the benefits of proper long-term forest management, and in a state for which agriculture is the most lucrative way to make money from land in the short-term, these interactions are especially important.

Species Types

Forest stands can contain a single species or a group of species with similar growth characteristics. A typical upland forest today contains large oak trees in the overstory with an understory dominated by shade-tolerant species. Oak is being out-competed by shade-tolerant species like sugar maple, basswood, bitternut hickory and eastern hophornbeam because these species are far more tolerant of shade than oak. Knowing which forest species are increasing and which are declining can provide information about forest succession, wildlife habitat, wood product potential, and need for forest stand improvements.

Many of Iowa's forests are dominated by mature timber. Figure 1.34 shows what tree species composition looks like below the dominant canopy layer. Shade-tolerant trees outnumber oak trees by an average of 6 to 1 in Iowa's forests. Without direct sunlight, current stands of oak will convert to the more numerous shade-tolerant species listed in Figure 1.34.

Figure 1.34 Average Number of Saplings per Acre of Forest Land by Species, 1999-2003.



Source: Leatherberry et al., 38.

According to Figure 1.35, eastern hophornbeam and shagbark hickory experienced the greatest decline in Iowa forests between 1990 and 2006; red mulberry, boxelder and hackberry experienced the greatest expansion during this time period. The significant increase in mulberry is a concern because it means that substantially more forest stand improvement work will be required in the future. Another species often selected for removal during forest stand improvement is eastern hophornbeam, second only to American elm in prevalence in 2006.

Figure 1.35 Species Changes in Iowa Forests, 1990 to 2006.

Species	Number of trees in 1990	Number of trees in 2006	Number of trees changed
Eastern Hophornbeam	131,663,751	104,259,558	-27,404,193
Shagbark Hickory	73,309,563	54,645,624	-18,663,939
Slippery Elm	67,737,063	51,833,461	-15,903,602
White Oak	41,734,022	25,866,363	15,867,659
Red Oak	24,418,477	17,487,538	-6,930,939
American Elm	168,992,484	162,961,260	-6,031,224
Black Oak	14,378,840	9,756,449	-4,622,391
Green Ash	25,870,879	23,297,021	-2,573,585
Basswood	50,110,623	49,196,025	-914,598
Butternut	1,387,109	766,888	-620,221
Red Mulberry	19,541,469	48,432,540	28,891,044
Boxelder	37,234,047	63,212,686	25,978,639
Hackberry	47,359,666	62,451,393	15,091,727
Black Walnut	19,604,048	34,378,639	14,774,591
Honey Locust	13,493,588	26,752,296	13,258,708
White Ash	17,783,056	29,600,187	11,817,131
Black Cherry	30,887,957	41,122,421	10,234,464
Silver Maple	45,579,708	52,471,135	6,891,427
Bur Oak	27,326,085	32,971,049	5,644,964
Sugar Maple	14,001,492	18,832,885	4,831,393
Bitternut Redcedar	36,902,962	41,236,334	4,333,373
Eastern Redcedar	28,437,900	30,857,903	2,420,003

Source: Miles, P.D.

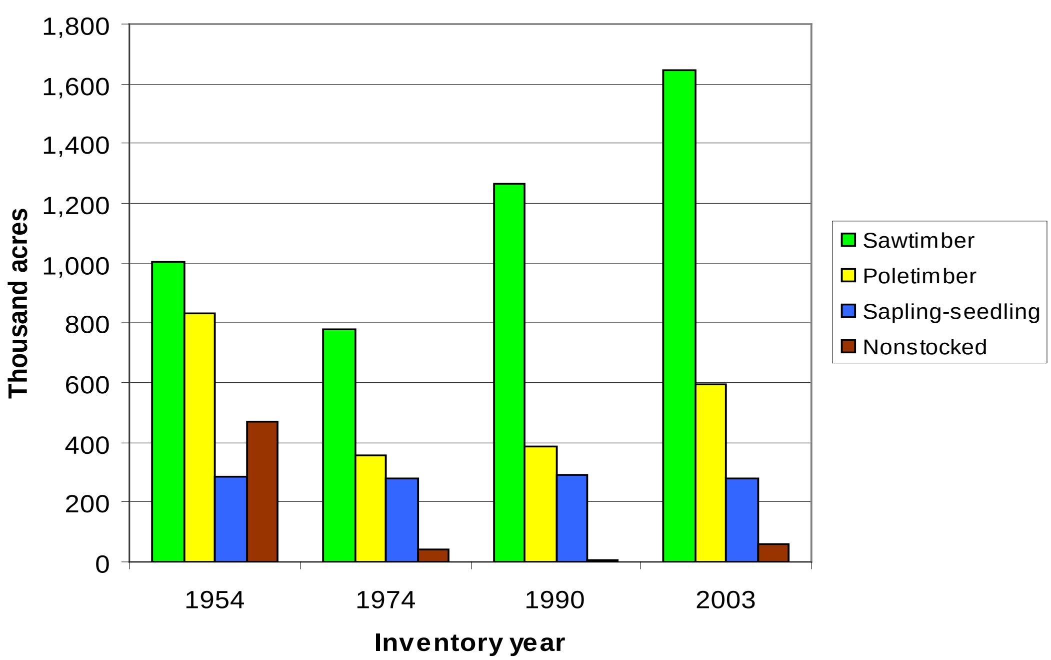
To put the data in Figure 1.35 into historical context, two types of forests, the oak-hickory and the elm-ash-cottonwood mix, made up 87% of the forest for Iowa in 1954.[17] Figure 1.35 shows that in 2008 they represented only about 57%. Changes in species groups that are inventoried together make it difficult for a direct comparison, but it goes without saying that there has been a huge change in the composition of Iowa's forests in the last fifty years. As was mentioned earlier, the effects of diseases such as Dutch elm disease and lack of disturbances like wildfire have contributed to this compositional change.

Size Class

Forests contain trees of various sizes. Stand size is a measure of the average diameter of the dominant trees in a stand; it is measured at 4.5 feet above the ground, expressed as diameter at breast height (DBH). Tracking changes in the distribution of stand-size class provides information about forest sustainability and succession, wood product material, wildlife habitat, and recreation potential.

Figure 1.36 shows that the number of acres of forest land made up of larger trees, known as sawtimber, increased by over 64% from 1954 to 2003. Sawtimber hardwoods are greater than 11 inches in DBH and sawtimber softwoods are greater than 9 inches in DBH. The expansion of areas made up of these large diameter trees indicates a maturing hardwood forest. The increasing area of sawtimber favors tree species that can regenerate under an existing canopy or shady conditions; oaks, hickory, and black walnut, on the other hand, require timber harvesting or other disturbances to regenerate successfully.

Figure 1.36 Long Term Comparison of Timber Land Area by Stand-size Class.



Source: Leatherberry et al. 23

Figure 1.36 indicates that nonstocked areas, those containing less than 10% live trees, made up a larger area of Iowa's forests than sapling-seedling areas in 1954, likely because of the detrimental effects of Dutch elm disease or overharvesting. Nonstocked forest areas experienced major decline

[17]Thornton, P.L. and J.T. Morgan. The Forest Resources of Iowa. Forest Survey Release 22. Columbus, OH: U.S. Department of Agriculture – Forest Service, Central States Forest Experiment Station, 1959. p. 40.

from 1954 to 1990, nearly vanishing altogether, and then increased between 1990 and 2003, likely due to the effects of the major flooding that took place in the state in 1993; it will be interesting to see how the floods of 2008 affect these numbers in the coming years.

Lack of light and disturbances in maturing forests has kept the growth rate of saplings and seedlings relatively constant over the last 60 years; moreover, Iowa's maturing overstory has continued to grow in the sawtimber size class during this same time period, likely due to lack of disturbances and laissez-faire management practices on the part of forest landowners.

Figure 1.37 shows the number of acres of different forest types for small, medium, and large diameter size classes for 2008. According to this data, 66.7% of Iowa's forests were in the large diameter class, 19.9% were in the medium class, and 13.3% were in the small class.

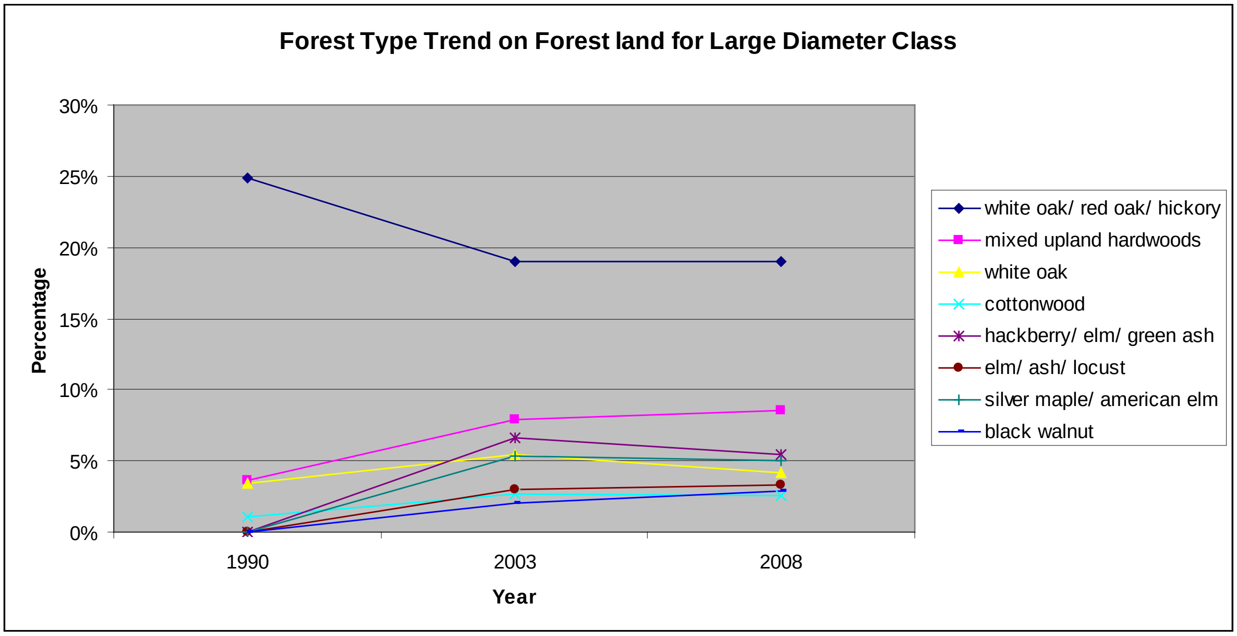
Figure 1.37 Breakdown of 12 Most Common Iowa Forest Types on Forest Land by Size, 2008.

Forest Type	Acres in Large Diameter (2008)	Acres in Medium Diameter (2008)	Acres in Small Diameter (2008)
Redcedar/Hardwood	21,438	26,835	13,154
Sugar Maple	24,590	0	0
Hard Maple/ Brasswood	35,266	0	0
Cottonwood	76,253	8,337	17,789
Black Walnut	87,915	11,863	12,148
Elm/Ash/Locust	100,478	82,684	64,827
White Oak	127,414	8,069	0
Silver Maple/ American Elm	153,162	16,753	8,055
Hackberry/Elm/ Green Ash	163,949	163,949	34,550
Bur Oak	185,075	14,447	1,701
Mixed Upland	258,282	155,028	72,286
Hardwoods/White Oak	578,150	117,091	83,250
Red Oak/Hickory			
Totals	1,969,806	587,635	393,998

Source: Miles, P.D.

Figure 1.38 compares the composition of large diameter class forests in 1990, 2003, and 2008. Of the eight forest types shown, three have come to make up smaller percentages of total forest land over time: the hackberry-elm-green ash, silver maple-American elm and white oak-red oak-hickory types. The large diameter class made up 65% of Iowa's forests in 1990 and 2003, indicating that there was a modest increase from 2003 to 2008 and that Iowa's forests are therefore continuing to mature.

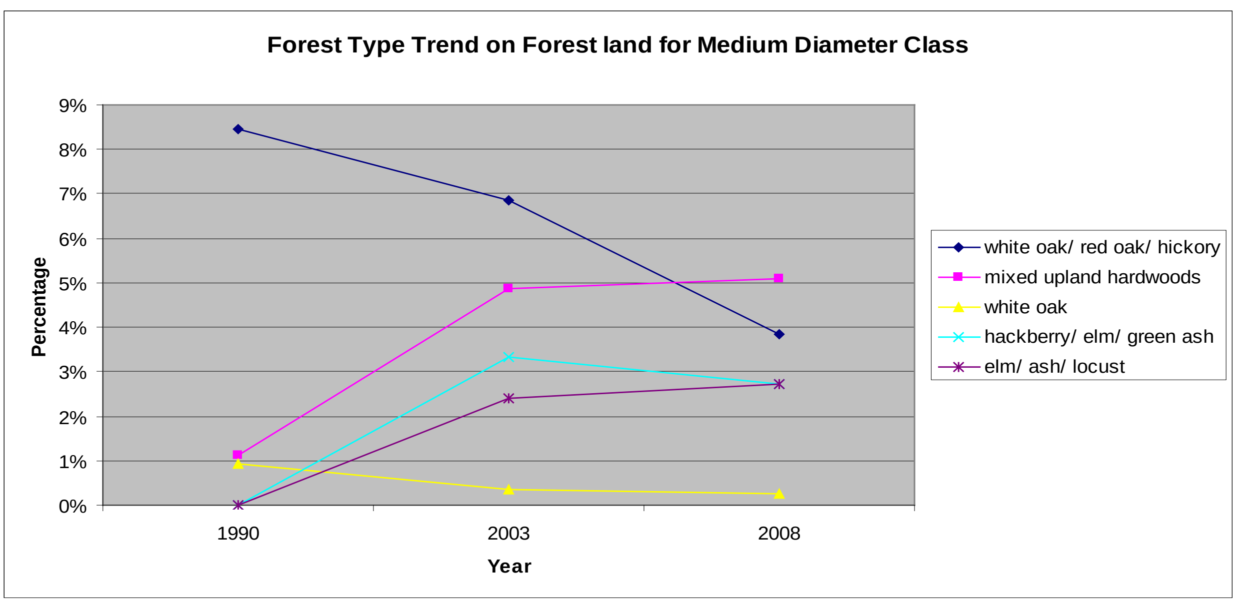
Figure 1.38 Forest Type Trends on Forest Land for Large Diameter Class.



Source: Miles, P.D.

Figure 1.39 shows the composition of the medium diameter class forests for the same years as in Figure 1.38. Of the five forest types in this figure, three have experienced decline: the hackberry-elm-green ash forest type between 2003 and 2008, and the white oak and white oak-red oak-hickory forest types between 1990 and 2008. These data indicate that there will be fewer white oaks, red oaks and hickories growing into the larger sawtimber size class in the future.

Figure 1.39 Forest Type Trends on Forest Land for Medium Diameter Class.



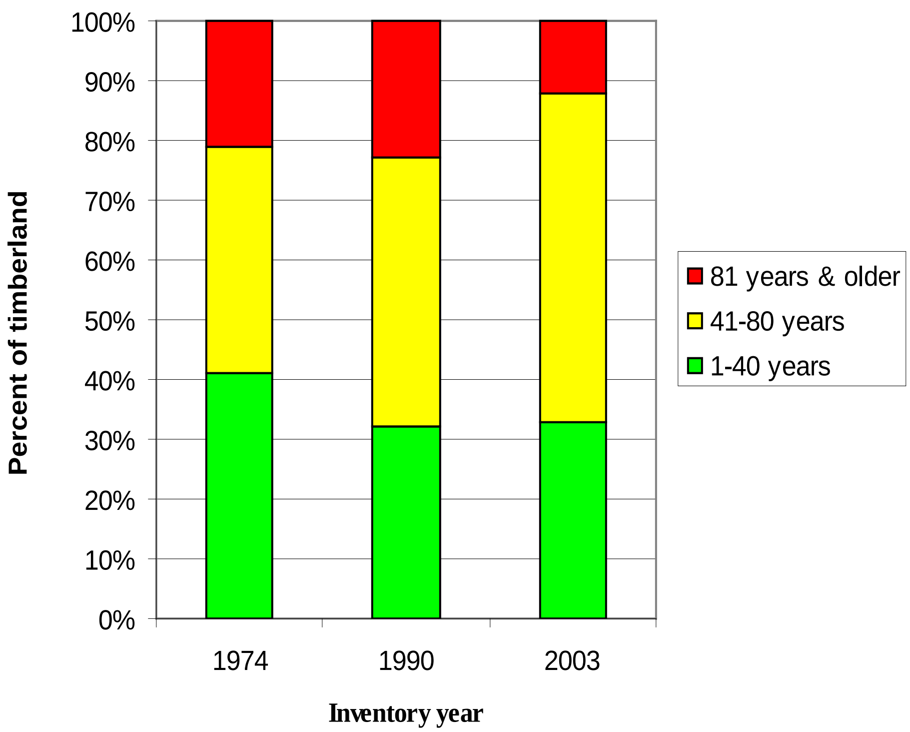
Source: Miles, P.D.

The only forest type experiencing decline in the small diameter class is white oak-red oak-hickory; there is no data for the white oak forest type, likely because the poor regenerative capabilities of this forest type in areas that lack direct sunlight and natural disturbances keep it from experiencing any kind of growth.

Age Class

According to Figure 1.40, timber land that is at least 81 years old came to make up a smaller percentage of total timber land in Iowa between 1990 and 2003; this change is attributable to an increase in shade-tolerant trees, which are no longer kept in check by wildfire. The percentage of land in the 41-81 year age class increased steadily over this time period, while land in the youngest age class experienced decline before 1990 and then leveled off afterward. In addition to variations in species and size classes, biologically diverse forests require age variability; Figure 1.40 shows that Iowa forests contain a good balance of young, middle aged and older trees.

Figure 1.40 Distribution of Iowa Timber Land by Stand Age Class, 1974-2003.



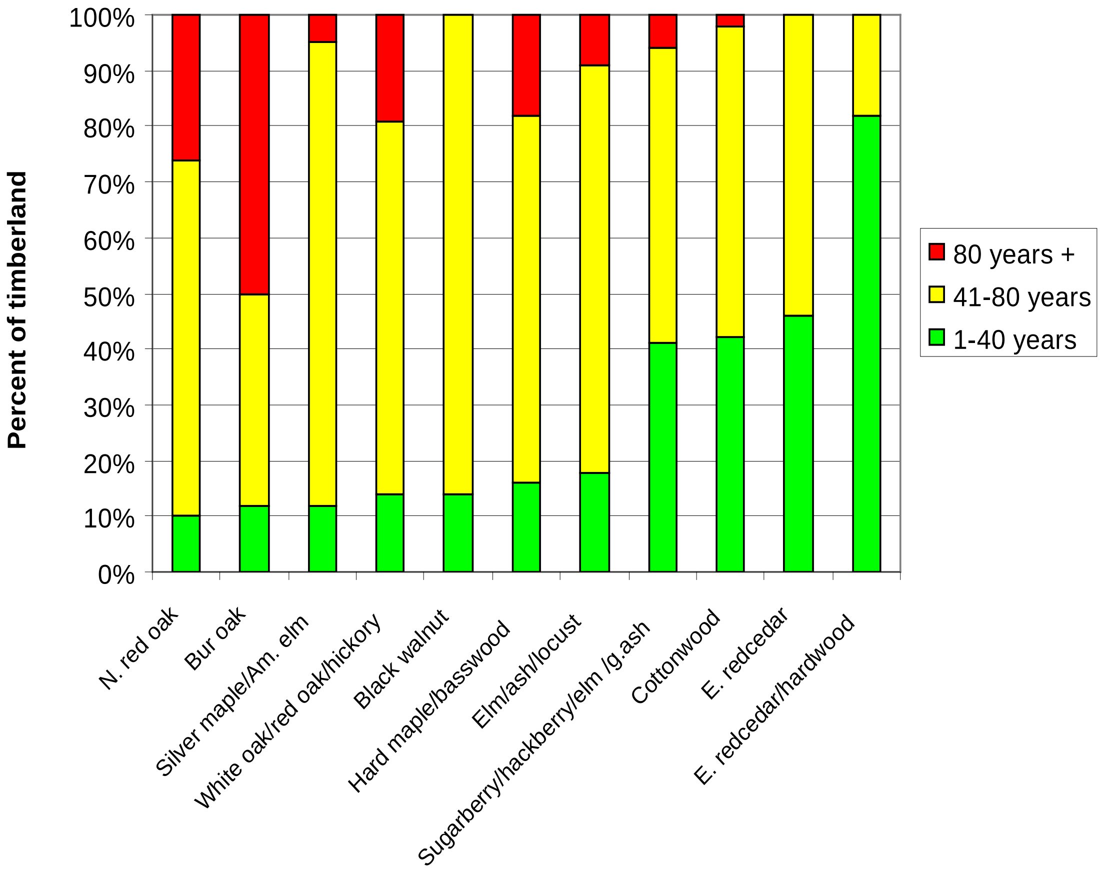
Source: Leatherberry et al. 25

Successional Stage

In Iowa, late successional stage species include hard maple, basswood, and black cherry; mid-stage species include oaks, hickory, and black walnut; and early-stage species include hackberry, ash, cottonwood, locust, sycamore, river birch, silver maple, redcedar, and elm.

Figure 1.41 shows the age class composition of eleven forest types for 2003. Notice that roughly 50% of bur oak, 25% of red oak, and 20% of white oak-red oak-hickory were at least 80 years old. Another telling statistic is that all of the black walnuts in the state are younger than 80 years, undoubtedly a result of a disproportionately high demand for the species' use in timber products. Finally, early succession species like redcedar, cottonwood, green ash, elm, and hackberry are comprised of at least 90% middle and young age class trees.

Figure 1.41 Breakdown of Forest Type by Age Class, 2003.



Source: Leatherberry et al. 25

1.3 Forest Land Conversion and Fragmentation

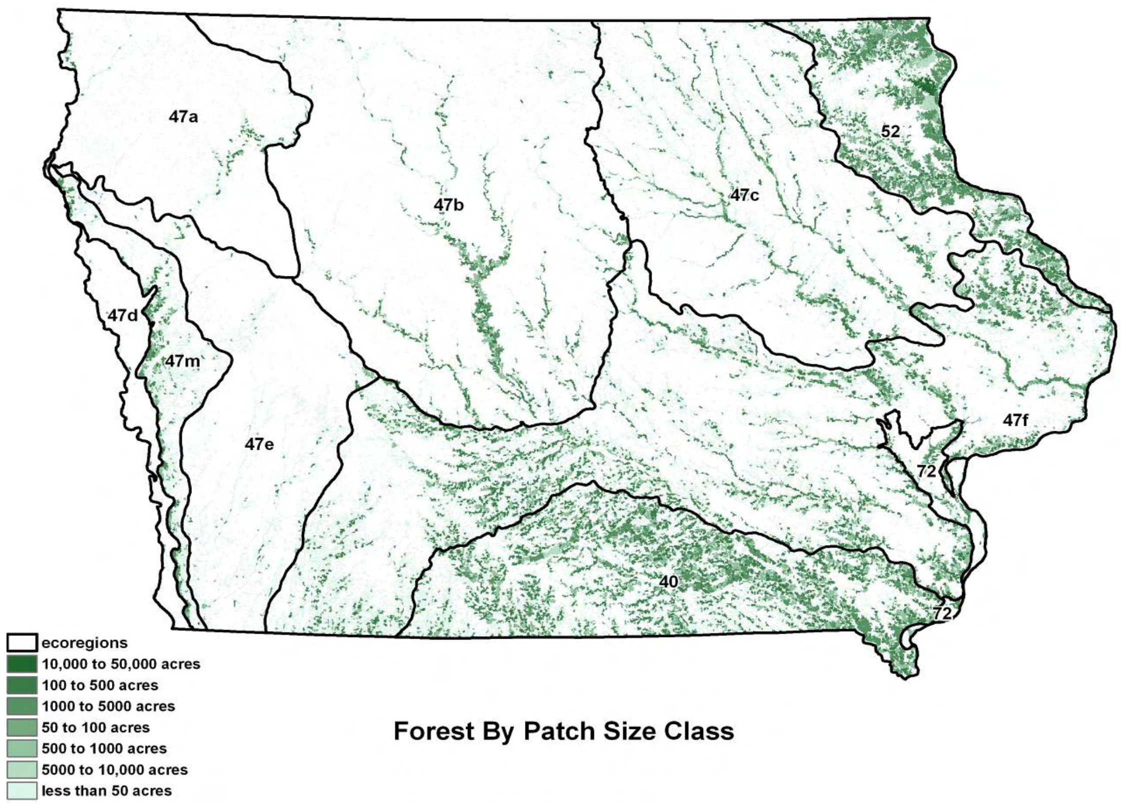
Fragmentation of Forests

Breaking forest areas into smaller pieces affects habitat quality for many species of wildlife and understory plants, which in turn affects biological diversity; forest edge also increases, which makes it easier for edge wildlife species to find habitat than interior species and for invasive species to become established. As forested areas become developed, distance between patches increases, making it more difficult for wildlife and plants to move between these areas; when this happens, measures must be taken to ensure that species diversity, abundance, and breeding capabilities are maintained. Encouraging landowners to plant more trees is one solution to this problem, as it re-connects fragmented areas and in turn re-establishes travel corridors for wildlife (it is important to note that harvesting, which is the movement of forest to a different part of the successional timeline, it is not considered fragmentation).

Fragmentation has a huge impact on forest management decisions as well. For example, silvicultural treatments may be deemed impractical and therefore neglected on relatively small tracts of land. Harvesting small areas of forest is also less profitable for loggers because of the opportunity cost of moving equipment from one area to another. Furthermore, landowners that lack knowledge of proper forest management often make decisions that cause more harm than good. One common result of such decisions is inadequate regeneration of desirable tree species, which will have a huge impact on future stand composition and overall forest cover quality.

Water quality is adversely impacted by fragmentation, mainly because of increased sedimentation. As impervious materials replace natural systems, water quantity also increases, leading to cutting and increased flooding. Finally, recreational opportunities decrease as a result of fragmentation, which has two significant environmental impacts: it increases travel distances for wildlife enthusiasts and thus leads to increased automobile emissions, and it puts undue strain on areas preserved for such activities, which can affect the long-term health of the species in these areas.

Figure 1.42 Contiguous Areas of Forest in Iowa.



Source: USDA-FS-NRS, Rachel Riemann.

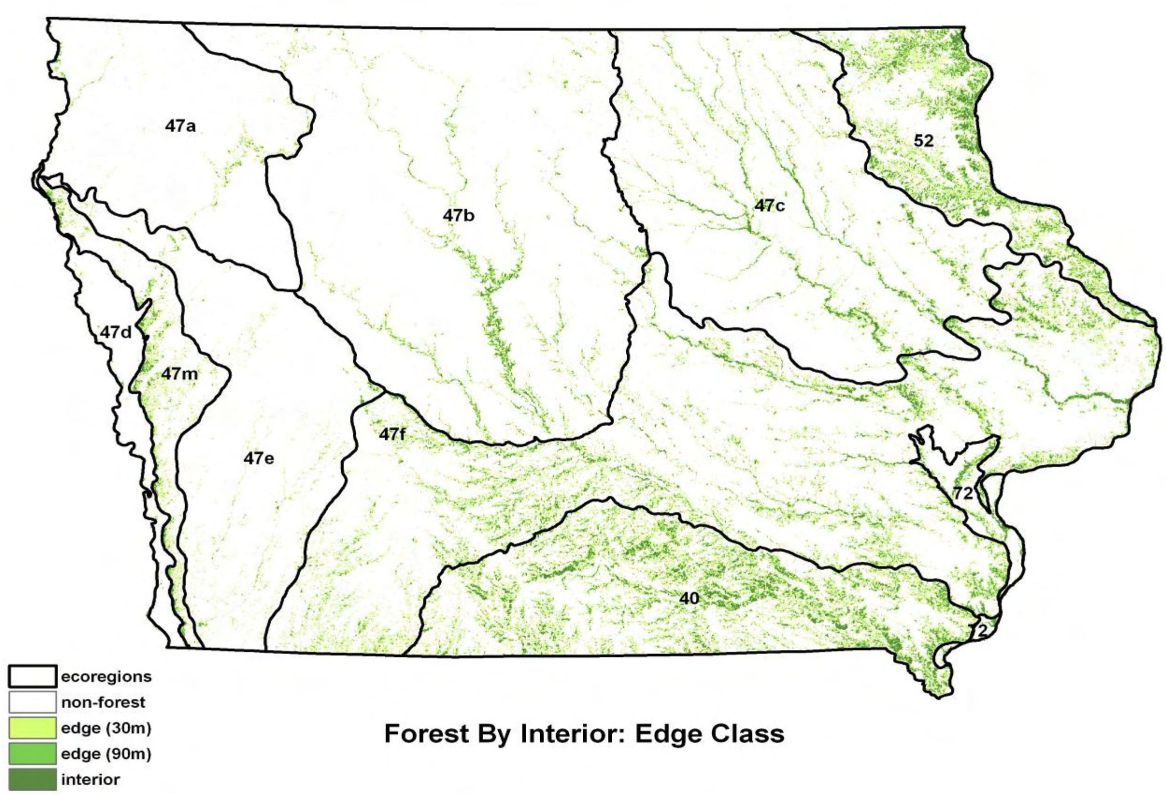
Figure 1.42 uses a color coding scheme to show where the largest areas of contiguous forest are in Iowa, with eco-region boundaries being separated by black lines (refer back to Figure 1.9 for eco-region definitions). Areas with contiguous forest, called patches, offer habitat for a variety of wildlife species. For this analysis, 100 acres is defined as the minimum patch size required for interior wildlife species. According to this figure, the Central Irregular Plains, Paleozoic Plateau, and Southern Iowa Rolling Loess Prairies eco-regions have the most areas of forest patches greater than 100 acres. The table in Figure 1.43 shows the number of forest acres in patches of 100 acres or less juxtaposed with the number of forest acres in patches greater than 100 acres for each of the state's eco-regions.

Figure 1.43 Acres of Forest based on 100 Acre Patch Size by Eco-region.

Eco-Region	Portion of Forest in Patches < = 100 Acres	Acres of Forest < = 100 Acres	Acres of Forest > 100 Acres
Central Irregular Plains	35%	242,600	450,600
Palezoic Plateau	21%	100,900	379,600
Southern IA Rolling	57%	494,200	372,800
Loess Prairie			
Iowan Surface	52%	144,400	133,200
Des Moines Lobe	46%	101,000	118,800
Loess Hills	54%	72,200	61,400
Interior River Lowlands	40%	17,400	26,300
NW IA Loess Prairie	72%	28,900	11,200
Loess Hills Rolling Prairies	91%	66,900	6,700
Missouri Alluvial Plain	61%	9,600	6,100
Total	45%	1,278,100	1,566,700

Source: USDA-FS-NRS, Rachel Riemann.

Figure 1.44 Iowa Forest by Interior: Edge Class



Source: USDA-FS-NRS, Rachel Riemann.

Another way to evaluate the suitability of Iowa's forests for interior wildlife and plants is to define how much area in the core or middle of the forest there is in relation to buffered forest edge; interior areas are less accessible for invasive species and other threats, and are therefore more likely to maintain their biological integrity. Figure 1.44 and the table in Figure 1.45 show where there is forest land with enough core area to sustain interior species populations. Edge forests are defined here as forest areas for which the distance from the center to any outside edge is less than 300 feet; forests for which this distance is greater than 300 feet are defined as interior or core forests. These data can help to highlight areas of the state that are in need of tree plantings to increase forest connectivity and reduce forest edge.

According to the above definition, 772,500 acres of Iowa forest are classified as interior; the eco-regions with the greatest amount of interior forest are the Central Irregular Plains, Southern Iowa Rolling Loess Prairie, and the Paleozoic Plateau, the same regions with the greatest number of 100+ acre forest patches. While some regions have very little interior forest, it is important to note that every region contains some interior forest; however, regions with relatively small amounts of interior forest do not possess the wildlife diversity of regions with relatively large amounts.

Figure 1.45 Interior Forest & Edge by Eco-region.

Eco-region	Proportion of Forest that is Interior	Acres of Forest Interior	Acres of Forest Edge
Central Irregular Plains	29%	201,000	492,200
Southern IA	22%	190,000	676,300
Rolling Loess Prairie			
Paleozoic Plateau	32%	153,800	326,700
Iowan Surface	30%	83,300	194,900
Des Moines Lobe	25%	54,900	164,900
Loess Hills	43%	45,400	88,200
Interior River Lowlands	60%	26,200	17,500
Missouri Alluvial Plain	44%	6,900	8,800
Loess Hills Rolling Prairies	8%	5,900	67.700
NW IA Loess Prairie	11%	4,400	35,700
Totals	27%	772,500	2,072,300

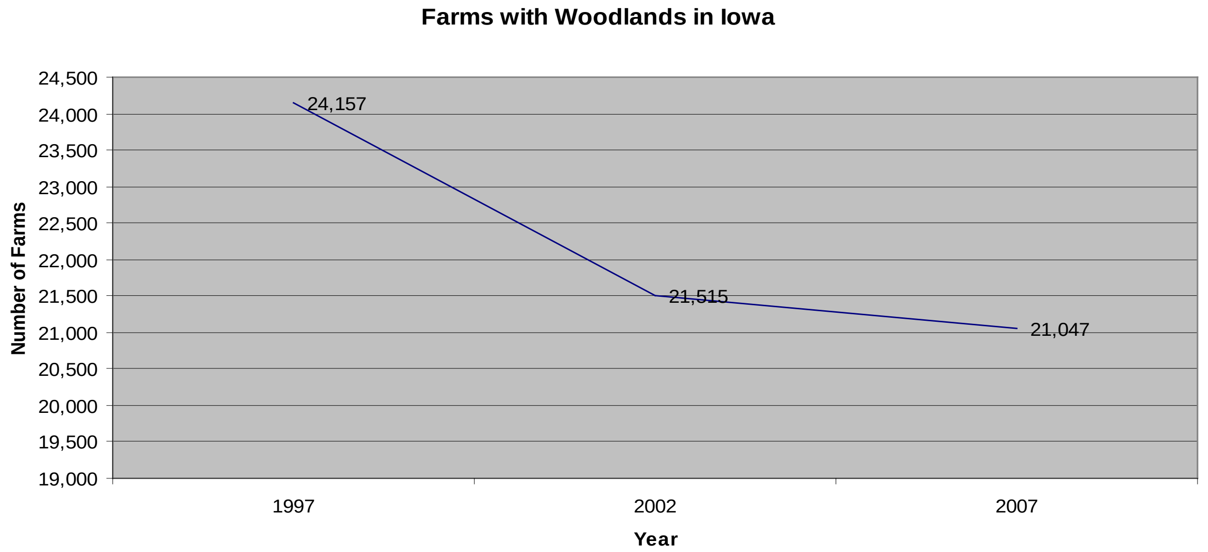
Source: USDA-FS-NRS, Rachel Riemann.

Ownership

Understanding forest resource ownership in Iowa requires consideration of how the state has grown and evolved since the time it was settled. In 1954, Iowa contained approximately 193,000 farms at an average size of 176 acres; by 2007, the number of farms had been cut by more than half to 92,600, with the average size nearly doubling to 331 acres.[18] The number of farms owned by families or individuals fell from over 100,000 in 1974 to 77,452 in 2007; conversely, the number of farms owned by corporations doubled from 1974 to 2007.[19]

As size and ownership of Iowa farms have changed, so have trends related to forest land on farms; Figure 1.46 shows that in recent years, there has been a decline in the number of farms with woodland, from over 24,000 in 1997 to 21,000 in 2007.[20]

Figure 1.46 Number of Iowa Farms with Woodland, 1997, 2002, and 2007.



Source: USDA-Farm Service Agency.

The picture below shows a degraded root system from a tree growing in grazed woodland. Grazing not only prevents young trees from growing, but adversely affects the stocking and quality of

Grazing woodlands provides little forage for livestock and reduces timber value. Photo by Mark Vitosh.

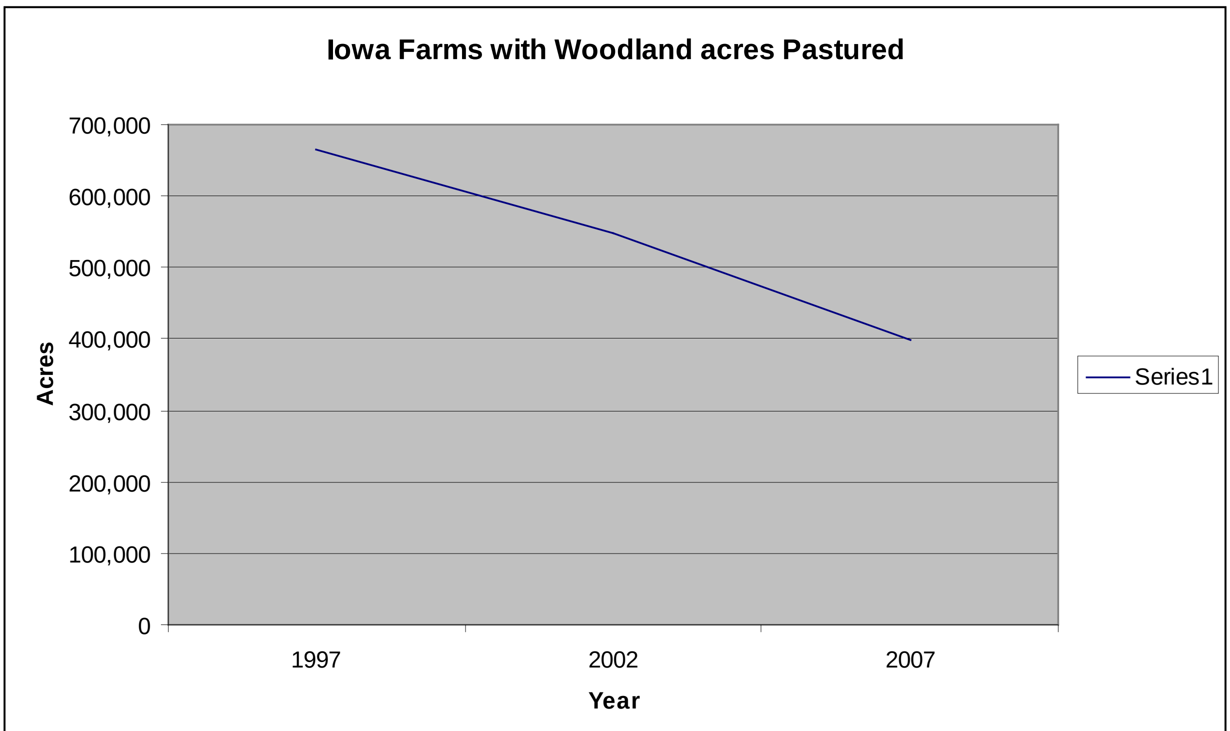
Decayed root system. Photo by Mark Vitosh.

[18]<www.nass.usda.gov/Statistics_by_Subject/Demographics/index.asp>. February 18 2010.
[19]<www.ers.usda.gov/statefacts/ia.htm#FC>. February 20 2010.
[20]<www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Iowa/st19_1_008_008.pdf>. February 1 2010.

trees, as browsing, soil compaction, and rubbing from livestock take their toll on the forests. The losses in tree growth from overgrazing of woodlands cannot be measured, but the damage done will take years to reverse. Fortunately, as Figure 1.47 indicates, the number of acres of woodlands grazed have been decreasing in recent years, from 664,000 acres in 1997 to 399,000 acres in 2007. Interestingly, forest land that was once neglected by forest inventories because of grazing is now taken into consideration, which is one explanation for the increase in total forest land in recent years.

Removing livestock from woodlands is the first step to restoring the ecosystem that once provided habitat to a wide variety of wildlife and herbaceous plants. The next step is to inform forest landowners to work toward increasing the productivity, biodiversity and overall health of these woodlands for future generations. Too often, landowners believe that a laissez-faire approach to woodland management is the best approach – little do they realize, for example, that the increasing presence of invasive species and the inability of oak seedlings to survive are reasons that sound advice from knowledgeable foresters and hands-on management are crucial for the health and longevity of their forests.

Figure 1.47 Number of Acres of Woodlands used for Grazing, 1997, 2002, 2007.



Source: USDA-Farm Service Agency.

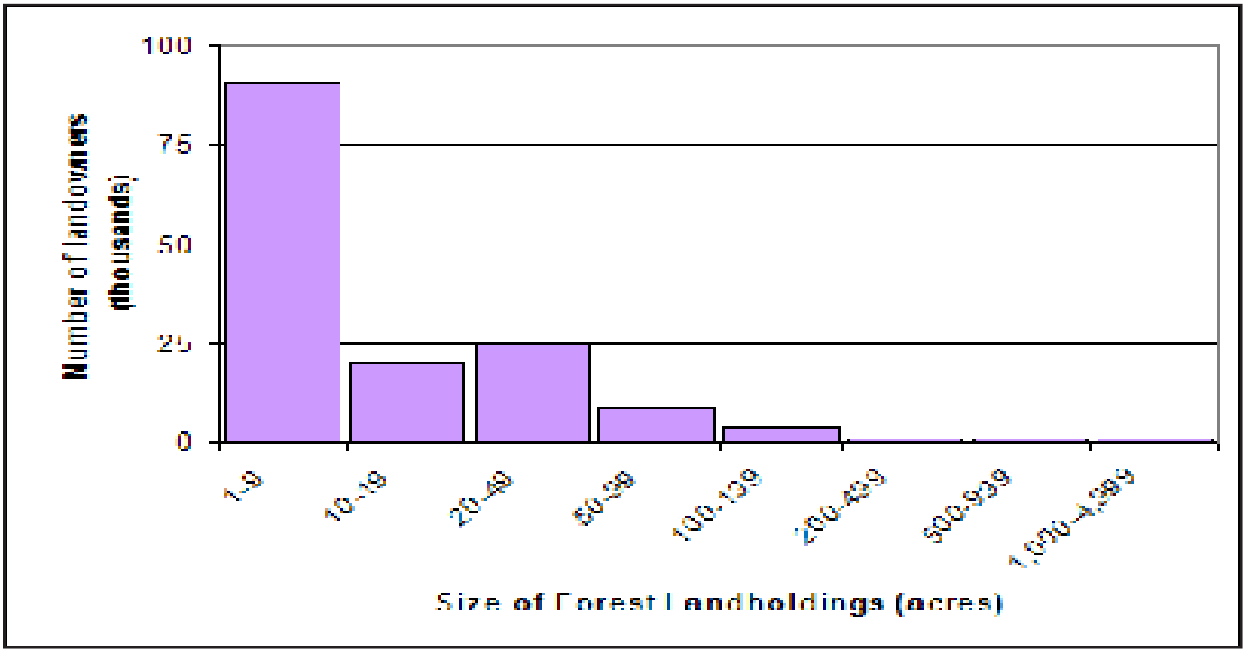
Privately-owned woodlands have decreased dramatically in size since the middle of the 20th century. In 1954, the average woodland owner owned 45 acres of woodland; this number shrank to 31 acres in 1990 and 17 acres in 2003. Figure 1.48 shows that in 2006, the majority of forest landholdings were less than nine acres; moreover, the number of private woodland landholdings nearly tripled from 55,000 in 1990 to 150,000 in 2008.[21] These numbers are alarming because they reflect the extent to which interior forests have been reduced over time and the

The number of private woodland landholdings nearly tripled from 55,000 in 1990 to 150,000 in 2008.

[21]Butler, Bret J. 2008. Family Forest Owners of the United States, 2006. Gen.Tech. Rep. NRS-27. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. p 72.

extent to which they may be reduced in the future. With this in mind, it is crucial that steps be taken at both the public and private level to ensure that the fragmentation of Iowa's forest cover is minimized, and that small landholdings are managed as best as possible. Though cost share opportunities are available, it is often difficult for small woodland owners and woodland owners without cropland to qualify for these programs.

Figure 1.48 Forest Landownership by Size of Forest Landholding, 2006.



Source: Nelson and Brewer.

Figure 1.49 Breakdown of Forest Land by Ownership.

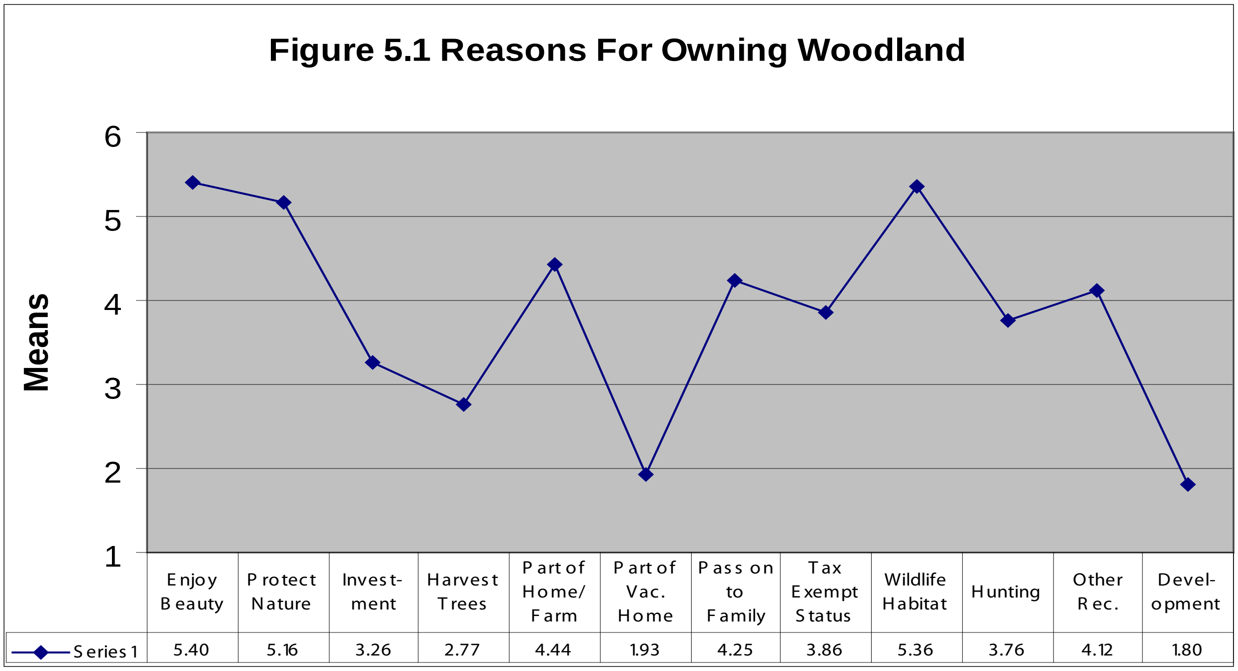
Year	Total Forest Assesed	Fish and Wildlife Service	Dept. of Defence & Energy	Other Federal	State	County/ City	Private
1990	1,947,937	N/A	N/A	43,907	74,445	37,631	1,663,489
2003	2,578,669	20,605	12,369	54,969	145,522	32,044	2,313,160
2004	2,687,101	23,282	20,612	55,750	154,874	44,241	2,388,343
2005	2,823,705	24,628	35,493	44,272	156,761	51,127	2,511,424
2006	2,939,615	26,809	53,079	33,470	192,849	77,033	2,556,376

Source: Miles, P.D.

According to Figure 1.49, the overwhelming majority of forest land in the state has been held by private landowners for at least the last twenty years; state agencies are in a distant second for overall landownership, followed by counties and federal agencies. There are a number of reasons that people choose to own forested land, the most common among them being scenery, protection of nature and biological diversity, privacy, farmland complementing, and heredity.

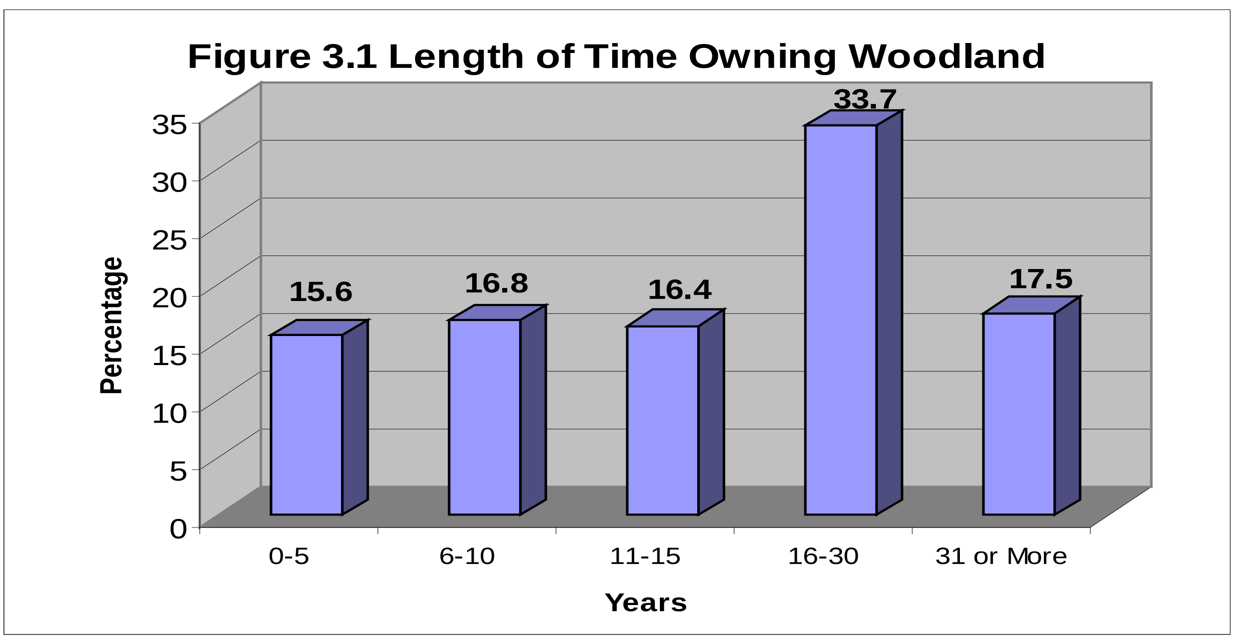
Figure 1.50 shows the results of a 2002 survey of 968 Iowa forest landowners that gives the reasons for forest or woodland ownership. The most commonly-sited reasons are enjoyment of beauty and scenery, protection of nature and biological diversity, farm or home additions, privacy and posterity. According to the same survey, roughly half of respondents acquired their first Iowa woodland parcel at least 16 years prior, with 17.5% having obtained at least one parcel of woodland more than 30 years prior.[22] A complete breakdown of woodland ownership by length of time is given in Figure 1.51. A high turnover rate for landownership can be detrimental for the long-term management needed in order for a forest to maintain multiple productive uses.

Figure 1.50 Reasons for Private Woodland Ownership in Iowa, 2002.



Source: Iowa Forest Reserve Program Study: Aggregate Results Task 1.

Figure 1.51. Length of Time of Private Woodland Ownership in Iowa, 2002.



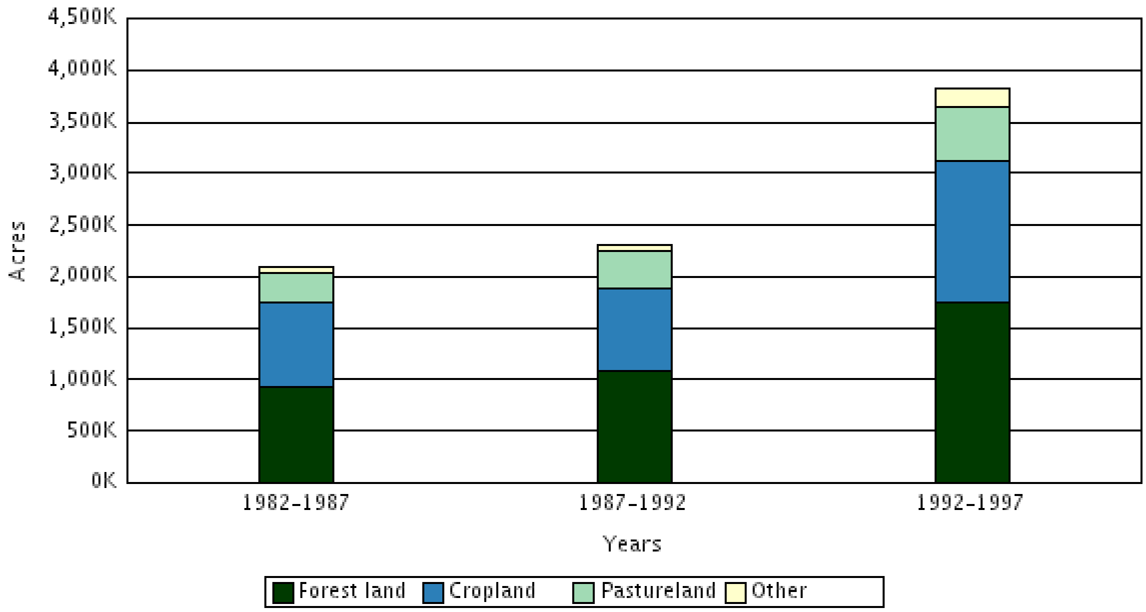
Source: Iowa Forest Reserve Program Study: Aggregate Results Task 1.

[22] "Iowa Forest Reserve Program Study: Aggregate Results Task 1." <www.iowadnr.gov/forestry/pdf/Consumerdatareport.pdf>. March 9 2009.

Forest Land Development

As was mentioned earlier in this assessment, Iowa annually lost an average of 18,000 acres of forest land to development between 1992 and 2002. As Figure 1.52 demonstrates, the amount of forest, cropland, or pasture developed annually in the northern United States nearly doubled from 1982 to 1997, and of these three land cover types, forests have experienced the most development.

Figure 1.52 Amount of Land Developed by Land Cover Type in the Northern United States, 1982-1997.

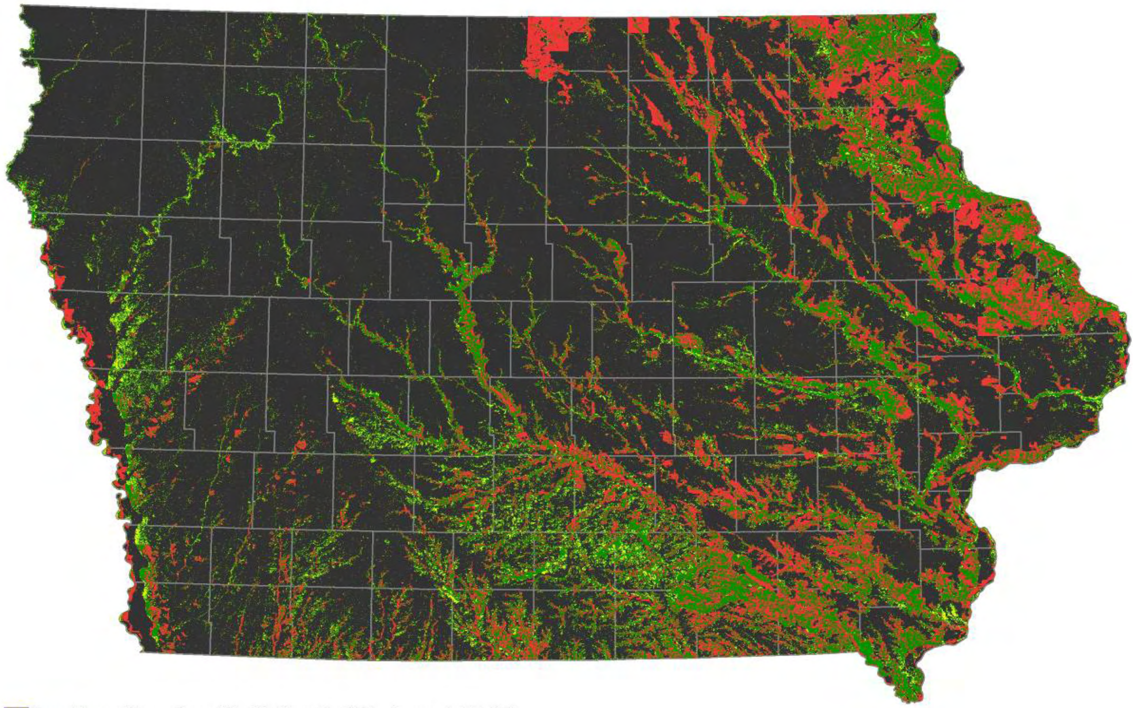


Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Net Change in Forest Land

Since 1850, 1,051,934 acres of forests have emerged in what are considered to be new locations; another 1,794,958 acres of forest that existed prior to 1850 are still around today. Iowa had approximately 6,471,581 acres of forest area in 1850, which means that 4,676,623 acres of original forest have been removed since this time. Since only 1,051,934 acres have been restored since then, Iowa has experienced a net loss of 3,624,689 acres of forest, or more than half of the forest area in existence at the time of European settlement. No data exists to describe if the best quality forest was lost or what the remaining composition of the original forests that were not lost are. Though details about the amount of forest lost within each eco-region were given in Figure 1.9., there is no way to determine the quality, composition, and other characteristics of these lost forests. Much of the forest that was removed came from land with relatively high quality soil, and for the purpose of crop production. The red in Figure 1.53 shows where most of Iowa's forest resource has been lost since 1850.

Figure 1.53 Forest Land Change, 1850 and 2002.



Source: Kathryne Clark using General Land Office (GLO) Maps as Surveyed from 1836-59, Iowa cooperative soil survey and Iowa DNR geological survey.

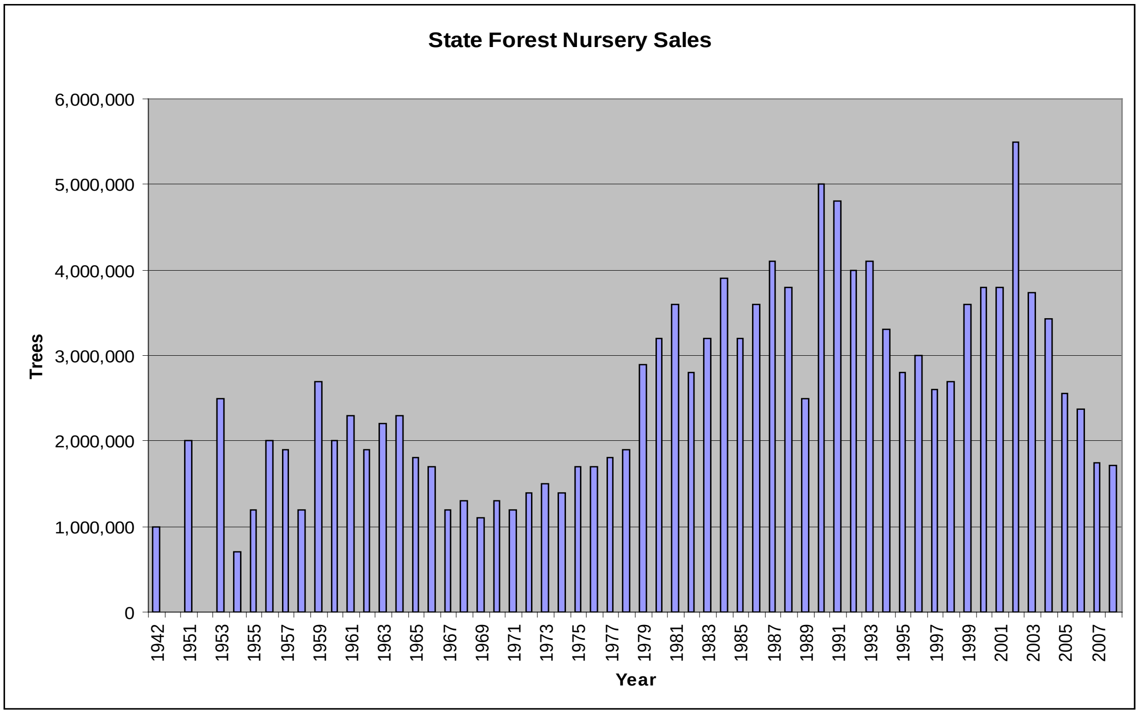
Native Seedlings

Native conservation seedlings from the State Forest Nursery planted on private land. Photo by Bruce Blair.

Since Iowa officially became a state, people have been planting trees for shelter, fuel, protection from the elements, and a host of other reasons. The establishment of the State Forest Nursery in the 1930's helped to supply low cost, native bare root tree and shrub seedlings for conservation plantings on public and private lands. Providing native genetic material to landowners helps to maintain genetic diversity, allowing all tree species a better chance to survive climatic changes and potential insect and disease problems. The nursery has sold more than 150 million seedlings since its establishment, including 64.5 million in the last twenty years alone. This relatively high volume of sales in recent years has led to the establishment of more than 15,000 new acres of forest in the state, and is due in large part to the effects of various conservation programs.

Private landowners have responded positively to market incentives and government programs, including subsidized afforestation on unproductive agricultural land, which is one reason that forest land has increased in the state in recent years. The ability of the State Forest Nursery to supply large quantities of native nursery stock at a relatively low cost has provided Iowans with excellent opportunities to develop forests on their land; without the nursery, Iowans would have had to pay more for their seedlings, which would have left them with fewer resources for weed control and other activities critical for successful tree planting establishment; had this happened, it is likely that fewer acres would have been planted during this time period. It is important that promotions of tree planting continues to ensure that landowners stay in touch with their properties and leave legacies for future generations; this is especially important when considering the extent to which landholdings have shrunken in the last half-century.

Figure 1.54 History of Iowa State Forest Nursery Seedling Sales.



Source: State Forest Nursery Manager, Roger Jacob.

Tree Planting

Figure 1.55 shows that the amount of land enrolled for conservation practices by the National Resource Conservation Service (NRCS) increased between 2002 and 2004; however, there was also a decrease in the number of acres of trees actually planted over the same time period. Tree planting represented only slightly more than 1% of the conservation acres funded by the NRCS; the permanent establishment of woody vegetation is something most farmers steer away from, as grassland is much easier to establish, maintain, and, if so desired, reconvert to agricultural land.

Figure 1.55: Base Conservation by NRCS in Iowa, 2002 to 2004

	2004	**2003**	**2004**
Acres planned for conservation	1,440,157	1,153,154	1,174,262
Acres of trees planted	3,518	4,398	6,399
Highly erodible land treated (ac)		381,708	405,678

Source: www.ia.nrcs.usda.gov/programs/conservationoperations.html.

Since 2003, the number of planted forest acres has risen by 11% to 63 million acres, and growing stock volume on planted forests has risen by 32%; this is an indication that intensive management and superior seedlings are having a big impact when applied toward reforestation.

Preserving Tree Genetics

The goal of Iowa's tree improvement program is to preserve the genes of locally adapted trees. Currently, the program is focused on the development of high-value black walnut trees for timber products and the preservation of butternut trees under threat of extinction from canker. If the program were to receive additional funding, other species in need of special consideration could be added. Maintaining a pool of genetic diversity for all native species on sites located across the state would ensure that Iowa's trees are in a suitable position to withstand climate change and threats from disease and insects in the future; this would also provide a dedicated seed source to supply future seed needs for nurseries to ensure a native local seed source is available.

The tree improvement program has collected from a diverse gene pool of black walnut trees in Iowa. As the most valuable black walnut trees are harvested, branches are collected in order to propagate seedlings with identical genetics. This will give landowners a better pool of trees from which to choose for growing, and will have positive implications for future yield and genetic and biological diversity; once enough of these trees are selected, there will also be a large enough sample of genes to represent over 95% of the genetic variation within this species. Since 2003, the program has been testing for a fast growing black walnut tree capable of growing above vegetation and wildlife browsing lines to quickly capture a site. The most successful tree so far, which is being reproduced and tested in field trials to see how it performs under various growing conditions, experienced growth of almost 9 feet in 2 years and 25 feet in 5 years.

Black walnut tree selected for its superior genetic qualities. Photo by Jeremy Cochran.

The other current focus of the tree improvement program is to preserve the genes of the valuable native butternut in an effort to prevent its extinction from butternut canker. Branches are collected from native trees and then grafted onto walnut root stock in an effort to maintain a population of native Iowa butternuts. Seedlings from twenty Iowa trees and over 100 trees from other states are being tested at the Loess Hills State Forest in western Iowa and Yellow River State Forest in northeast Iowa (the latter site is in an area of the state that is still highly susceptible to the disease, while the former site is outside of the butternut canker range).

Black walnut is Iowa's most valuable timber species. Photo by Paul Tauke.

Butternut seedlings established at Loess Hills State Forest. Photo by Aron Flickinger.

1.4 Status of Forest Communities and Wildlife Species of Special Concern

Baby Opossums. Photo by Bruce Ehresman.

There are two primary aspects of wildlife habitat: food and shelter. Many creatures rely on trees for habitat, and the usefulness of a tree or group of trees depends on factors such as size, condition and spacing. Generally speaking, a tree's value to wildlife is proportional to its size, since trees that are relatively large are able to provide more food and more opportunities for shelter than trees that are relatively small. Trees that produce fine hardwood products are usually valuable for wildlife because they produce acorns and nuts (known as mast); as these trees age, they may also develop cavities that birds and animals can use for shelter. Other tree species of value to wildlife include aspen (buds used for food), silver maple (mostly shelter), serviceberry (food and shelter), pines (shelter and roosting sites), red cedar (food and shelter) hawthorn (shelter) and crabapple (food). A large variety of shrubs such as wild plum, ninebark, dogwood, hazelnut, elderberry, arrow wood, nannyberry and common choke cherry can also provide food and shelter for wildlife.

Historically speaking, most of Iowa's forests have existed along river corridors; these areas have shrunken in size as a result of agricultural growth, which has had a huge impact on water quality and habitat availability. Forested river corridors are important to terrestrial and aquatic wildlife because they provide connectivity to larger tracts of forest and shade water from hot sun rays in the summer.

The remaining pieces of the state's original landscape can and do attract wildlife, but small habitat remnants obviously cannot sustain the array of birds and animals that once lived in Iowa. Forest wildlife such as red-shouldered hawks, long-eared owls, cerulean warblers, Indiana bats, timber rattlesnakes, and southern flying squirrels used to be common inhabitants of Iowa's woodlands, but are now in decline due to loss and fragmentation of suitable habitat.

Conservationists have been able to help a small number of species recover from habitat loss. Peregrine falcons, wiped out by the pesticide DDT in the 1960's, are nesting again with the help of captive breeding; wild turkeys, bald eagles, river otters and trumpeter swans have rebounded as well. Wildlife conservation funding is limited, however, particularly for non-game species, so the future of many of Iowa's forest species is not secure.

About 150 Iowa plant species have been classified as rare or endangered, while 40 more have not been seen for decades. To avoid losing more species, Iowans must learn how to maintain their habitat into the future. For county-level maps showing threatened and endangered species status and distribution, visit the Natural Areas Inventory website at https://programs.iowadnr.gov/naturalareasinventory/pages/Query.aspx

The fragmentation of Iowa's remaining forest resources makes them even more susceptible to invasive species. With few natural enemies, exotics disrupt native communities in a number of different ways: exotic bush honeysuckles and buckthorn take over the understory layer of forests, choking out native species; oriental bittersweet aggressively edges out other woodland species by girdling trees or shading out understory vegetation; garlic mustard poses a severe threat to woodland wildflowers, out-competing native species for light, space, water and nutrients. Aside from their devastating affects on native trees and plants, these invasives provide relatively little for native wildlife creatures, and so threaten their existence as well.

Successful natural reproduction of native wildlife populations is dependant upon habitat protection; clean water and air and protection from predators are necessary for the long term health of wildlife. Unfortunately, society continues to struggle to find a balance between economic development and the long-term sustainability of natural communities.

Iowa's woodlands benefit a variety of wildlife, including birds, mammals, reptiles, amphibians, butterflies and snails. Water corridors that meander under tree canopies have less extreme temperature fluctuations than those that don't, and therefore provide superior habitat for many aquatic species as well. Although Iowa cannot and will not sustain the breadth of wildlife species that used to inhabit the state's natural areas, Iowans are still fascinated with the wildlife that still exists in the state; for example, the U.S. Fish & Wildlife Service estimates that more than a million of Iowa's 3 million citizens watch, hunt, or fish for wildlife.

Forest-associated Communities and All Wildlife Species

According to the Iowa Wildlife Action Plan (IWAP), conservation activities should be directed to regions of the state having the greatest wildlife species diversity.[23] The Iowa Gap Analysis Program (GAP) is a model for predicting the degree to which native animal species and natural communities are represented in the present-day mix of conservation lands. Those species and communities not adequately represented in the existing network of conservation lands constitute conservation "gaps." The purpose of Iowa GAP is to provide broad geographic information on the status of ordinary species (those that are not threatened with extinction or are naturally rare) and their habitats in order to provide land managers, planners, scientists and policy makers the information they need to make better-informed decisions.[30]

Maps that delineate regions of the state with the greatest potential terrestrial vertebrate wildlife diversity based on habitat distributions (Figure 1.57) are produced using this information. Hexagons shown on the species richness maps cover 635 square kilometers; Iowa has a total of 265 of these units either wholly or partially within the boundaries of the state.

Iowa lacks comprehensive distribution data for many terrestrial and aquatic species; because of this, the Multi-Species Inventory and Monitoring Project (MSIM) was launched in 2006 to conduct a statewide inventory of Iowa's fish and wildlife resources. Once the inventory phase is complete, the project will allow scientists to monitor changes in species distributions over time.

A table of all wildlife species known to inhabit forested areas in Iowa is included in Appendix F. For species of greatest conservation need (SGCN), promoting woodland management activities

[23]Iowa Wildlife Action Plan. <www.iowadnr.gov/wildlife/diversity/plan.html>.
[24]Iowa Gap Analysis Program. <www.gis.iastate.edu/gap/terra/IA_Report.pdf>. January 10 2009.

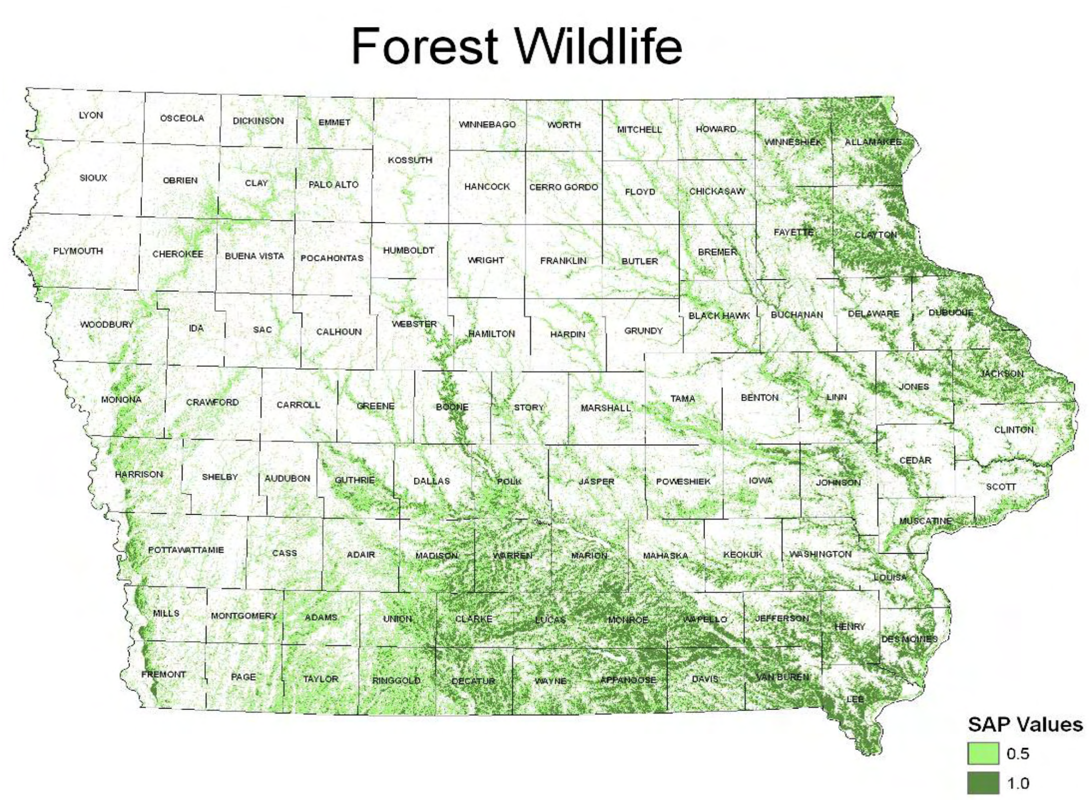
such as thinning, removal of undesirable tree species, manipulation of woody plant understory, timber harvesting, and tree planting is a key to creating better habitat.

A variety of data resources were utilized for the selection of SGCN, including:

- Iowa GAP -completed in 2003 with ongoing updates provided by Iowa Nature Mapping;
- Published historic and scientific literature;
- Unpublished reports, scientific surveys and databases maintained by the IDNR fisheries, wildlife and water quality bureaus;
- Personal research and survey data supplied by wildlife ecologists at Iowa educational institutions;
- Museum and personal specimen collections;
- State and regional databases maintained by other conservation organizations (e.g. NatureServe, PIF, PARC, TNC, USFWS, IOU, Audubon IBA, etc.);
- Personal expertise of working group members and consultants.

The procedures used to identify SGCN are elaborated on in Chapter 3 of the Wildlife Action Plan. Figure 1.56 shows a comprehensive map that prioritizes forest habitat for SGCN; areas with 7 to 13 SGCN were given a value of 0.5 and those with 14 to 38 were given a value of 1.0.

Figure 1.56 Priority Habitat for Forest Wildlife Species of Greatest Conservation Need as Determined by Iowa's Wildlife Action Plan.



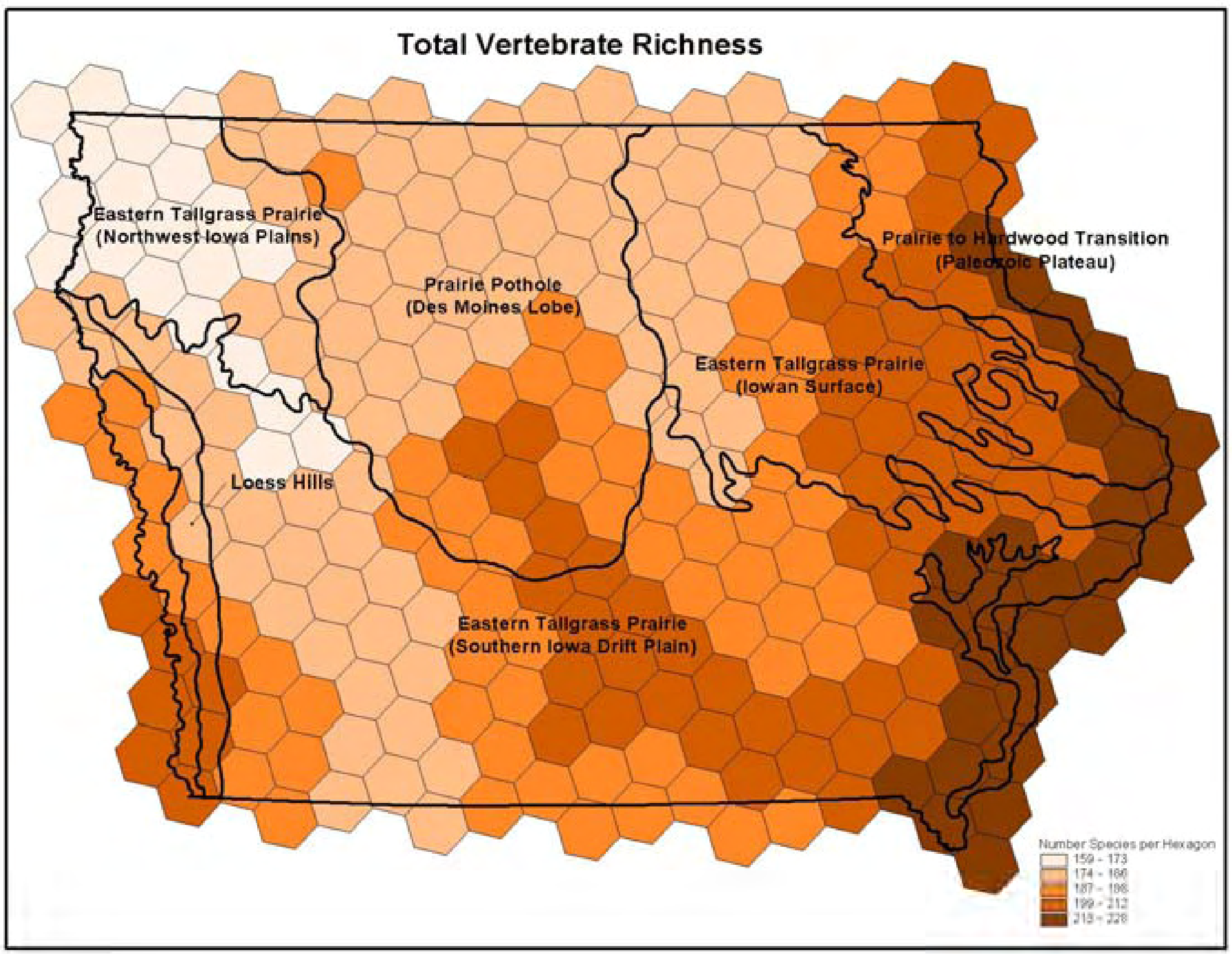
Source: Kathryne Clark using satellite land cover from 2002 and wildlife data from DNR Wildlife Bureau.

Nearly all SGCN are non-game wildlife negatively impacted by lack or degradation of suitable habitat. The table in Figure 1.63 shows that nearly one third of all the wildlife in Iowa is in need of some conservation action.

The statewide wildlife diversity map is based on individual habitat models for 288 species also included in the Wildlife Action Plan. Individual species richness maps are provided for birds (170 modeled species), mammals (53 species), reptiles (44 species) and amphibians (21 species) (see Figures 1.58 through 1.62). Although these maps do not show distribution predictions for all Iowa wildlife species included in the Wildlife Action Plan, they can be used as indicators of regions of species richness for SGCN. Some SGCN may have specific habitat requirements or limited distributions that are not found within species rich portions of the state. The special needs of these animals must be considered when specific management plans are prepared.

The species richness maps show the general distribution of existing wildlife habitats. The eastern and southeastern regions of the state and the southern Loess Hills have the greatest total species diversity (Figure 1.57) and the greatest diversity of birds (Figure 1.57), reptiles (Figure 1.59) and amphibians (Figure 1.60). This may be because the substantial portions of the state's remaining woodland habitat contained in these regions serve as major migration corridors for birds. Diversity tends to decline moving northwest into the agriculturally-dominated part of the state.

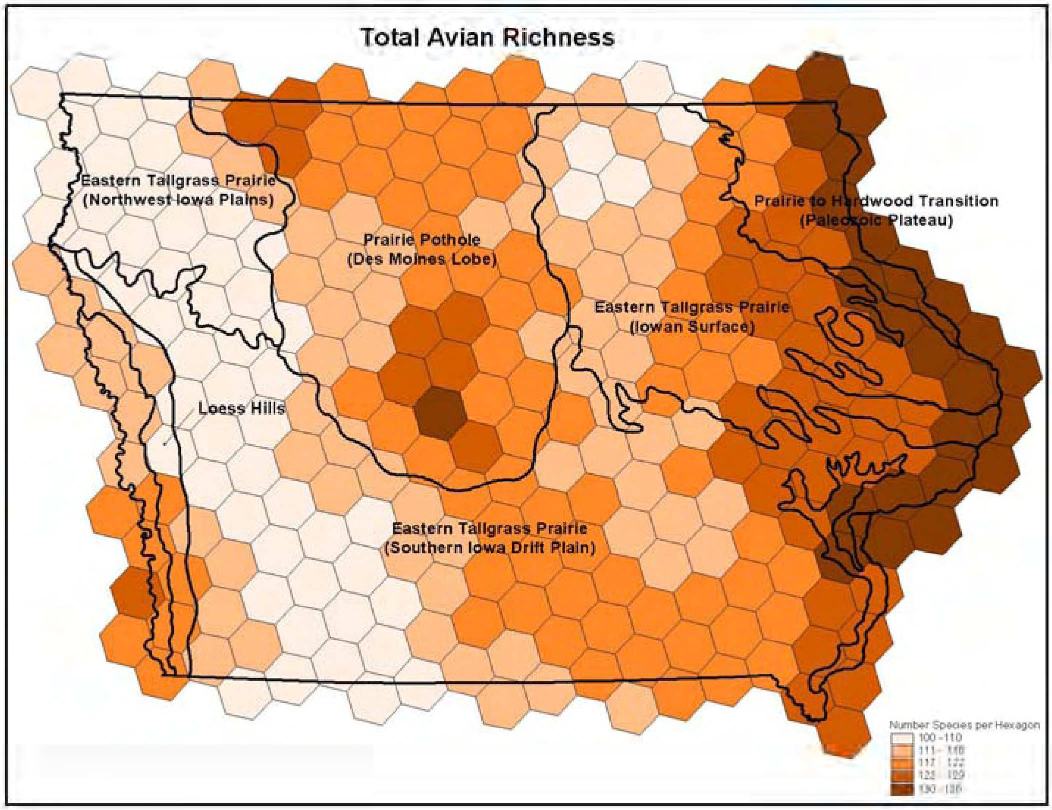
Figure 1.57 All Terrestrial Vertebrate Species Richness.



Source: Iowa GAP.

Figure 1.58 shows that avian richness is greatest along the Mississippi river, and steadily declines the further west one moves; those areas of richness that are contained within the central and western parts of state are generally found along larger river corridors.

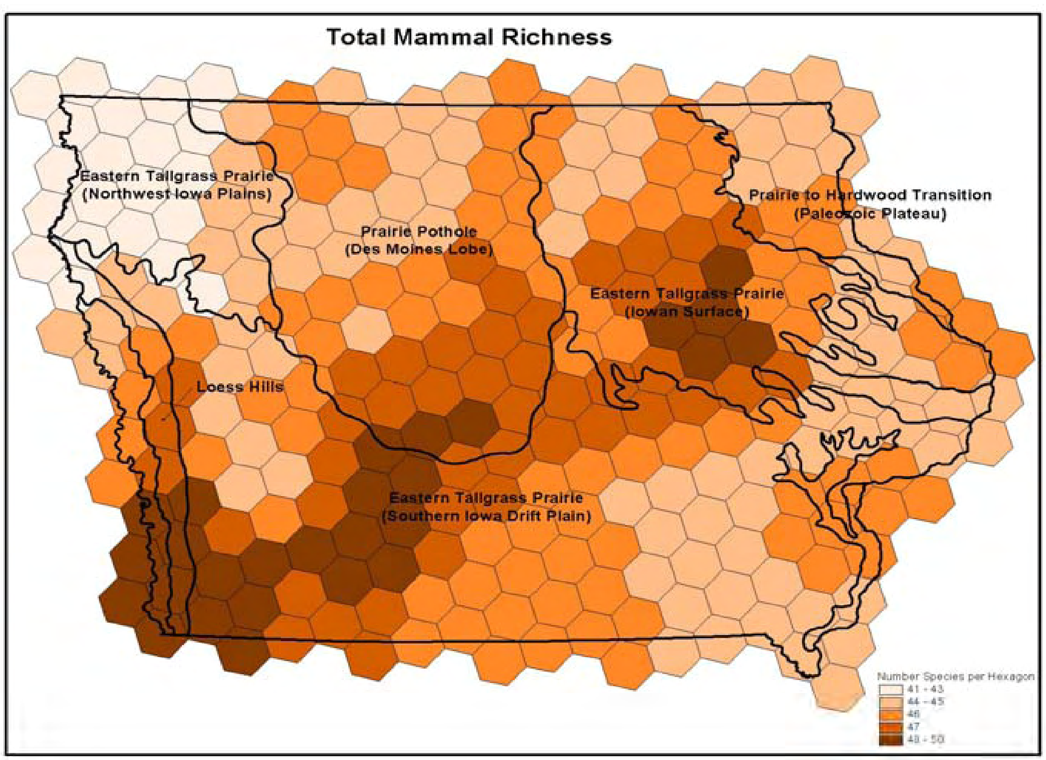
Figure 1.58 Avian Species Richness.



Source: Iowa GAP.

Figure 1.59 shows that mammal habitat is richest from the southwest to the northeast part of the state, and poorest in the northwest part.

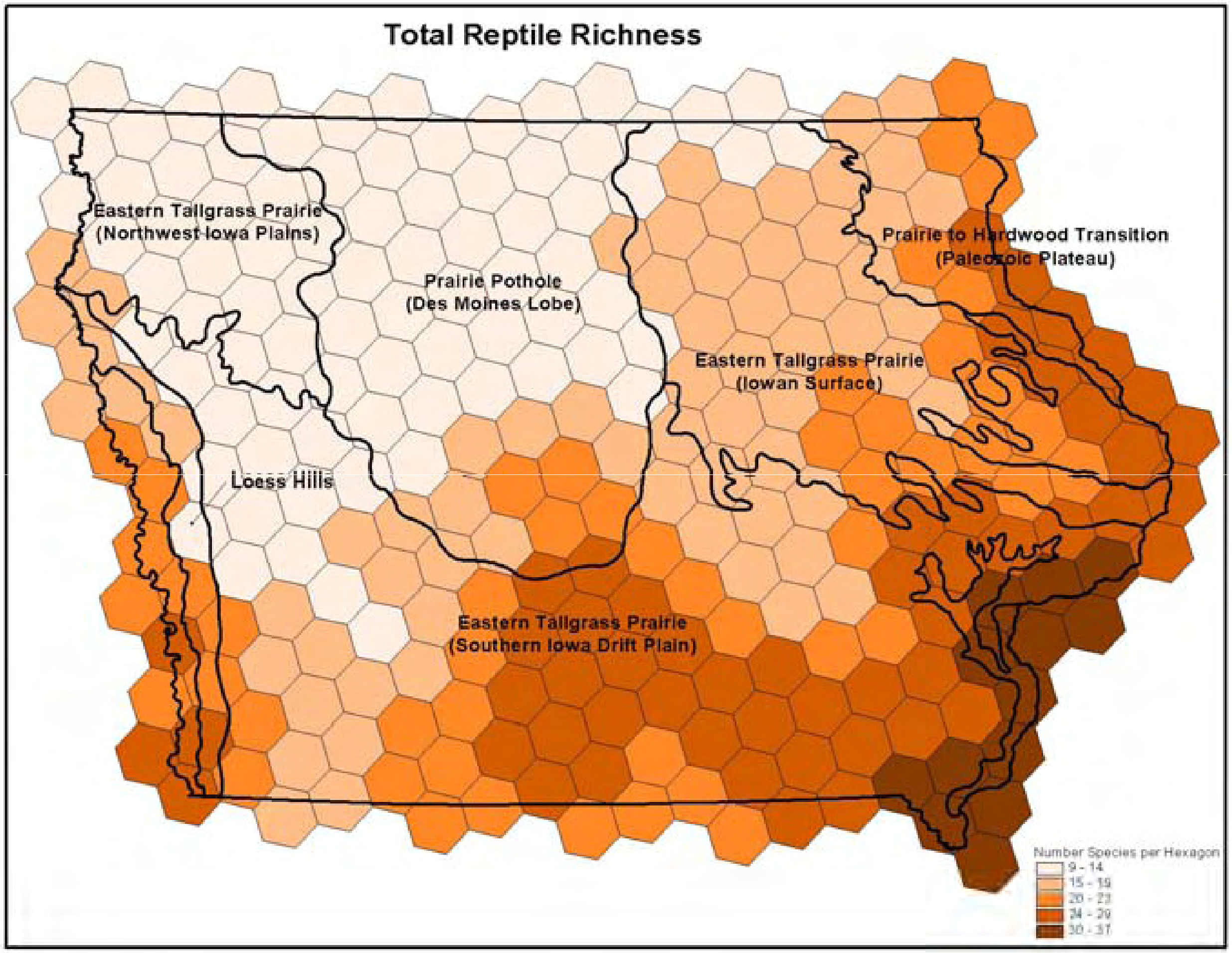
Figure 1.59 Mammal Species Richness.



Source: Iowa GAP.

Figure 1.60 shows that desirable reptile habitat is greatest in southeast Iowa and declines steadily moving northwest.

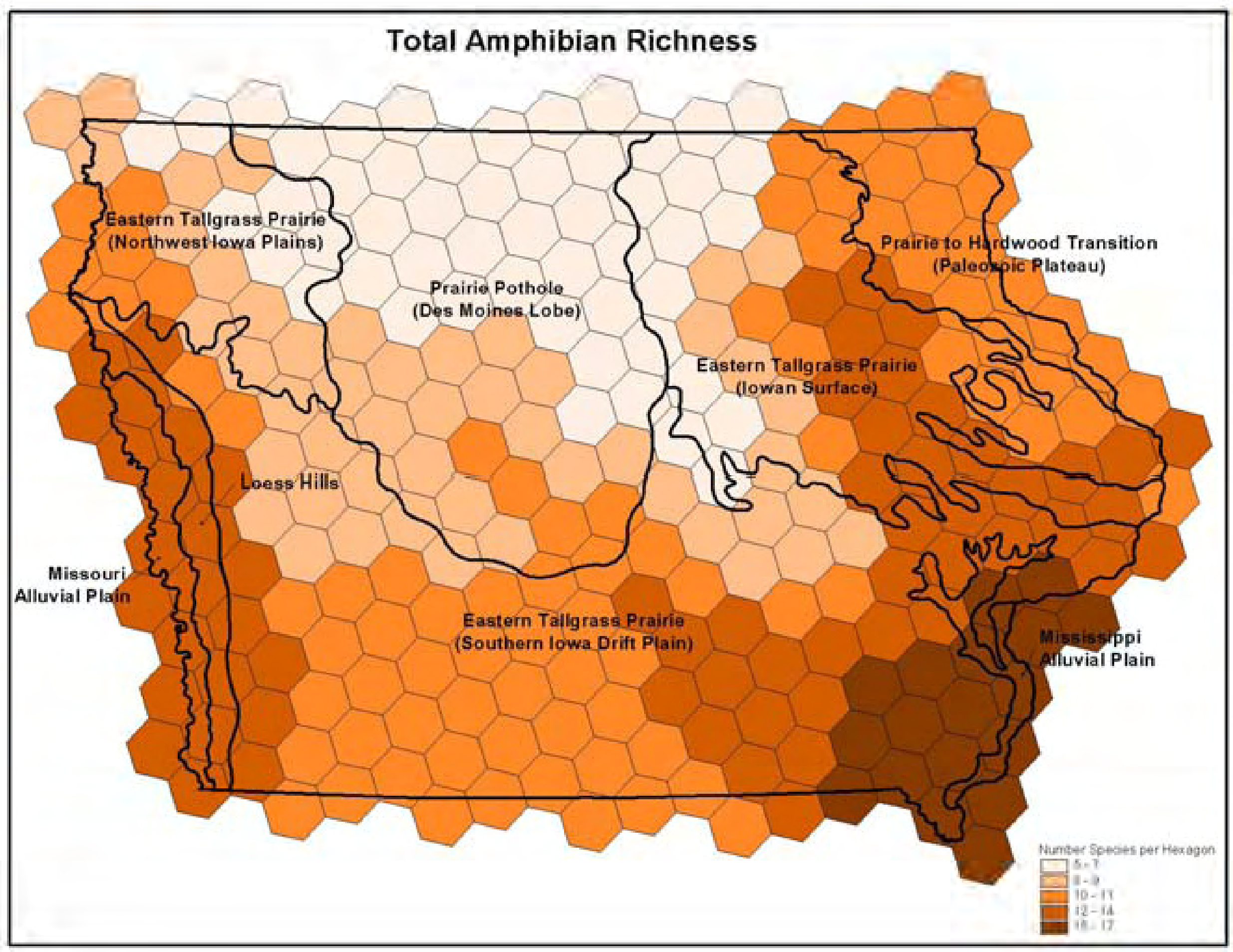
Figure 1.60 Reptile Species Richness.



Source: Iowa GAP.

According to Figure 1.61, the best amphibian habitat is in the southeast corner of the state as well; habitat is fairly rich along the eastern, southern, and western borders of the state and comparably poor in the northern prairie pothole region.

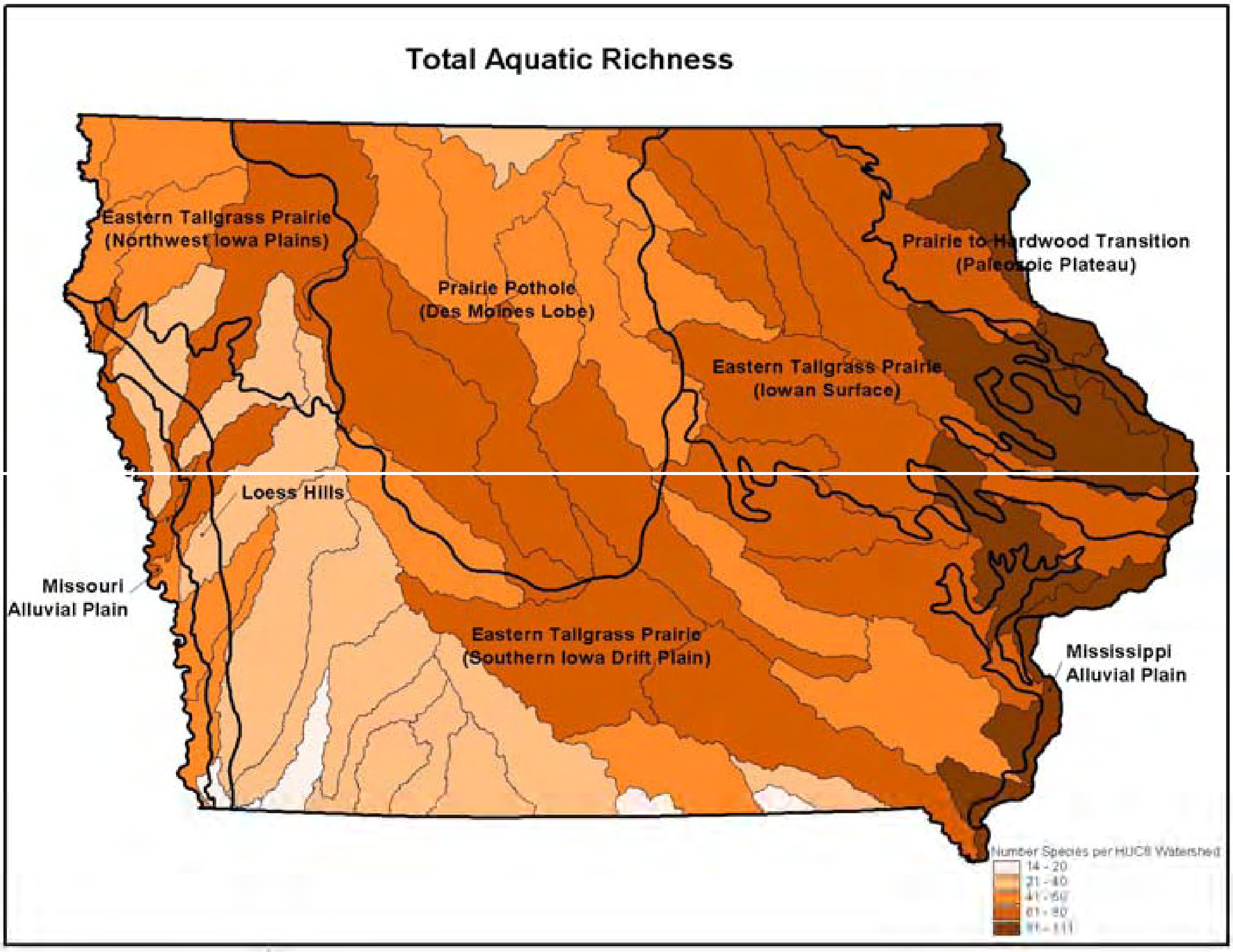
Figure 1.61 Amphibian Species Richness.



Source: Iowa GAP.

Figure 1.62 shows that the most desirable aquatic habitat exists in the eastern part of the state. The state has a relative abundance of aquatic habitat throughout, with the exception of western and southwestern Iowa.

Figure 1.62   Aquatic Species Richness.



Source: Iowa GAP.

While these maps show general areas of species richness, there is still much to be learned about the actual distributions and abundance of SGCN within these regions; the needs of these species cannot be fully addressed until comprehensive inventory and monitoring begin to take place.

Forest-associated Species of Concern by Taxonomic Group

Nearly all SGCN are non-game wildlife negatively impacted by lack or degradation of suitable habitat. The table in Figure 1.63 shows that nearly one third of all the wildlife in Iowa is in need of some conservation action.

As Figure 1.63 demonstrates, forests provide habitat for a number of SGCN species, including 74 bird, 19 mammal, 19 reptile and amphibian, 12 butterfly, and 8 land snail species.

Figure 1.63   SGCN according to the IWAP.

Taxonomic Class	Species Considered	Number with Greatest Need	Percentage of Group Total
Breeding Birds	206	67	33
Migrant Birds	199	18	9
Mammals	88	18	22
Fish	153	68	44
Reptiles & Amphibians	71	31	44
Freshwater Mussels	55	29	53
Land Snails	8	8	100
Butterflys	113	30	25
Dragonflies & Damelfies	106	28	26
Total Species Considered	999	297	30

Source: Iowa Wildlife Action Plan.

Common wildlife trees in Iowa include oaks, hickories, persimmon, mulberry, hackberry, dogwood, serviceberry, honey locust, and black cherry. Oaks, the most important of these, produce acorns, which are an important winter food supply for wildlife in forested areas, including foxes and channel catfish. There are two groups of oaks in Iowa, the white oak group and the red oak group. Acorns in the white oak group ripen in one growing season, while those in the red group ripen in two years. The availability of acorns from two sources, rather than just one, means that complete acorn failures are rare, though they do occur from time to time.

Forest Bird Richness

Within the last two decades, alarming declines in many species of North American birds have led to the emergence of national and international initiatives dedicated to the conservation of game and non-game birds; various programs are gathering under the umbrella of North American Bird Conservation Initiative (NABCI) to conserve all birds in all habitats. As part of this initiative, and in an effort to protect dwindling populations of Iowa birds, Iowa's Bird Conservation Area (BCA) program was established by the DNR Wildlife Bureau in 2001; Figure 1.64 shows Iowa habitat areas that meet BCA requirements.

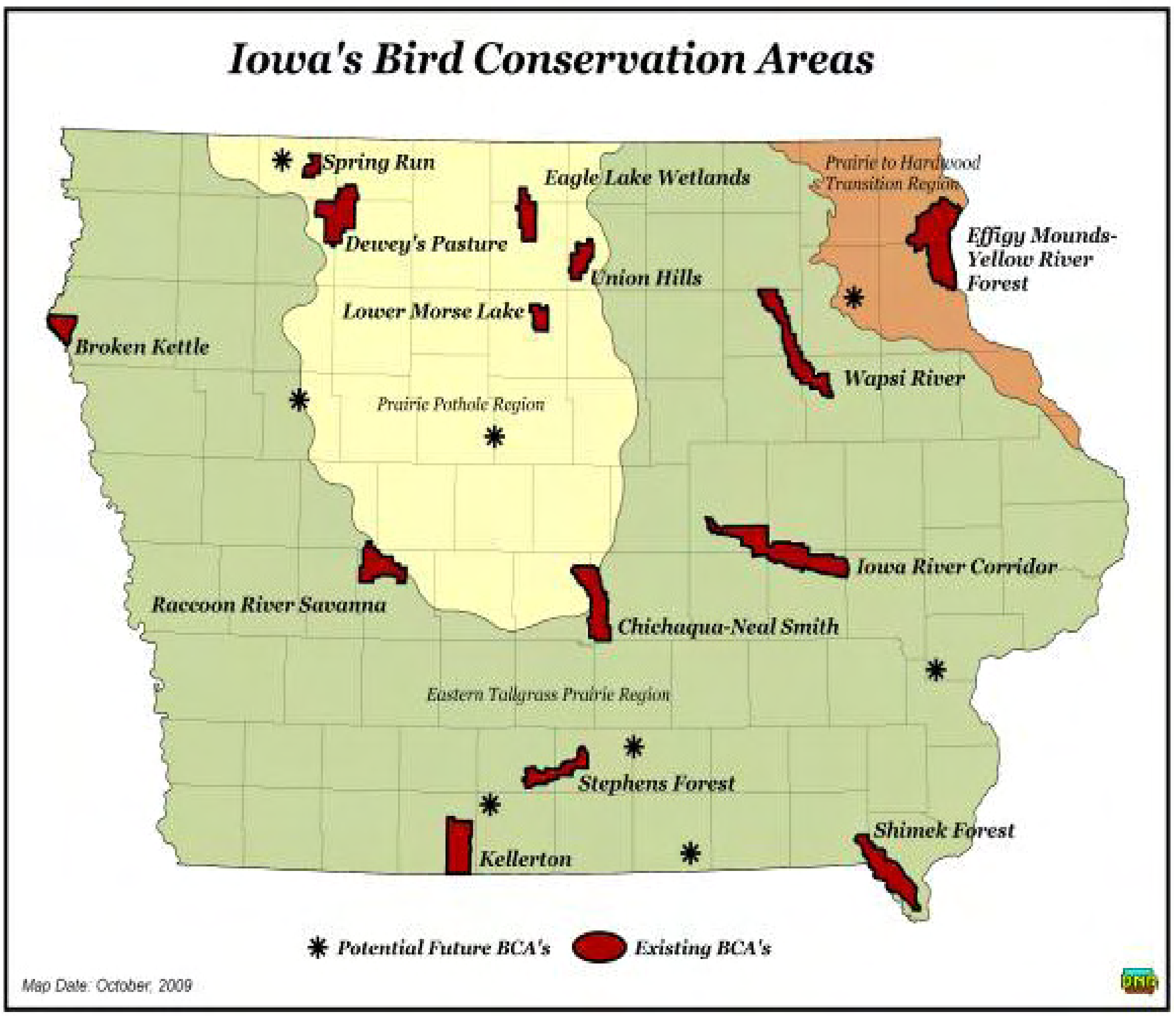
What is a BCA?

The Bird Conservation Area concept was first proposed by the Midwest working group of Partners In Flight (PIF) as a way to maintain populations of breeding grassland birds; this guideline has since been expanded to include birds breeding in a variety of habitats, including grassland, wetland, woodland, and savanna. This approach is backed by research suggesting that in order to maintain viable bird populations, conservation efforts must be undertaken at a landscape level. Through cooperation with private landowners, private conservation organizations, and other government agencies, the Iowa DNR is making progress in its efforts to develop BCAs.

There are several criteria for the ideal BCA: first, it should encompass at least 10,000 acres of public and/or private lands, approximately 25% of which is grassland or some other type of key bird habitat. Another important factor is the existence of a “core” area of protected high-quality habitat that is at least 2,000 acres in size. This core should then be surrounded by a mix of private and public lands that are either ideal for bird habitat or, at the very least, neutral in their effects on birds. Finally, these outlying parcels should contain at least 100 acres of contiguous targeted habitat in order to provide a “matrix” of quality habitat; reducing the fragmentation of forest cover in these areas is one way to meet this last objective.

Bird watching, or birding, is one of North America’s fastest growing pastimes, with an estimated 50 to 70 million participants in the United States. Partly in response to the growing popularity of birding, expenditures for wildlife monitoring have grown in the U.S. by 46% since 1991. Special highway and recreational area maps guide birders along “birding trails,” and bird festivals and guided birding field trips are growing in popularity. The economic affects of birding in the state are significant - for example, a recent survey by the U.S. Fish & Wildlife Service found that the million or so people who engaged in wildlife viewing in Iowa in 2006 contributed on additional $304 million to the state’s economy. One of the many benefits of BCAs is that they may draw even more bird enthusiasts to the state, which would lead to an even greater increase in wildlife-related revenue.[31]

Figure 1.64 Iowa’s Bird Conservation Areas.



Source: Kathryne Clark using landform regions of Iowa and wildlife data from DNR Wildlife Bureau.

[25]<dnrdeve.iowa.gov/wildlife/files/BCA_index.html>. March 9 2009.

1.5 Highlights of Conservation of Biological Diversity

Many of the problems facing Iowa's forests are a result of conversion of forest land for other uses such as community development and agriculture.

If managed at full stocking levels, Iowa forests could be growing a 47% greater volume of wood.

Iowa has lost 3.6 million acres (56%) of its forest during the last 160 years.

As the state's population ages, its forest land is likely to broken into even smaller parcels as it is sold or handed down to younger generations (approximately 12% of privately-owned forest land is expected to change ownership in the next 5 years).

At present, only 9% of Iowa's land is publicly-owned; as more people gravitate to urban areas, increased pressure will be placed on the limited amount of land available for public use.

Over 90% of the forest land in Iowa was privately owned; however, the ratio of district foresters to forest landowners decreased dramatically from 1:5,500 in 1990 to 1:9,200 in 2008, making it more difficult to service landowners.

Over the last 160 years, the Southern Iowa Rolling Loess Prairie eco-region has lost more than 1.1 million acres of forest, the greatest number of acres of any eco-region in Iowa, while the Paleozoic Plateau has lost 47%, the highest percentage.

If managed at full stocking levels, Iowa forests could be growing a 47% greater volume of wood.

Tree inventories and detailed management plans are critical for helping communities better manage their tree resources.

Few communities in Iowa have a dedicated forester or arborist to manage their tree resources.

Available nursery stock must be improved so that residential tree plantings, carried out for the purpose of long-term community tree resource improvement, are best able to adapt to site conditions and withstand threats from insects and diseases.

More than 60% of Iowa communities have less than 5% urban tree cover.

Row cropping is the most common use of land in watersheds that provide communities with surface water for their drinking water supplies.

Iowa lost 11% of its oak hickory forest between 1990 and 2008 due to lack of disturbance and lack of active management on private and public forest land.

While roughly 2 million acres of forest in Iowa are classified as edge forest, only 770,000 acres are classified as interior forest.

The average number of forest acres owned by private landowners has decreased dramatically since the middle of the 20th century, from 45 in 1954, to 31 in 1990, to only 17 in 2003.

Forests provide habitat for 74 bird, 19 mammal, 19 reptile and amphibian, 12 butterfly, and 8 land snail species that are Species of Greatest Conservation Need.

Policies that promote conservation on marginal soils or land along water corridors lead to increased tree plantings; conversely, policies that promote expansion of crop production to meet growing food and energy demands lead to decreased tree planting.

Forests provide habitat for 74 bird, 19 mammal, 19 reptile and amphibian, 12 butterfly, and 8 land snail species that are Species of Greatest Conservation Need (SGCN).

Forest landowners are becoming increasingly less dependent on their forest resources for meeting their day-to-day survival needs.

The State Forest Nursery is one of the last nurseries in Iowa to provide genetically diverse native plant material that can best withstand future forest health problems.

More genetic conservation of biological diversity could be achieved with better funding.

Forestry practices account for only slightly more than 1% of the conservation programs funded by the NRCS in Iowa.

2.0 Maintenance of Productive Capacity of Forest Ecosystems

Productive forests supply a number of important goods and services to society: they help prevent soil erosion, produce oxygen, filter pollutants, protect and enhance water quality, and offer opportunities for recreation and spiritual renewal; they supply lumber and wood for homes, furniture, papermaking, and fuel; and they supply non-wood products like cones, boughs, herbs, medicines and foods such as mushrooms, nuts and berries. Forest productivity varies according to the amount of forest land available and its fertility, health, environmental pollutants, location along the urban to rural continuum, past and current uses and management. Managing forests sustainability means balancing resource production with the ecosystem's capacity to renew and sustain itself. Measuring and tracking the amount of forest land available for producing goods and services, the productivity of that forest land, and the amount, quality, and type of trees and other plants growing there is critical to determining whether people are balancing production, long-term ecological health and the capacity of forest products markets to utilize timber and other forest products.

2.1 Area of Timberland

Sustainable forest management promotes production of wood and non-timber forest products in a way that maintains the ecosystem's capacity for renewal. A forest's ability to provide these benefits is dependent upon the soil type, water access and general health of sites that are suitable for production. Forest use decisions affect the acreage available for production, and management choices affect short and long-term yield potential.

According to 2007 USDA-FS-FIA data, Iowa has 3,054,000 acres of forest land, which the Forest Service defines as land comprised of at least 10 percent forest trees of any size; land that formerly had such tree cover and that will be naturally or artificially regenerated falls within this classification as well. Forest land includes transition zones, such as areas between heavily forested and non-forested lands comprised of at least ten percent forest tree stock and areas adjacent to urban and built-up lands; afforested areas, where no trees were growing before trees were planted, also count as forest land. The minimum area for classification of forest land is 1 acre; roadside, streamside, and shelterbelt strips of trees must have a crown width of at least 120 feet, whereas unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide. 98% of Iowa's forest land is timber land, defined by the Forest Service as land, not withdrawn from timber utilization by statute or administrative regulation, which produces or is capable of producing industrial wood crops. Areas qualifying as timberland are capable of producing in excess of 20 cubic feet of wood per acre per year in natural stands.[26]

In Iowa, 98% of forests are mixed hardwoods, which means that 2% are conifer trees, otherwise known as softwoods. The 2007 USDA-FS-FIA data reported that all of the softwoods on timber land were found in native stands of timber on private land.

[26] Miles.

During the 2007 USDA-FS-FIA inventory, hardwoods were inventoried on 2.9 million acres of naturally regenerated timberland. About 27,000 acres of hardwood timber land were planted, of which 14,000 acres were on public land and 13,000 were on private land. The inventory plots were located on 2.4 million acres of private land and on 406,000 acres of public land.

Riparian forest area. Photo by Mark Vitosh.

Riparian corridors, like the one pictured here, tend to have even aged stands of elm, ash, cottonwood, swamp white oak, silver maple, black walnut, bur oak, basswood and hickory. On the uplands, there is a mix of white oak, bur oak, hickory and ash on drier sites while red oak, walnut, green ash and hard maple tend to grow on cooler north and east-facing slopes.

Knowing how much actual land is unavailable for harvesting, or reserved, is difficult to determine because private landowners own over 90% of Iowa's forests, and landowner attitudes about cutting trees on their land can change from day to day. Data from the 2006 Forest Service Woodland Owner Survey reveals that landowners who had trees harvested or removed from their property were out-numbered 2:1 by those who had not allowed any harvesting or cutting. Of those landowners that did harvest trees, only 1 in 6 received professional forestry assistance. Iowa landowners who do not intend to harvest timber from their land in the next five years outnumber those that do by a ratio of five to one. Those landowners that do harvest typically do so in order to improve the quality of remaining trees, remove trees damaged by natural catastrophes or use the wood of mature trees for personal consumption.[27]

Landowners with relatively small amounts of forest are less likely to harvest than those with relatively large amounts because the little land that they do own is usually valued for its aesthetic rather than its productive capabilities; furthermore, those with older, larger trees are concerned about the time frame needed for the reestablishment of such trees once they are cut down. Approximately 111,000 forest landowners in Iowa collectively own roughly 482,000 acres or an average of less than five acres apiece.[28]

The USDA-FS defines the North Central Region as the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin. Figure 2.1 compares the percentage of forest in Iowa and the percentage of forest in the North Central region capable of producing a specific volume of wood for different volume ranges in 2007; for example, 23.1% of Iowa's forests produced 85-119 cubic feet of wood, compared to 21.5% in the North Central Region as a whole; the figure also shows that most of Iowa's forests were capable of producing at least 50-84 cubic feet.

[27]Butler.
[28]Butler.

Figure 2.1 Site Productivity of Iowa and the North Central Region, 2007.

Site Productivity (Cubic ft)	Percentage of forest in Iowa 2007	Percentage of forest in NC region
120 +	3.8	4.5
85-119	23.1	21.5
50-84	48.9	38.5
20-49	22.4	31.9
0-19	1.4	1.2
reserved	.4	2.3

Source: Forest Resources of the United States.

2.2 Comparison of Net Growth and Removals of Timber

Lumber production reached its peak in Iowa around 1890, when more than 600 million board feet of lumber was produced by the state's various sawmills; by comparison, only 65 million and 85 million board feet were produced in 1954 and 2005, respectively. This drop in harvesting has allowed most of Iowa's forests to grow into the larger saw timber size classes during the latter half of the 20th Century.[29]

Over 90% of Iowa's woodlands are now fragmented into privately-owned holdings averaging less than seventeen acres.

Sawmills in Iowa have declined from over 1,000 in 1954 to only 79 in 2009, the fewest since the 1800's. Those that have survived include only one veneer mill, numerous portable sawmills and those permanent sawmills that have weathered the ups and downs of the wood products market. Changes in technology, including the efficiency with which logs can be processed, and the increased mobility of wood products in the United States are two of the reasons for this decline; another reason is that over 87% of Iowa's woodlands are now fragmented into privately-owned holdings averaging less than seventeen acres.[30] Not only are landowners reluctant to harvest from such small pieces of land, but the increased cost and reduction in efficiency of logging from such small parcels is unattractive to logging companies as well.

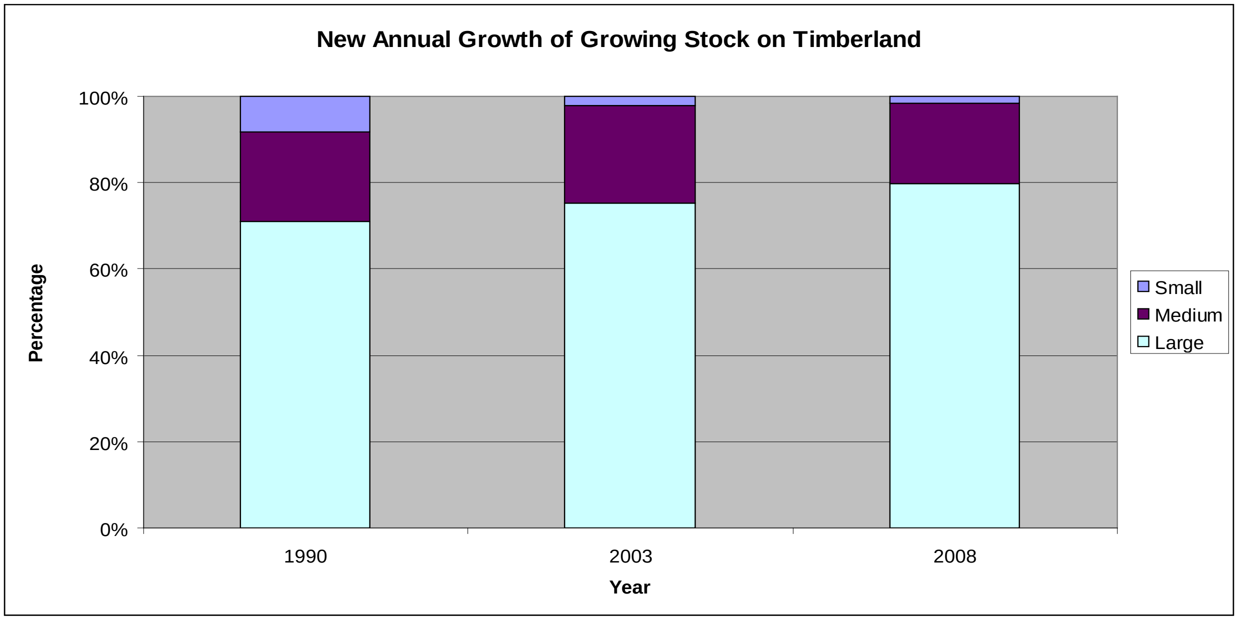
The timber harvested in 2008 provided $20 million to forest landowners. Comparing this number to the volume of board feet harvested in 2005, the average amount paid to an Iowa forest landowner, regardless of species, was $0.09 per board foot.

The economic value of a tree depends on the market conditions for its species, the volume and quality of the logs, the condition of the terrain over which the tree is moved and the hauling distance to the mill. Many factors influence the quality of the logs produced by an individual tree, including site quality, genetics, available growing space and species characteristics; fire, grazing, insects and diseases can reduce the yield of high grade lumber or veneer.

As Figure 2.2 indicates, trees in the large-diameter size class experienced the most growth between 1990 and 2008.

[29] Haugen, David E. and Dennis D. Michel. "Iowa Timber Industry-An Assessment of Timber Product Output and Use, 2005." St. Paul, MN: U.S. Department of Agriculture, Forest Service, Northern Research Station, 2008.
[30] Butler.

Figure 2.2 Net Annual Growth of Growing Stock on Timberland.



Source: Miles, P.D.

The net volume of timber in Iowa has continued to increase and Iowa forests have continued to mature because harvesting has failed to keep pace with growth. As more than 75% of landowners are either retired or nearing retirement age, and therefore much of Iowa's forest land will be changing hands in the near future, it is important to get information to these people so they have the tools to educate new landowners about proper forest management.

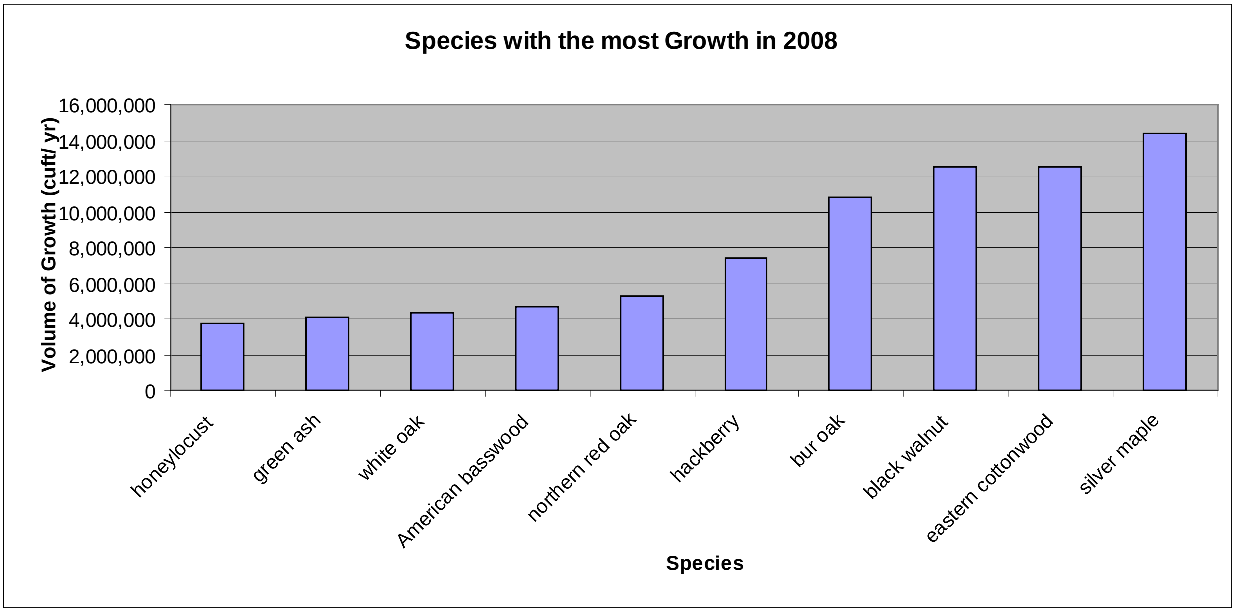
If harvesting and forest stand improvement are not carried out in a timely manner, succession will continue, causing shade-tolerant species like ironwood, bitternut hickory, basswood and sugar maple to prevail. This resulting change in species composition will impact the habitat that is available for wildlife, particularly those creatures that depend on mast-producing oak species; at the very least, this species composition change will reduce the habitat available to current wildlife.

Responsible and sustainable harvesting of mature timber gives forest landowners the opportunity to maintain desirable species composition within their forests; by leading to better timber stock in the long-run, moreover, it can potentially provide more income for better future management. District foresters can help landowners get the most from their forest by providing technical assistance and knowledge regarding existing forest stands, new tree plantings, cost-share opportunities and other important matters.

There are a number of variables and points of view to consider when discussing quality: from a wood product point of view, for instance, cutting smaller trees results in more knots in the lumber; also, despite the greater diversity within forests today than in previous times, the amount of available habitat and the number of mast producing trees is declining, which adversely affects wildlife.

Figure 2.3 shows the species that experienced the most growth based on volume change in 2008. Silver maple volume increased the most, at over 14 million cubic feet, followed by cottonwood, black walnut and bur oak. Even though the oak-hickory forest type is the most common forest type in Iowa, the species is experiencing less growth than species like silver maple and cottonwood because of its relative maturity.

Figure 2.3 Species with the Most Growth, 2008.

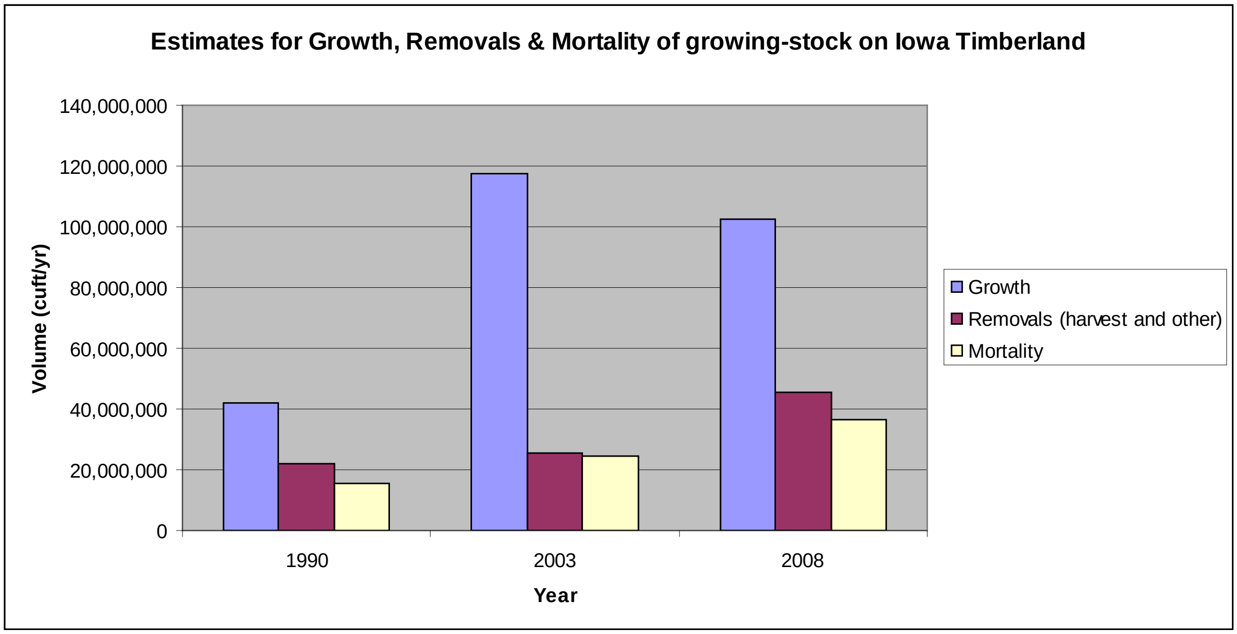


Source: Miles, P.D.

Figure 2.4 shows that growth within Iowa forests continues to out-pace removals from harvesting and mortality. Most of Iowa's forests are experiencing growth of approximately 30% less than their potential because of poor stocking levels. The ratio of growing wood volume to harvested volume was more than two to one in 2008; this trend may be difficult to maintain as Iowa's trees mature because growth rates will decrease while losses from harvesting and mortality will likely stay the same or increase. This trend is reflected in Figure 2.4, which shows that there was a 20% drop in forest growth between 2003 and 2008. In 2008, 45% of the volume of wood grown on timber land was harvested and another 35% was lost due to mortality, a combined loss of over 36 million cubic feet; mortality losses that year were the highest reported in the eighteen years leading up to that time.

More volume of timber is lost to mortality than what is harvested for wood products.

Figure 2.4 Estimates for Growth, Removals & Mortality of Growing Stock on Iowa Timberland.



Source: Miles, P.D.

Figure 2.5 compares the net annual growth, removal and mortality in forests located in Iowa and surrounding states. Iowa was one of four states out of seven in the surrounding area that had a positive growth rate according to 2002 Timber Product Output (TPO) data. Even after taking acreage discrepancies between the different states into account, Iowa's net growth from its timber land ranked fifth out of the seven (Illinois was ranked highest). Since over half of Iowa's forests are under-stocked, their growth will continue to lag behind surrounding states, even though Iowa has soils that provide a competitive advantage.

This data shows that Iowa has the ability to produce a significant amount of timber from its forests while also providing carbon storage, high quality water, habitat for wildlife, erosion resistance and natural beauty. Considering that most of Iowa's forests are on poor quality soils, steep slopes or areas too wet to farm, the potential to grow highly productive stands of timber remains very high. When faced with the choice between growing agricultural crops for an annual income or growing trees, which provide benefits such as clean air, clean water and habitat for hundred of species of native wildlife, landowners typically choose annual income; only those people that do not depend on agriculture for their livelihood can afford to take land out of agricultural production to grow trees. Until there is a mechanism to reimburse forest landowners for the benefits that the trees on their land provide to society, the short-term financial gains associated with agriculture are going to make increasing forest cover in the state extremely difficult.

Figure 2.5 Net Annual Growth, Removal and Mortality of Growing Stock (per 1000 cubic feet) for Midwestern States, 2002.

State	Net Growth (ave./acre)		Removals	Mortality	Difference (Growth- Removals-Mortality)
WI	489,009	30.6	347,187	187,797	-45,975
MN	370,145	22.2	316,130	215,962	-161,947
MO	239,428	17.1	167,895	65,718	5815
IL	172,023	39.7	69,338	72,316	30,369
IA	**41,151**	**20.0**	**25,251**	**15,878**	**22**
SD	40,059	24.7	20,910	8,157	10,992
NE	14,181	15.0	10,387	13,029	-9,235

Source: Forest Resources of the United States.

Figure 2.6 below shows the volume of timber available in forests in Iowa and the surrounding states.

Figure 2.6 Net Volume of Hardwood Growing Stock (per Million Cubic Feet) for Midwestern States.

State	2002	1997	1987	1977	1953
WI	14,061	14,059	12,300	10,117	6,412
MN	10,495	10,564	9,645	7,978	4,253
MO	8,109	8,135	7,334	5,631	5,450
IL	5,774	4,717	4,717	4,185	2,387
IA	**1,651**	**1,651**	**1,244**	**1,032**	**1,357**
NE	645	643	312	304	285
SD	171	161	70	128	79

Source: Forest Resources of the United States.

As trees in Iowa age, more are being lost to mortality than are being utilized in the wood products industry. In 2006, 7,444,000 cubic feet of logs were bought outside of Iowa for Iowa sawmills to process; the 35,205,000 cubic feet of wood lost to mortality in the same year in Iowa could have been used instead. Black walnut represented the largest volume of logs brought into Iowa, followed by red oak, white oak and soft maple. A complete listing of tree species imported to Iowa sawmills is provided in Figure 2.7.

Figure 2.7 Tree Species Imported to Iowa Sawmills from Surrounding States, 2006.

Species	Volume (1,000 cubic feet)	State(s) harvested from
Black Walnut	2,049	MO, WI, IL, KS, AR, NE, MN
Red Oak	1,493	MN, IL, WI, MO
White Oak	1,411	WI, IL, MO, MN
Soft Maple	1,079	IL, MO, WI, MN
Hard Maple	521	IL, WI, MN, MO
Black Cherry	237	WI,IL,MN,MO
Basswood	236	WI, IL, MO, MN
Hickory	141	WI, IL, MN, MO
Cottonwood	130	IL, MO, MN
Elm	75	WI, IL, MN, MO
Ash	58	IL, MO, WI, MN

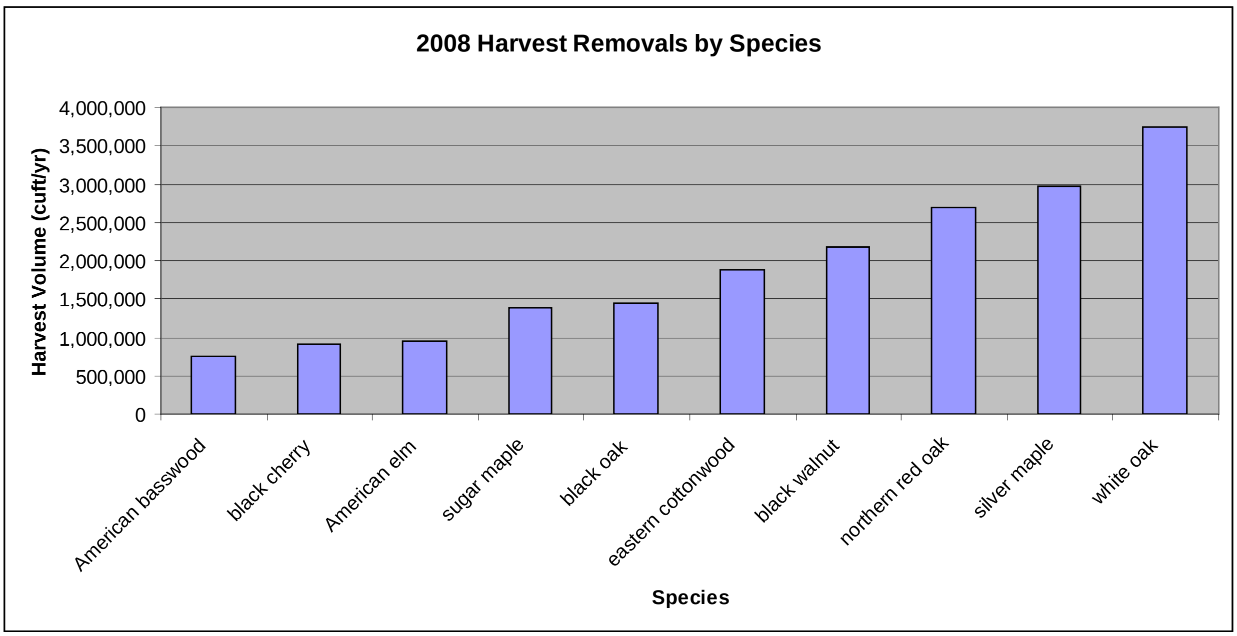
Source: Miles, P.D.

2.3 Trend of Timber Harvesting by Species

While the volume of timber from Iowa's forests has increased in the past twenty-five years, the quantity and quality of the state's woodlands are at considerable risk. The strong markets for traditional agricultural commodities in the 1960's and 70's created incentives for forest landowners that led to the clearing of one-third of Iowa's existing woodlands. If concern for Iowa's forest resources does not increase among the general populace, agricultural incentives and rapid suburban development will continue to cause woodland losses, which will in turn lead to degraded wildlife habitat and decreased water quality.

Figure 2.8 shows that in 2008, white oak harvesting exceeded black walnut harvesting by a factor of nearly two; what's more, the amount of silver maple and northern red oak harvested also surpassed that of black walnut.[31]

Figure 2.8 Harvest Removals from Iowa Forests by Species, 2008.



Source: Miles, P.D.

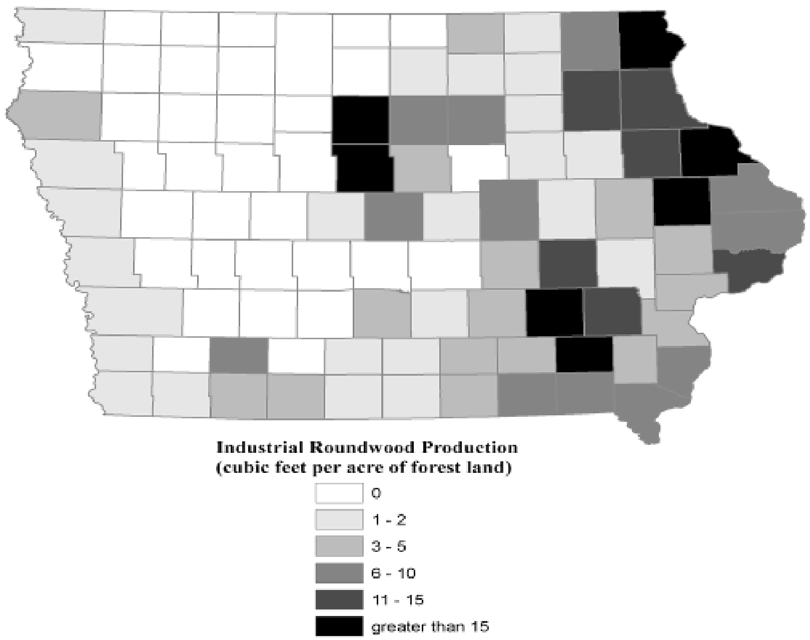
Between 2000 and 2005, veneer log production in Iowa increased by 40%, from 3.6 million board feet to 5.1 million board feet; in 2005, black walnut accounted for 2.5 million board feet, while white oak accounted for 1.7 million board feet.[32]
Improper management and harvesting techniques have led to a reduction in the quality of much of Iowa's forests; moreover, high-grading, or the selective cutting of the best trees, has forced log buyers and sawmills to revert to using increasingly smaller diameter and lower quality logs than they used in the past. As a result, the amount of timber land with little to no immediate economic, wildlife, or aesthetic value continues to increase.

Figure 2.9 gives a county-level breakdown of timber harvesting in Iowa for 2006. As the figure

[31]Miles.
[32]Haugen and Michel.

reflects, the eastern quarter of the state, which has the most forest and greatest number of sawmills, experienced the most overall harvesting activity.

Figure 2.9 Industrial Roundwood Production by County, 2006.



Source: Leatherberry, et al.

Volume of Timber in Iowa's Forests

In the 1950's oak, hickory, elm, ash and cottonwood made up nearly 90% of the forest land in Iowa. In 1954, Iowa's forests contained 1.4 billion cubic feet of volume growing stock; American elm made up the largest portion of this stock, at 206.6 million cubic feet, followed by white oak, northern red oak and cottonwood at 132.5 million, 126.8 million and 120.4 million cubic feet, respectively.[33] By comparison, the total volume of growing stock in 2007 was about 4.2 billion cubic feet, an increase of roughly 2.8 billion cubic feet or 200% over a sixty-year period. Silver maple made up the biggest share at 515 million cubic feet, followed by bur oak and cottonwood. Figure 2.10 shows a more complete breakdown by species for 2007.

Biological diversity is important for the long term sustainability of a healthy forest. The tree species composition within Iowa is diverse and stable. The greatest determinant of the future composition of a forest is its exposure to sunlight, or, in Iowa's case, lack thereof; species such as sugar maple and basswood, which are highly shade-tolerant, will thrive, while those that require sun exposure, such as oak, will not. This is a point that has been made numerous times throughout this assessment, and, as the above paragraph indicates, it is a fact that has already affected the composition of Iowa's forests.

[33]Thornton, P.L. and J.T. Morgan. The Forest Resources of Iowa. For. Surv. Release 22. Columbus, OH: U.S. Department of Agriculture - Forest Service, Central States Forest Experiment Station, 1959. p. 40.

Figure 2.10 Most Common Tree Species by Volume, 2007.

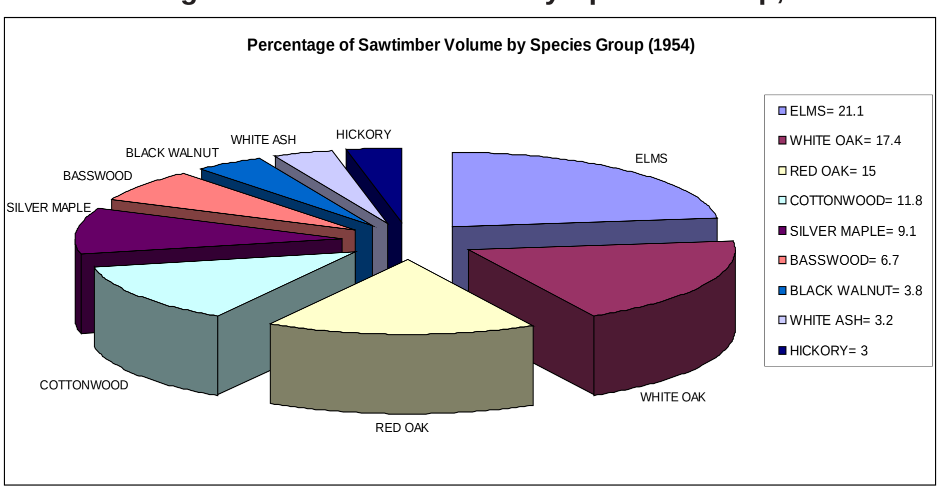
Species	Volume of live Trees on Forest Land (1,000,000 ft^3)	Sampling Error (%)	Change since 2006 (%)
Silver Maple	516.2	20.2	4.3
Bur Oak	434.6	11.7	-6.7
Cottonwood	372.2	31.5	2.0
White Oak	351.0	13.5	-0.9
Black Walnut	266.9	12.5	2.5
Northern Red Oak	257.1	15.3	-1.2
American Elm	245.2	8.0	3.8
American Basswood	193.0	15.6	0.3
Hackberry	186.5	13.1	0.9
Shagbark Hickory	159.2	12.0	-2.7
Other Softwood Species	44.8	16.3	-5.9
Other Hardwood Species	1217.2	4.8	2.5
All Species	4243.9	4.5	0.8

Source: Nelson and Brewer.

Sawtimber Volume

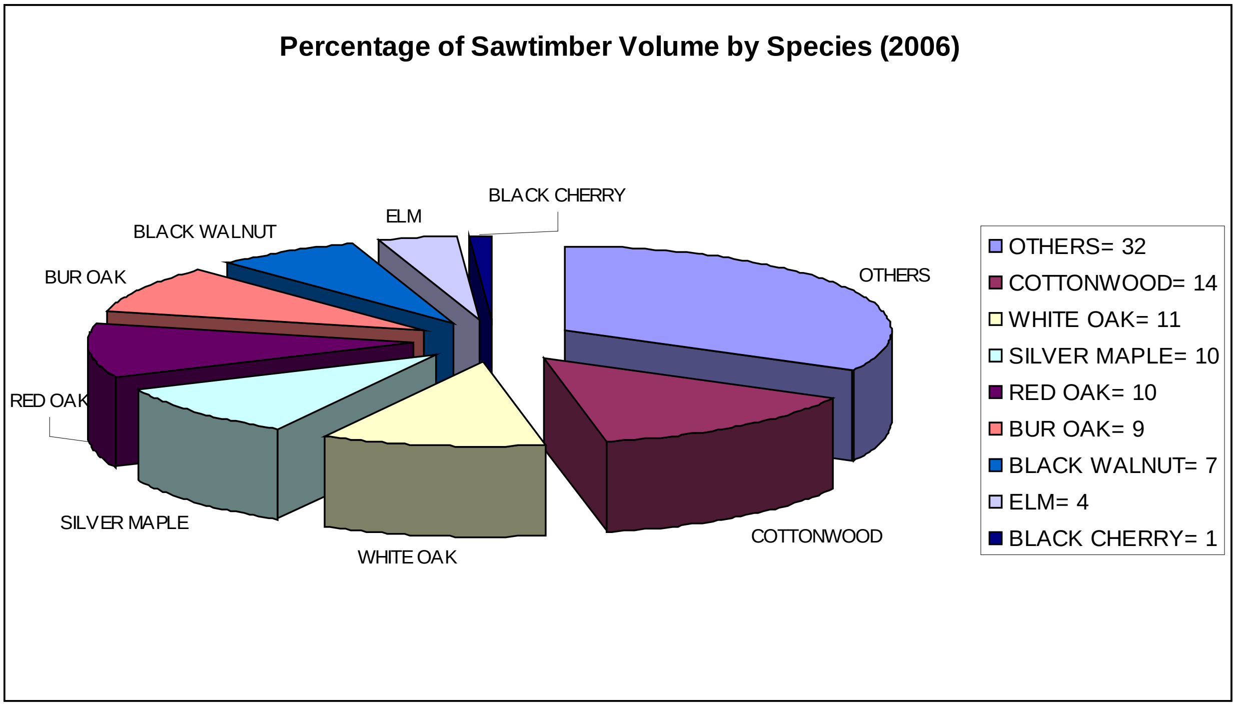
Figures 2.11 and 2.12 show the distribution of sawtimber volume by species as a percentage of total volume for 1954 and 2006, respectively. Figure 2.12 shows that by 2006, Dutch elm disease had reduced elm, which made up the largest portion of sawtimber in 1954 at 21%, to only 4% of total sawtimber. Black walnut, the most economically valuable tree species in the state, saw its representation nearly double from 1954 to 2006 as forest landowners came to recognize its financial value. Iowa's increasing forest diversity is reflected in the emergence of an "other" category in Figure 2.12, which represented nearly one-third of all sawtimber in 2006.

Figure 2.11 Percentage of Sawtimber Volume by Species Group, 1954.



Source: Thornton and Morgan.

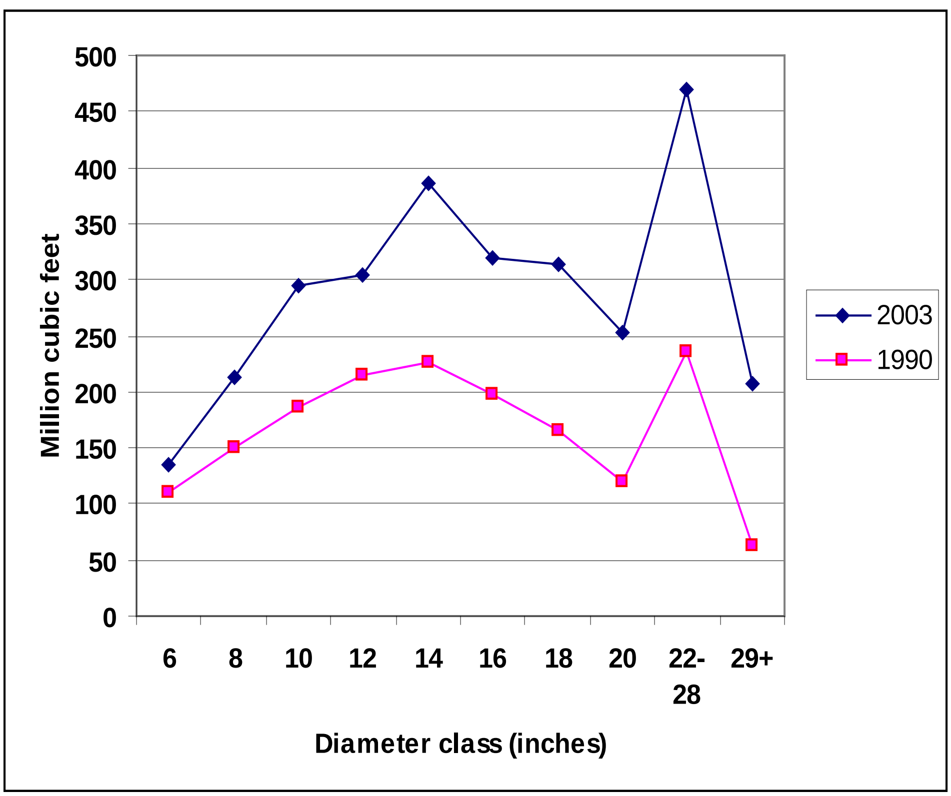
Figure 2.12 Percentage of Sawtimber Volume by Species Group, 2006.



Source: Miles, P.D.

The volume of wood in all diameter size classes increased in Iowa between 1990 and 2003, a fact displayed in Figure 2.13 below. Growing stock in the 22"+ categories made up the largest proportion of total stock, and doubled over the thirteen-year time period.

Figure 2.13 Distribution of Growing-Stock Volume by Diameter Class, 1990 and 2003.



Source: Leatherberry et al.

Management Implications

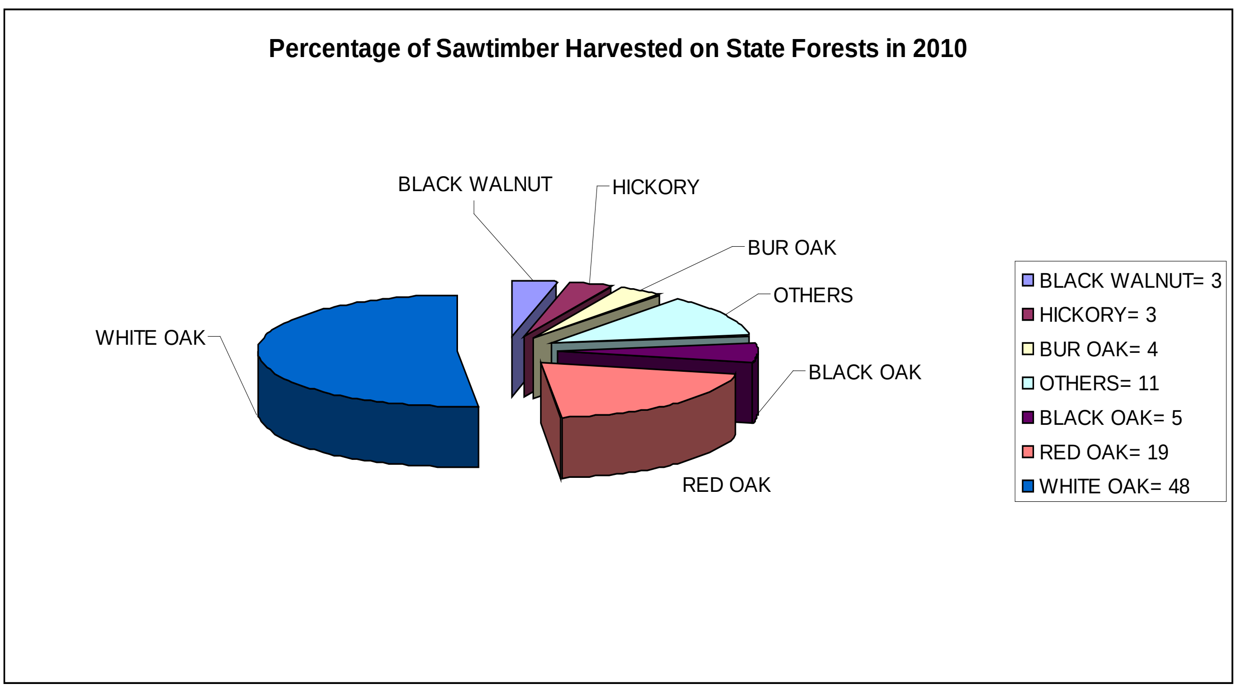
Markets are needed to utilize small diameter trees that are girdled during forest stand improvement activities; this could potentially allow forest landowners to not only pay for forest stand improvements through the removal and sale of low-quality timber, but to improve their long-term potential by putting more quality growth on the trees that remain after such treatments. This would help forest landowners become more engaged with their forests and counteract the low stocking levels present in the majority of their forests. Another area in which markets are lacking for landowners is that of harvesting residues; in 2005, loggers left 11.4 million cubic feet of timber residue behind, of which about 33% was oak and 24% was silver maple.[34]

Knowledge and skills are available to landowners through workshops, field-days and one-on-one appointments with DNR district foresters across the state; unfortunately, the dramatic increase in the number of landowners in recent years has made it difficult for these foresters, who continue to be spread more and more thinly. It is a challenge to keep forest landowners updated on programs for which they may be eligible and to ensure that thinning is performed at the correct times in a forest's lifecycle; as land continues to change ownership and parcels continue to decrease in size, however, these tasks will be even more difficult to carry out.

Management plans guide decision making for stands on state forests; these plans reflect management intentions over a twenty year period, and are based on current knowledge of land capability, inventory data, sound forestry practices, land stewardship and public demands. They are considered working documents, and are revised as needed to address the challenges of managing constantly changing forest resources.

A species-specific summary of timber harvested on state forest land is given in Figure 2.14.

Figure 2.14. Percentage of Sawtimber Harvested on State Forests in 2010.



Source: Jeff Goerndt.

[34]Haugen and Michel.

Often times, forest landowners sell their timber without thinking about how the remaining stand composition of their forest lands will influence future economic potential. High-grading typically results in changing species composition, particularly the growth of less desirable species and the decline of more desirable ones. As these stands become less productive, loggers lose interest in them and financial opportunities for landowners dry up, leading to no management in the future and even further decline. In order to ensure that this cycle does not persist, it is important that incentives for proper forest management are provided to landowners.

2.4 Highlights of Productive Capacity

The number of sawmills in Iowa has shrunk to its lowest since the 1800s.

Shade-intolerant species are becoming less common in Iowa's forests due to lack of disturbances.

About 111,000 forest landowners own less than 20 acres of forest apiece, and they are unlikely to commit such small parcels to timber harvesting.

Over 36 million cubic feet of wood in Iowa's forest land that could have been harvested for wood products died in 2008, due either to a lack of awareness of proper management techniques or an unwillingness to manage on the part of forest landowners.

Lack of disturbance is creating changes in the species composition of Iowa forests, which is in turn leading to changes in wildlife composition.

Until incentives are put into place that reward forest landowners for the numerous benefits that their forests provide, Iowa forest lands will continue to succumb to the financial appeal of agriculture.

Shade-intolerant species are becoming less common in Iowa's forests due to lack of disturbances.

The species most harvested in 2008 were shade-intolerant white oak, silver maple, northern red oak and black walnut.

Markets are needed for sawtimber and small diameter trees so that forest landowners have financial incentives to better manage their forests.

3.0 Maintenance of Forest Ecosystem Health and Vitality

Forest health describes the overall condition of forests and trees and how well they recover from stress. There are many factors that affect forest health: natural factors include insects and diseases, as well as severe weather or catastrophic events like ice storms, tornados, hurricanes, floods, and droughts; unnatural or human-induced factors include housing and other developments, which cause changes in soil hydrology and reduce the size of forest patches, leading to destruction of habitat for native species. The greatest problems are caused by a combination of stressors; much as human susceptibility to illness depends on constantly changing factors, stressors to trees come and go, making forest health difficult to assess at individual points in time; for example, damage from native insects varies from year to year and decade to decade, depending upon weather, natural population cycles and other factors.

Iowa's forest health issues can be separated into two categories, native and non-native. Native insects and pathogens that help to recycle trees by breaking them down to simpler organic compounds are usually beneficial. These insects and diseases usually help maintain a healthy forest and are usually only a problem for a tree when it has reached its biological maturity or natural causes have compromised its ability to grow, which causes it to release pheromones, or chemical signals, that attract insects. Healthy trees are able to repel attacks from native insects and diseases; often times insects act as disease carriers. Normal insect feeding activity may by tolerable to a tree, but if the insect releases a disease while feeding on the tree, even an exceptionally healthy tree can be compromised.

Some forest health issues affecting states bordering Iowa include the non-native gypsy moth, emerald ash borer, and Asian long-horned beetle, which, if established, will impact Iowa's forest composition. Non-native insects or pathogens do not have as many predators as native ones, and are usually devastating to the tree species they feed on because those trees' defense mechanisms are not able to repel them.

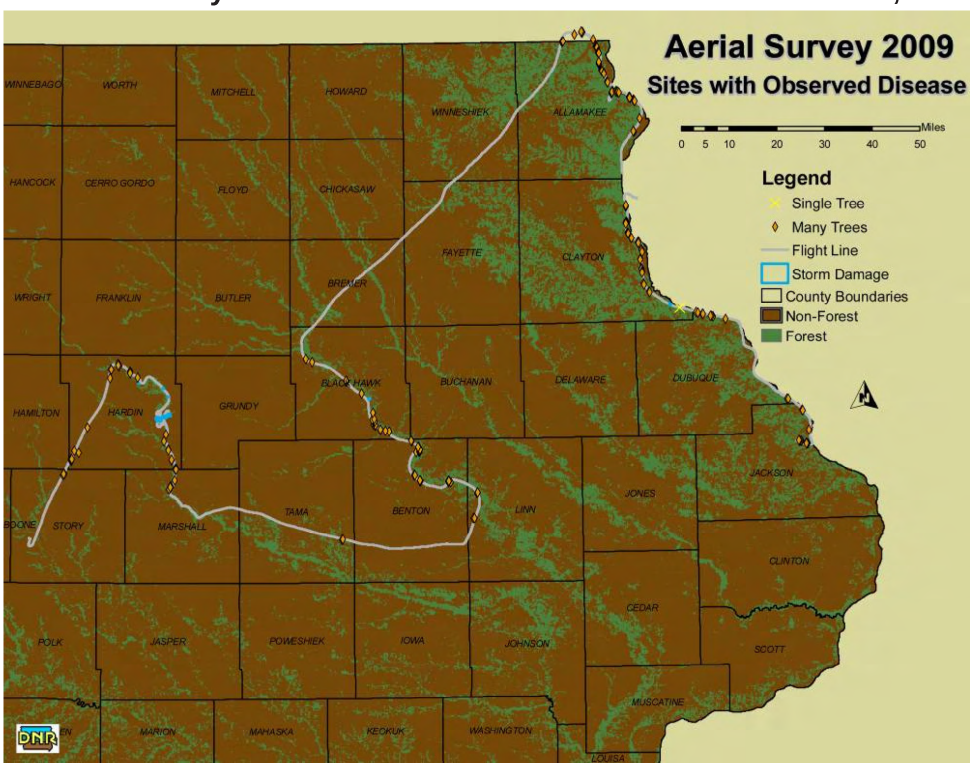
In addition to insects and diseases, weather has an indiscriminate impact on both forest resources and urban community trees in Iowa. In 2008, 87 of Iowa's 99 counties were declared national disaster areas by the President of the United States due to severe flooding and tornado damage; these events displaced 38,000 residents and required 166,000 tons of debris to be removed from affected communities. State managed lands were severely impacted as well, as wind and water caused an estimated $3.3 million in damage to campgrounds, trails, roads, docks, beaches, bridges, buildings, playgrounds, and residences in 32 Iowa parks. The economic impact of lost revenue during 2008 for DNR operations totaled more than $1.1 million.[35]

[35]Feeley, Tivon. 2009 Forest Health Report. <iowadnr.gov/forestry/files/fhr2009.pdf>.

3.1 Area of Forest Land Affected by Potentially Damaging Agents

Aerial flight surveys of Iowa forests are performed annually to look for large pockets of dead trees, which indicate possible insect or disease population outbreaks. Iowa forests surveyed by plane in 2009 were found to be in generally good condition. On September 2, the surveying crew started above Ames, IA and flew south along the Iowa River, north along the Cedar River, further north to Yellow River State Forest, and then south along the Mississippi River to Dubuque. A total of 559,946 acres were surveyed. Observance along this route showed tremendous damage (95% damage) from the hail and straight line winds in Hardin County; additionally, silver maple and cottonwood trees throughout the state showed chlorotic leaves from water saturated soils.

Figure 3.1 Aerial Survey of Sites with Observed Disease in Eastern Iowa, 2009.



Source: Kathryne Clark using landform regions of Iowa and DNR Forestry data.

Most counties along the route also showed signs of Dutch elm disease (DED). A large population of lace bugs caused oak leaves to look discolored in late August. Scattered trees with lace bug damage were noticed throughout the state, with most of the damaged trees occurring in Eastern Iowa. The aerial flights found the same levels of pine wilt and oak wilt noted in the 2008 aerial survey. In addition, the aerial flight found large pockets of aspen continuing to decline in the northeastern counties of Iowa.

Emerald Ash Borer

The Emerald Ash Borer (EAB) is native to the Orient, and was introduced in the United States near Detroit in the 1990's. Various quarantines have been placed by USDA-APHIS for the states of Illinois, Indiana and Ohio; the lower peninsula of Michigan is under this quarantine as well. The federal order prohibits the interstate movement of ash nursery stock, ash green lumber, and other materials such as logs, stumps, roots, branches, and composted and un-composted chips. Due to the difficulty of distinguishing between species of hardwood firewood, all hardwood firewood is included in this quarantine.

EAB has more potential for future harm to Iowa forests and urban communities than any other insect currently being dealt with in the United States. EAB kills all ash species by burrowing under the bark and eating the growth (cambium) layers of the trees. EAB has been found capable of killing every species and size of ash tree in neighborhoods or woodlands. Ash is one of the most abundant native tree species in North America, and has been a preferred and heavily planted landscape tree in yards and other urban areas.

Managing urban ash tree with an advancing emerald ash borer will require resources for inventory, outreach, monitoring, tree removal and tree replacement. With ash representing approximately 20% of every community's public trees, the costs associated with emerald ash borer will be significant for both homeowners and communities.

Iowa Emerald Ash Borer Locations in Surrounding States

The Iowa Department of Natural Resources (IDNR) Forestry Bureau, in cooperation with the Iowa Department of Agriculture (IDALS) State Entomologist Office, has been following the United States Department of Agriculture Forest Service (USFS) protocol to monitor Iowa for signs of EAB. The detection of EAB in Victory, WI in the spring of 2009 places this insect only a few miles away from Allamakee County in northeast Iowa, which is of particular concern because it is Iowa's most heavily forested county and is essential to the state's timber industry. The detection of EAB in Peru, Illinois in July of 2007 places EAB only 85 miles from the city of Davenport, Iowa; this detection is of concern because of its proximity to both Iowa and Interstate 80, which is a major link between the two states. Furthermore, the confirmation of EAB in Missouri in 2008 is of great concern. According to recent sources, Iowa has an estimated 60 million rural ash trees and 35 million urban ash trees.[36]

Iowa Emerald Ash Borer Surveillance Effort- Visual Surveys

An EAB surveillance effort has been in place since 2004. In 2004 and 2005, this activity consisted of visual surveys of urban ash trees in cities of more than 1,000 residents in all 99 counties, as well as visual inspections of ash saw logs from 43 sawmills and ash nursery stock. Visual surveys involved 2,078 trees on 252 sites in 2004 and 1,318 trees on 238 sites in 2005.

During the 2006, 2007, 2008 and 2009 seasons, surveillance strategies shifted to the highest risk areas in the state, campgrounds. Sites were selected based on proximity to interstate highways, tourism sites, and the state's eastern border. Up to 10 trees were examined in each campground for signs of EAB; the larger the campground and the greater the ash density, the more ash trees that were visually examined. In 2006, 417 ash trees were surveyed in 50 state and 10 county campgrounds; in 2007, surveillance increased to 1,102 trees in 400 campgrounds, including all federal, state, private and large campgrounds in 69 counties. In 2008, 235 campgrounds in 55 counties were identified as high risk sites and 1,269 ash trees were subsequently inspected; in 2009, 234 campgrounds in 55 counties were identified as high risk and 1,265 trees were inspected. No evidence of EAB was noted during visual surveillance in Iowa from 2004 to 2009. Figure 3.2 shows where visual surveys were performed in 2009.

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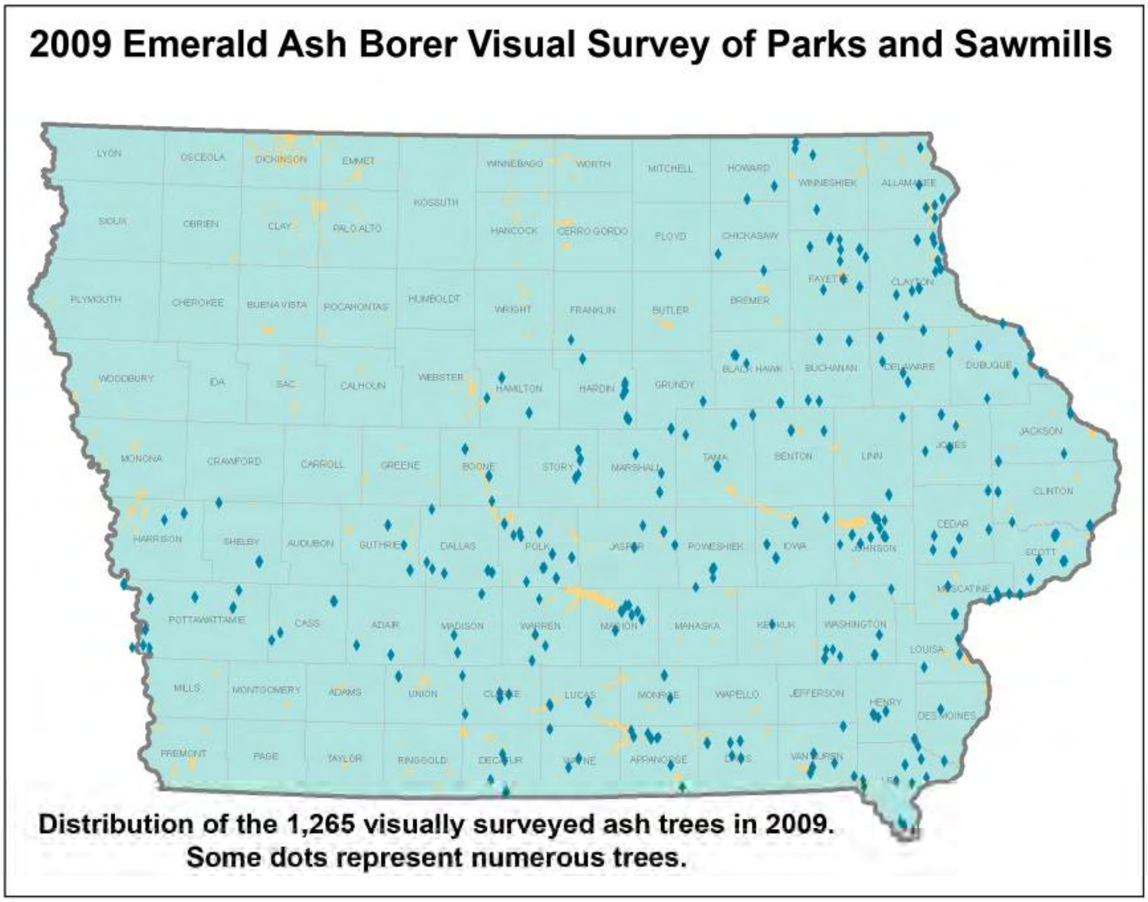
[36]Miles.

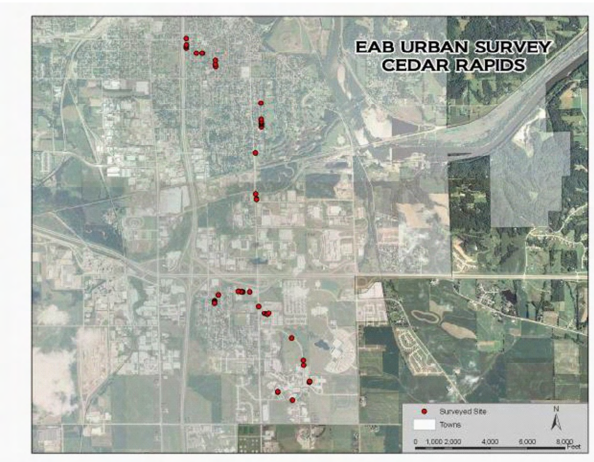
Figure 3.2. Emerald Ash Borer Visual Survey, 2009.

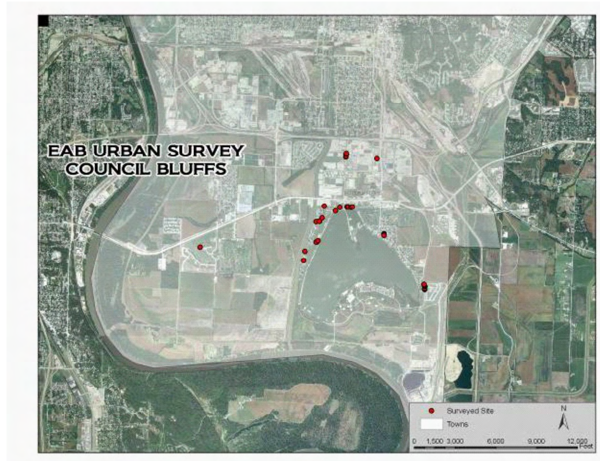


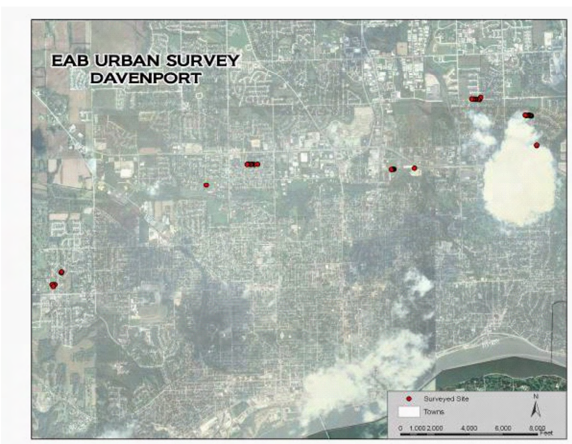
Source: Kathryne Clark.

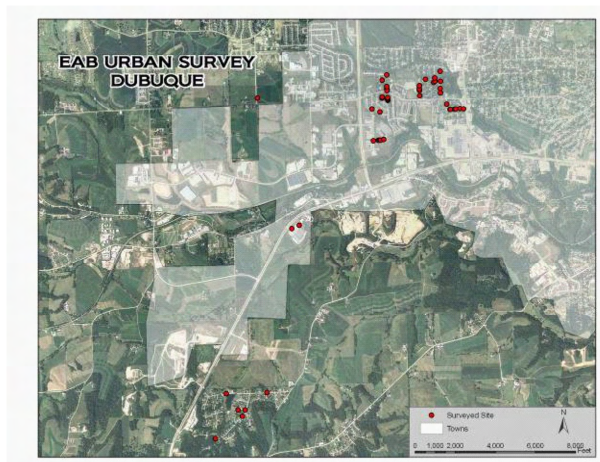
EAB Visual Survey of New Developments:

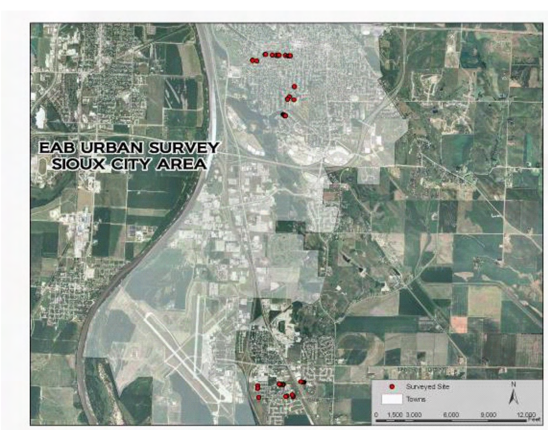
During 2009, additional surveillance efforts were made in six developments that had emerged in large Iowa communities since 2002. The rational for such an effort was that ash trees from nurseries located in areas east of the Mississippi that are infested with EAB may have been planted in these new developments. A total of 274 green ash trees in these new developments were surveyed for the presence of EAB symptoms; a total of five trees were flagged as suspect trees, but all of these came out negative for EAB after follow-up inspections or removals.

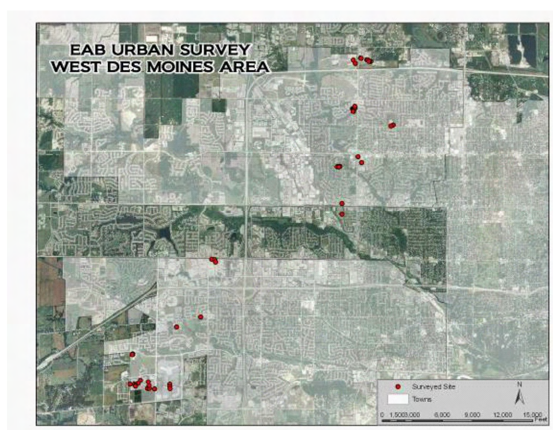












Source: Kathryne Clark.

Sentinel Trees

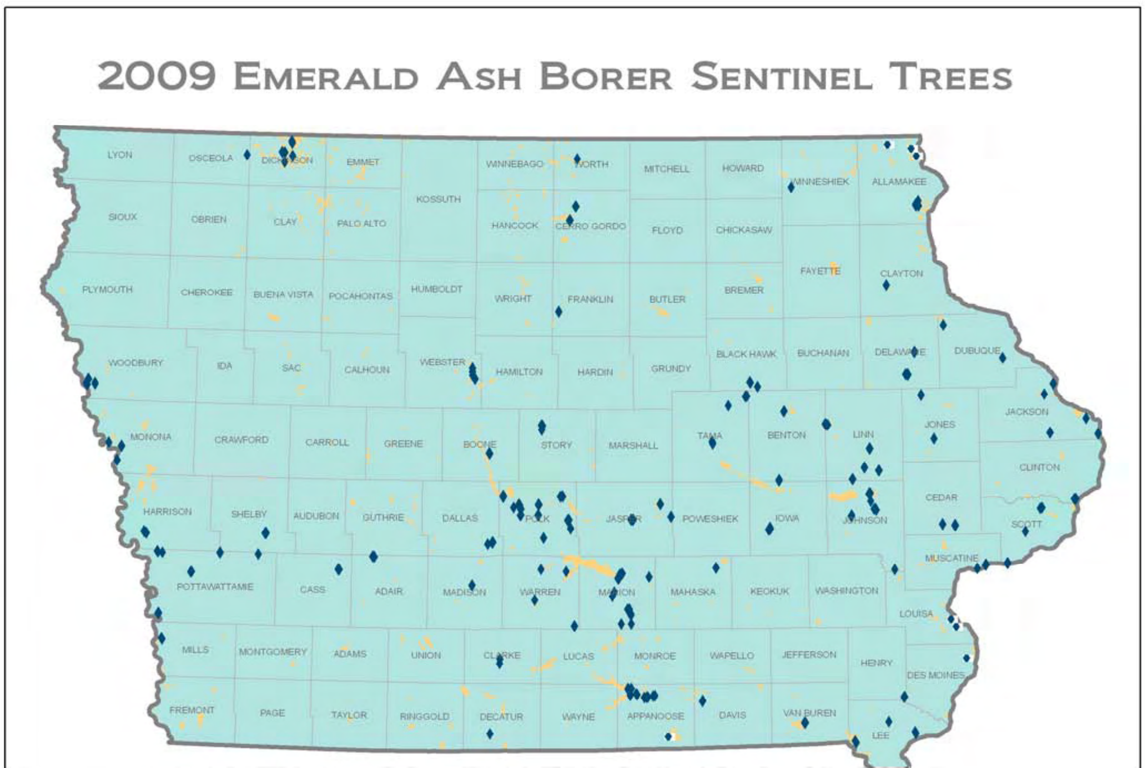
Sentinel trees are created in one of two ways: girdling standing ash trees that are 4-13 inches in DBH, or planting and girdling donated containerized ash trees that are approximately three inches in caliper. Sentinel trees are established by June 1 of each year. In general, containerized trees are used for private campgrounds or in areas with few ash trees, while standing ash trees are used on federal, state or county properties. A tree is girdled by using a folding hand saw to make two cuts through the bark approximately four to six inches apart, and then removing the bark between the cuts with a drawknife. Every effort is made to select standing ash that are either in the open or exposed on two or three sides; trees within forest stands are rejected as possible sentinel trees.

In 2005, 48 sentinel trees, including 23 standing and 25 containerized trees, were set up on 12 sites across the state; in 2006, 68 sentinel trees, including 27 standing and 41 containerized were established on 18 sites; of these sites, ten were retained for evaluation in 2007. In 2007, 237 sentinel trees, including 190 standing and 47 containerized trees, were established on 57 sites; in 2008, 401 sentinel trees, including 272 standing and 129 containerized, were established on 117 sites. During the fall of each year, sentinel trees were bark peeled on site, and new sentinel trees were girdled for monitoring the following season. A single EAB larvae was discovered in one sentinel tree in Clayton county in 2008, but no other signs have been detected in the area. Figure 3.3 shows general locations of sentinel trap trees throughout Iowa in 2009.

In 2010, EAB was found in Iowa.

During a site visit in May of 2010, four EAB larvae were found in an ash tree growing on an island in the Mississippi River about 2 miles south of the Minnesota border in Allamakee County. This was Iowa's first confirmation of EAB. A quarantine prohibiting the movement of firewood, ash nursery stock, ash timber, or any other article that could further spread EAB is pending from the Iowa Department of Agriculture and Land Stewardship. A federal quarantine will follow the state quarantine.

Figure 3.3. Emerald Ash Borer Sentinel Trees, 2009.



Distribution of the 423 sentinel ash trees that were girdled for the 2009 bark peeling season. Some dots represent numerous trees.

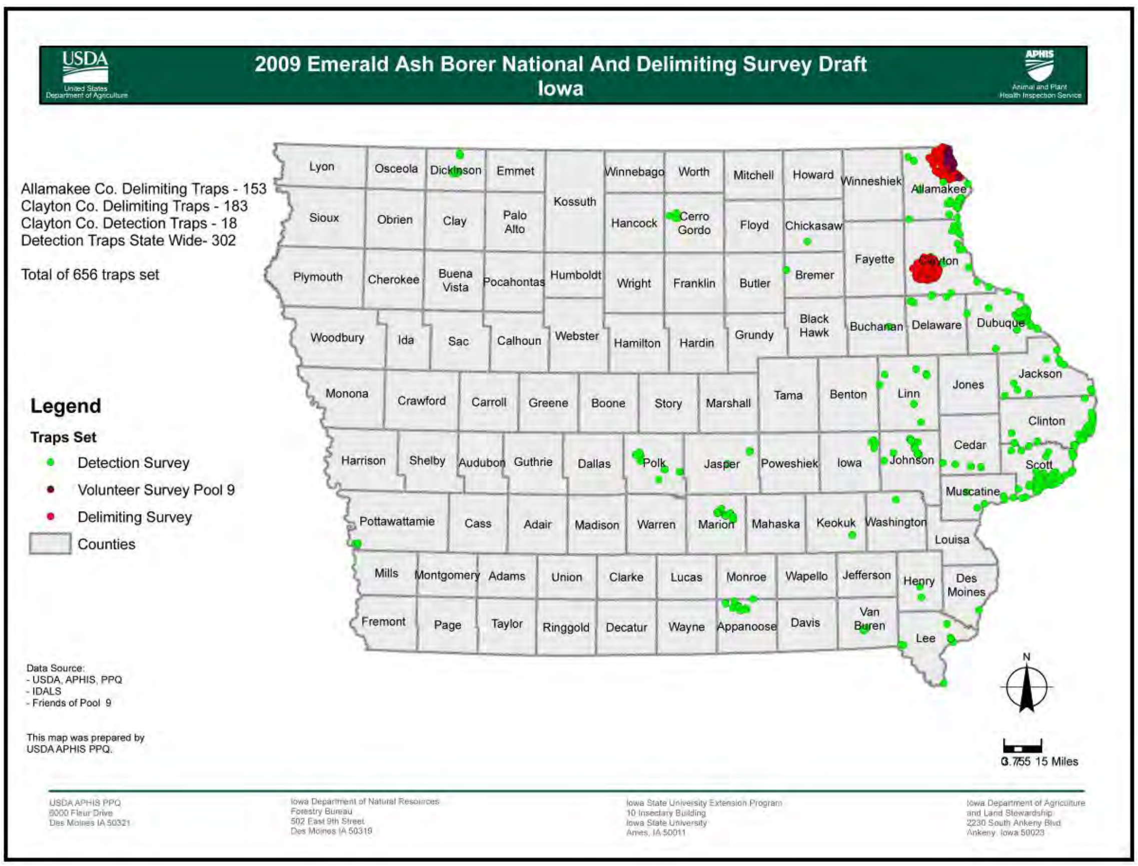
Source: Kathryne Clark.

Experimental Traps

During 2009, 656 purple sticky traps were obtained from USDA-APHIS for detection efforts in Iowa. Traps were installed in June and a mid-season trap check was conducted approximately one month after placement in order to collect suspect beetles, re-coat panels with Tanglefoot (glue) and then re-install traps in the canopy. By the end of August of that year, all traps were removed, insects were collected, and traps were discarded. The picture on the next page is an example of an EAB purple trap hung in an ash tree. Figure 3.4 shows where purple traps were located in 2009.

EAB purple trap hanging in an ash tree. Photo by Mark Vitosh.

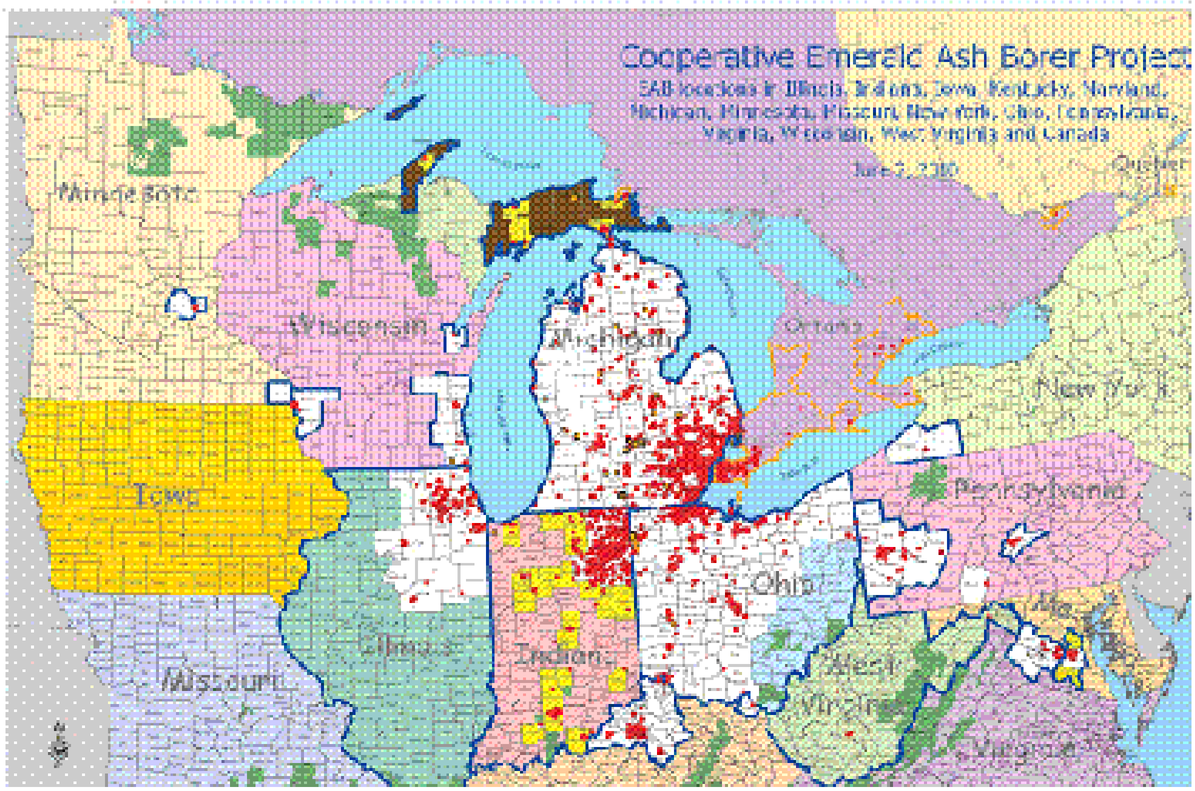
Figure 3.4 Iowa Emerald Ash Borer National and Delimiting Survey Draft, 2009.



Source: Mark Hollister, USDA-APHIS-PPQ.

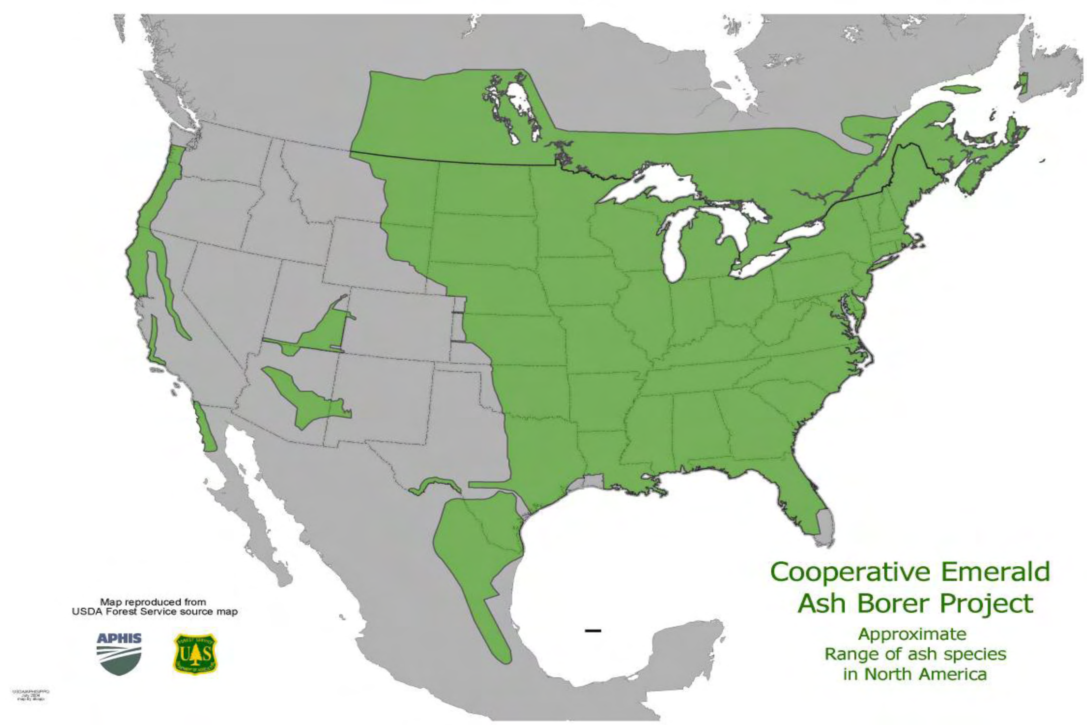
Figure 3.5 shows EAB locations in the United States as of June 2, 2010, while Figure 3.6 shows the range of ash trees susceptible to EAB in the U.S. Because ash trees have been useful as trainer trees in tree plantings, as firewood for homeowners, and for successful planting in urban areas, preventing EAB from getting established is the key to protecting the ash resource. The longer Iowa can isolate or minimize the population of the emerald ash borer, the longer ash trees will still be a viable tree in the landscape. Hopefully researchers will soon come up with a better detection system and/or a way to contain this destructive insect. For now, these survey methods offer the best tools for monitoring for the presence of EAB in Iowa. (For current information on the status of EAB, log onto www.emeraldashborer.info).

Figure 3.5 Known North American Emerald Ash Borer Sites as of June 2, 2010.



Source:USDA-FS/USDA_APHIS_PPQ,www.emeraldashborer.info/files/MultiState_EABpos.pdf.

Figure 3.6 Approximate Range of Ash Species in North America



Source: USDA-FS/ USDA-APHIS-PPQ, www.iowadnr.gov/forestry/eab/files/ashrange.pdf.

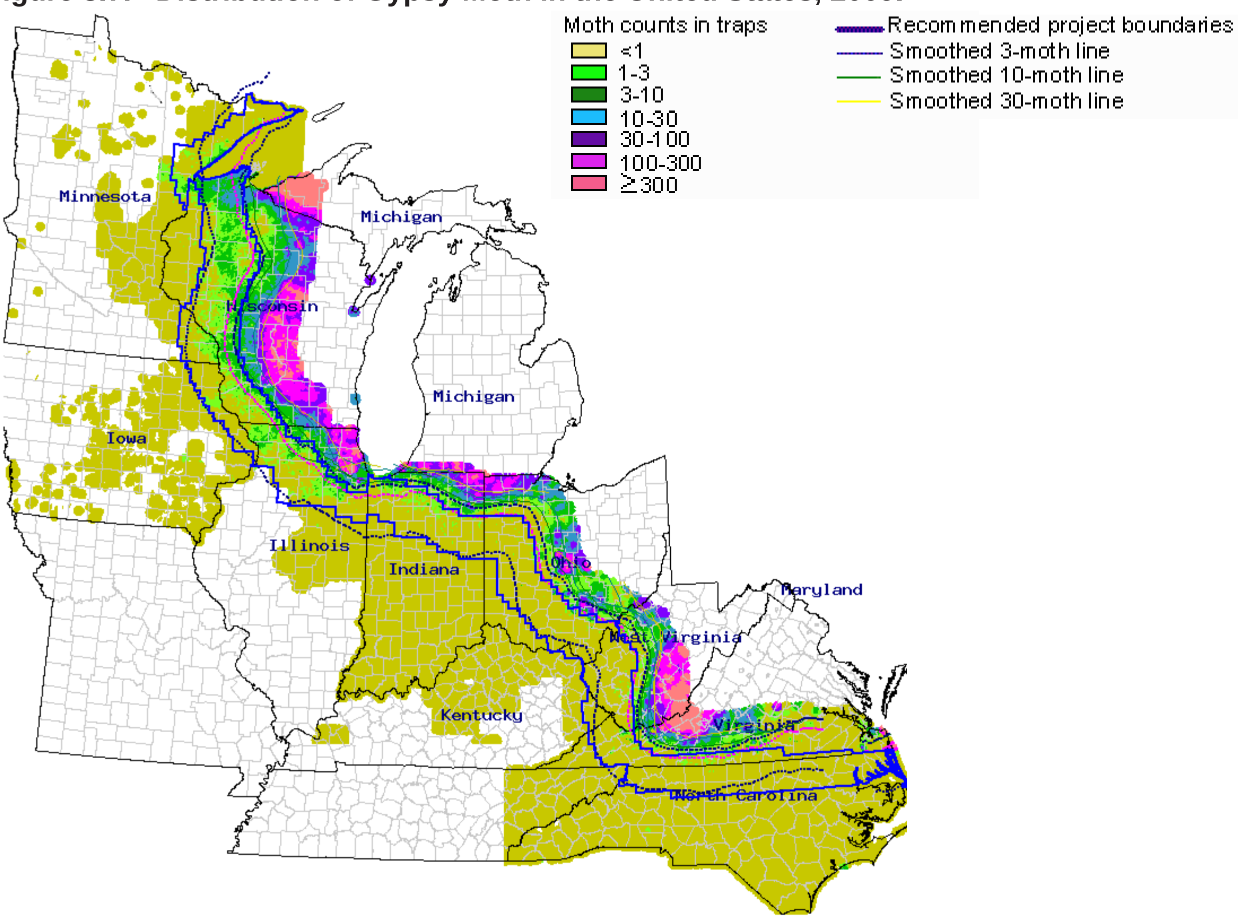
Gypsy Moth

Gypsy Moth is a European insect species that was introduced into New England over 100 years ago in an attempt to provide silk for the textile industry. This exotic insect continues to spread west from its introduction site and defoliate native forests wherever it becomes established. Gypsy moth larvae feed on the leaves of host trees during the summer, removing the hosts' ability to use their leaves to create food. If repeated defoliation occurs several years in a row on the same trees, these trees' stored reserves of nutrients will be depleted, leading to their decline. The establishment of Gypsy Moth in Iowa will affect the survival of some of the oldest trees in the state.

The 2008 summer season provided the largest catch of male gypsy moths in state history; 626 moths were caught in 495 traps, with most catches found in northeast Iowa, the part of the state closest to the established population in Wisconsin. Unlike previous years, many traps had multiple moths in 2008. There were far fewer catches during the 2009 summer than during the previous year, as only 82 male moths were caught in 68 traps. Because no egg masses were found, no treatments are being planned for Iowa in 2010; however, there will be additional traps placed around the positive catches.

Weather patterns, an introduced fungus disease called entomophaga maimaiga and a federal program called Slow the Spread (STS) have collectively contributed to a decrease in the rate of spread of gypsy moth into Iowa; the insect is not currently established in the state, but there are now five counties (Allamakee, Clayton, Dubuque, Jackson and Clinton) that are within 60 miles of the gypsy moth establishment boundary line, shown in Figure 3.7.

Figure 3.7. Distribution of Gypsy Moth in the United States, 2009.



Source: STS, da.ento.vt.edu/results4.html.

The number of gypsy moth catches and the number of acres treated for the purpose of gypsy moth eradication in Iowa each year from 1970 to 2008 can be viewed in Table 1 of Appendix G. For more information about gypsy moth and updates on its movement throughout the United States, visit www.aphis.usda.gov/ppq/ispm/gm/.

Current

Gypsy moth trap locations in 2009 were focused within cities, campgrounds, and around nursery operations. Along the Mississippi, traps were placed every 1500 meters to form a line of detection along Iowa's eastern border; the nine largest cities were also put on a 1500 meter grid.

In 2009 the following agencies were involved with gypsy moth trapping:

Agency	Employees	Traps
IDALS	4	192
PPQ	4	1539
Contractors	8	2499
IA DNR	7	987
Total	**23 Employees**	**5217 traps**

Figure 3.8 shows the locations of the gypsy moth catches in Iowa for 2009. Populations have been building in neighboring Adams, Columbia, Dane, Marathon and Sauk counties in Wisconsin over the past couple of years; this, combined with good weather conditions, has allowed for the movement of male gypsy moths into one of Iowa's most heavily forested areas.

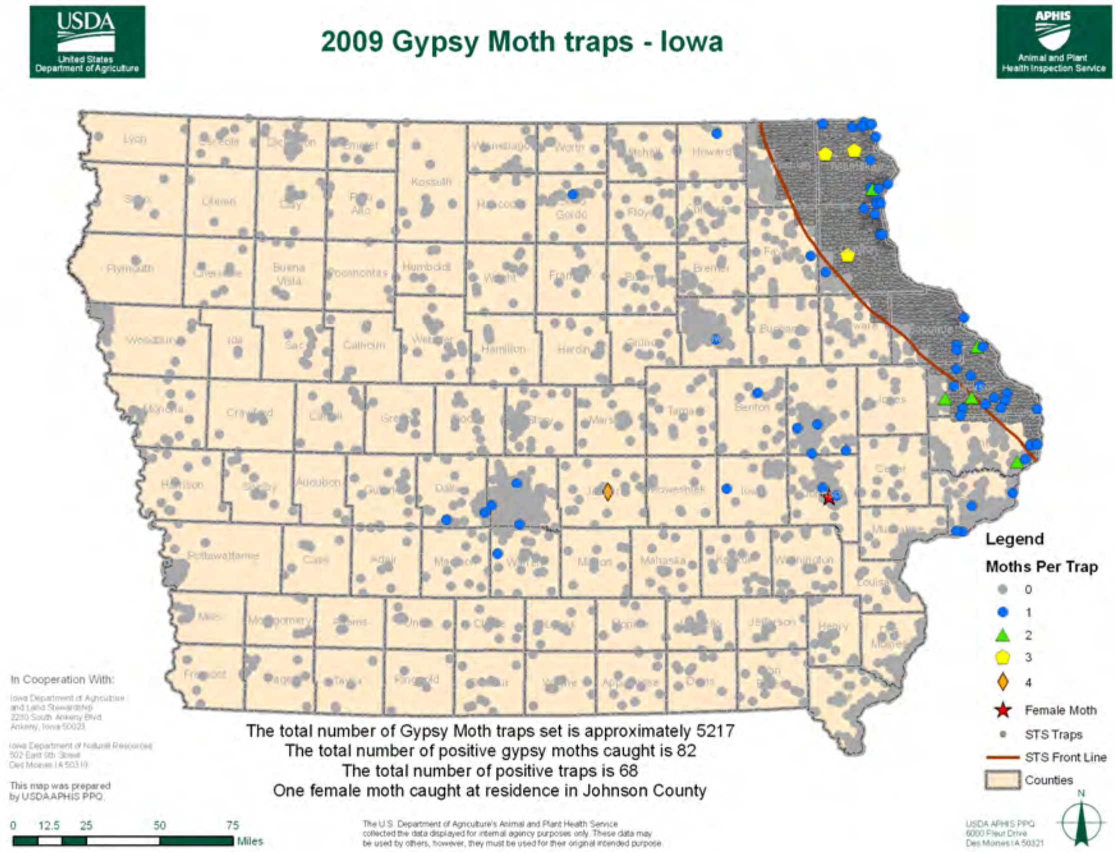
Considering that 67% of Iowa's forests are classified as sawtimber, it is important to manage this resource for the upcoming stress this insect will cause.

In 2009, Iowa worked with STS to begin trapping in Allamakee, Clayton, Delaware, Dubuque, Jackson, and Clinton counties. Using the STS calculations, 2,500 traps were set up in these counties alone, while an additional 4,000 traps were set up outside the STS zone.

Iowa will be working with STS for a second year in 2010. In addition to the six aforementioned counties, the STS region will now include Winneshiek and Fayette counties. Using the STS calculations, 2,566 traps will be set up in this region, which now includes five delimit sites; approximately 4,000 more traps will be set up throughout the rest of the state.

Male pheromone trapping is currently the most effective way to monitor for the presence of gypsy moth. Considering that 67% of Iowa's forests are classified as sawtimber, it is important to manage this resource for teh upcoming stress this insect will cause. Furthermore, since gypsy moth typically attack mature trees, and because most of Iowa's mature trees are oak, establishment of the insect could lead to even greater decline in the state's population of oak trees.

Figure 3.8 Gypsy Moth Traps, 2009.



Source: Mark Hollister.

Bur Oak Blight (Tubakia spp.)

An example of bur oak leaves infected with Tubakia spp. Photo by Christine Engelbrecht.

Bur Oak Blight has been found on bur oak trees over the past four years in Iowa; it appears in late July or August as discoloration in the leaves, especially along the interveinal tissue. The DNR and Iowa State University are currently working to determine if this disease is causing long-term oak decline in Iowa. A number of sightings have already occurred throughout western and central Iowa, with comparatively fewer sightings in the eastern part of the state.

In an effort to better understand the impact of this disease, permanent monitoring plots were established in 2007 at Loess Hills State Forest, Gull Point State Park and Thomas Mitchell Park. Trees were mapped and rated for severity of infection, digital pictures were taken to show the condition of the trees, and notes were taken about the presence of new leaf flushing.

These bur oak trees show different levels of Tubakia decline; the tree on the right is healthy, the tree on the left is infected, and the tree in the top left corner is dead. Photo by Aron Flickinger.

Leaves from documented trees were then collected, bagged, and taken to the Iowa State University (ISU) Plant Insect Lab for diagnoses. All the samples tested positive for Tubakia spp. and negative for bacterial leaf scorch (which can be confused with Tubakia). Bur Oak Blight generally does not affect a tree's health unless repeated infection occurs several years in a row, in which case serious decline results from loss of starch reserves.

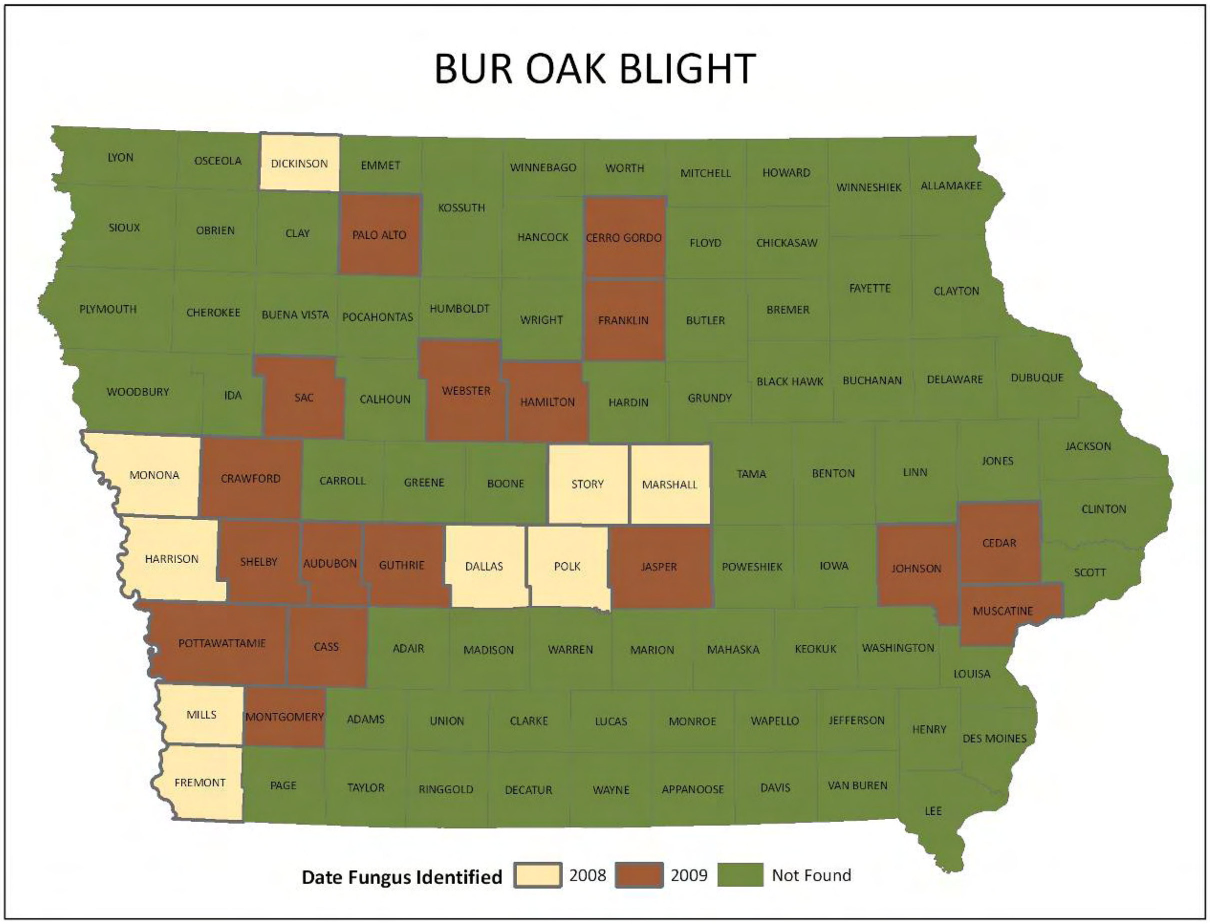
During the 2009 season, samples from around the state were sent to Dr. Tom Harrington at Iowa State University for genetic analysis. Based on DNA sequence analyses and morphology of cultures, it was determined that the species of Tubakia spp. that is consistently associated with blighted bur oak trees in Iowa is distinct from two other species that have been found in the U.S., both of which are leaf-spot fungi; one is commonly found on red oak and the other was found on an ornamental white oak on the campus of ISU. The red oak species is probably one that is commonly reported in eastern North America.

The Tubakia species associated with bur oak blight apparently moves into twigs and branches as an endophyte and, by doing so, can probably overwinter in its host. This might explain how the leaf symptoms tend to be uniform across affected branches and often uniform throughout the entire crown in the most seriously affected trees; trees seriously affected one year tend to be severely affected the next year, and leaves of affected trees may be colonized by the fungus even before leaf symptoms appear in late July.

Bur oak leaves with a new flush at the end of August. Photo by Aron Flickinger.

Further research is needed to understand this fungal blight and its current distribution. According to Dr. Harrington, the species of Tubakia spp. that causes bur oak blight was confirmed on post oak in Missouri in 2008. In Iowa, about 33 million bur oak trees, which make up 7% of the state's forest, are at risk to this disease; Figure 3.9 shows counties in Iowa where bur oak blight was found in 2008 and 2009.

Figure 3.9 Confirmed Cases of Bur Oak Blight.



Source: Kathryne Clark using ISU Plant and Insect Diagnostic Clinic data.

Tatters Study in Iowa

Leaf tatters causes a reduction in interveinal leaf tissue in newly emerged oak leaves as they grow larger, which makes them look deformed or "tattered"; the first sign is curling of the young succulent white oak leaves. Not all trees develop tatters, as leaves must be exposed to certain conditions after they have emerged from their buds and may escape tatters if they have grown a certain amount; however, oak trees of all ages growing in both urban and rural areas are susceptible to damage. Leaf tatters was first reported in Iowa, Indiana, and Ohio in the 1980's and in Wisconsin and Minnesota more recently.

The current wisdom holds that oak tatters is caused by the transfer of farm chemicals from crops to trees; so far, foresters have not found any links to insects or other diseases. It appears that acetochlor, an herbicide used to control weeds, volatilizes after being applied on agricultural fields, and it is possible that these vapors are then blown into nearby trees and forested areas; another possibility is that wind could be carrying acetochlor-covered soil particles into these areas. These are good theories) because they account for occurrences of tatters on edge and interior forests rather than just edge forests, and because they explain how tatters affects all sides of a tree rather than just some parts. Trees that do not experience tatters one year may develop them the following year, while trees that experience tatters one year may not the next. Though a tree's susceptibility to tatters may vary from year to year, one thing is certain: exposure to tatters for many successive years can lead to serious decline or mortality.

On April 27, 2006, five tree pollination bags were placed over several branches of a white oak tree that had shown leaf tatters in the past year at White Pine Hollow in Dubuque County; normal emergence of white oak leaves was noted during this time. The photos to the right show findings from a visit to the same site on May 2nd, only five days later. The leaves that were protected by the pollination bags displayed no signs of tatters and looked normal; those that weren't protected, conversely, displayed curling indicative of early-stage oak tatters. Iowa DNR foresters have been investigating the incident ever since it occurred; one theory is that the sudden outbreak of tatters was caused by chemical spraying, as much farming activity was observed in the county at the time of these visits.

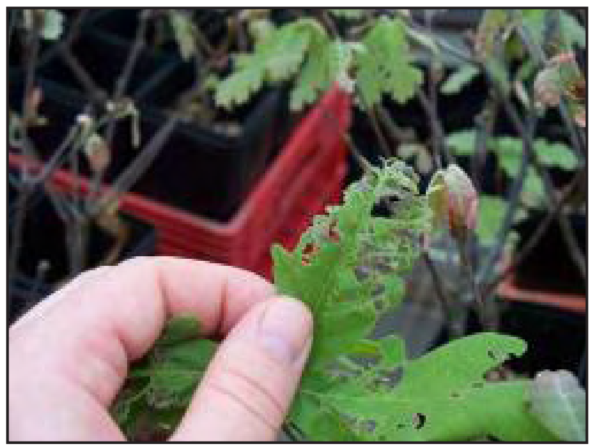
White oak leaves protected from pollination bags; the rest of the leaves on the trees showed tatters. Photos by Aron Flickinger.

From April 10 to May 18 of 2006, air, rainwater and leaf tissue samples were collected from White Pine Hollow and analyzed at the University of Iowa Hygienic Laboratory. It was discovered that air concentrations of acetochlor nearly quadrupled during this time, from 15 nanograms per cubic meter (ng/m^3) to 55 ng/m^3. Rainwater concentrations went from almost nothing on April 10th to more than 9.5 ng/ml on May 2nd, followed by a dramatic decrease by May 18th. Concentrations were 5 ng/g or less for leaves protected by pollination bags, while unprotected leaves had levels 3 to 10 times greater. These elevated levels of acetochlor are likely associated with the occurrence of tatters at the site (it is worth noting that neither frost nor freezing temperatures, both of which are capable of causing leaf damage similar to that of tatters, occurred during this time).

In addition, the DNR and ISU collaborated in 2008 for a study to determine which chemicals could be causing oak tatters in Iowa. Each of the following six treatments was applied to 120 white oak seedlings: 300 grams(g) (1/10 application rate), 30 g (1/100), and 3 g (1/1000) of acetochlor; 5 parts per million (ppm) of chlorine; 2-4 D (another farm chemical known to volatilize and damage leaves); and water, the control treatment.

As expected the, the water treatment did not have any visual effects. The chlorine treatment caused the leaves to turn purple for about two weeks and then back to green shortly thereafter. The 2-4D completely killed the leaf material on the trees that were treated at bud break, and discolored and cupped the leaves that were expanding; within a month, however, these trees began to re-flush with new growth, and they no longer showed signs of damage. Finally, all trees treated with acetochlor showed damage, including those treated with the relatively minute 1/1000 application rate.

Tatters from 1/10th application rate Acetochlor. Tatters from 1/10th Acetochlor application rate at bud break.



Tatters from 1/10th Acetochlor application rate; leaf tissue separating out and gone within two weeks of treatment.

Cupping and discoloration of leaves prior to tattering treated with Acetochlor rate of 1/100th; Leaves treated at bud break.


Purpling from chlorine treatment. Cupping from 2-4D treatments. Photos by Tivon Feeley.

Pine Shoot Beetle

The pine shoot beetle (Tomicus piniperda L.) was first discovered in the U.S. at a Christmas tree farm near Cleveland, Ohio, in July of 1992. A native of Europe, the beetle attacks new shoots of pine trees, stunting the growth of the trees. The pine shoot beetle may also attack stressed pine trees by breeding under the bark at the base of the trees. The beetles can cause severe decline in the health of trees or, if populations are high enough, even kill them.

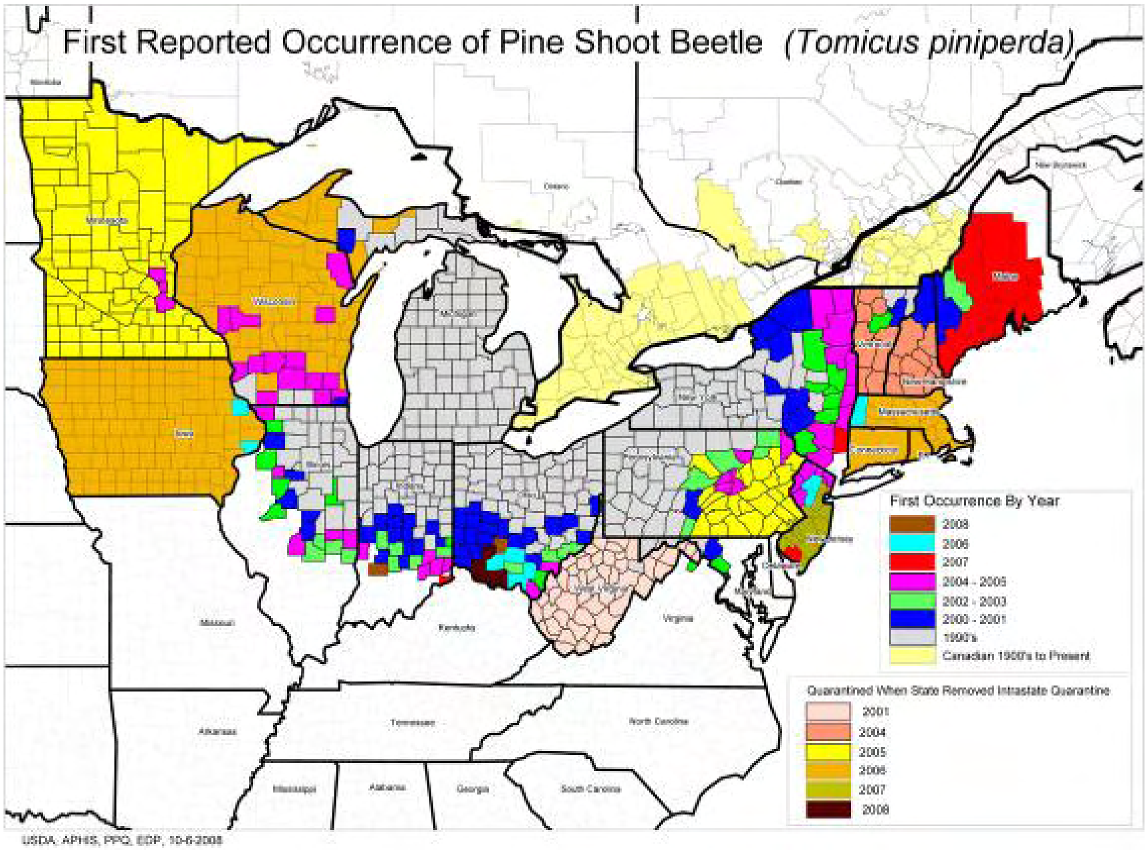
In May of 2006, USDA-APHIS-PPQ confirmed the presence of pine shoot beetle (PSB) in Dubuque and Scott counties. A Federal Order was issued effective June 22, 2006 that placed Dubuque and Scott counties under a Federal quarantine for interstate movement of PSB regulated articles. Iowa Department of Agriculture and Land Stewardship (IDALS) was provided a copy of the Federal Order as well as additional information concerning the pine shoot beetle, and was requested to consider placing a state PSB quarantine for intrastate movement of PSB regulated articles from Dubuque and Scott Counties. However, after considerable review, IDALS declined to implement an intra-state quarantine for PSB. Therefore, a Federal Order was issued effective September 18, 2006 for quarantine of the entire state of Iowa for PSB, Tomicus piniperda.

The quarantine affects the following pine products, called “regulated articles”:

- Pine nursery stock
- Pine Christmas trees
- Wreaths and garlands
- Pine logs/lumber (with bark attached)

All pine nursery stock shipped from Iowa to a non-regulated state must be inspected and certified free from PSB. This inspection and certification must occur just before shipping. Small pine seedlings (less than 36 inches tall, and 1 inch in diameter) and greenhouse grown pines require a general inspection of the whole shipment. All other (larger) pine nursery stock shipments must have 100% tip-by-tip inspection.

Figure 3.10 First Reported Occurrence of Pine Shoot Beetle.



Source: USDA-APHIS-PPQ, www.aphis.usda.gov/plant_health/plant_pest_info/psb/downloads/psbquarantine.pdf.

Hickory Mortality

Fungal isolates obtained from cankered stems of bitternut hickory trees sampled in Iowa during 2008 survey were identified. All Ceratocystis isolates obtained in 2007 and 2008 surveys were found to be C. smalleyi based on morphological characteristics and DNA sequences (ITS and tef gene regions). All Fusarium isolates obtained were identified as F. solani, though two types were found (black walnut canker and birch bark types) based on DNA sequences (tef gene region). C. smalleyi, F. solani and Phomposis sp. isolates obtained during the survey were summarized by state on a poster presented at the 2009 meeting of the American Phytopathological Society. These findings represent the first report of C. smalleyi and associated cankers in Iowa, Indiana, Minnesota, New York and Ohio. Two additional field evaluations (transect surveys) were completed in Iowa and Wisconsin in July of 2009. Disease incidence and severity data were collected.

Multiple year monitoring plots were established in two eastern Wisconsin locations and three Iowa locations during the summer of 2009. Six to eight apparently healthy bitternut hickories were selected for each plot, and plots were chosen based on their proximity to stands with advanced hickory decline and mortality. Data on tree size, tree crown condition, stem damage and other stand characteristics were collected for each plot in August of 2009. Plots will be visited two times per growing season from 2010 to 2012 in order to assess the rate at which hickories become affected and the decline of individual trees progresses, and whether mortality results.

The study fulfilled Koch's Postulates demonstrating that C. smalleyi is the cause of diffuse cankers with reddish inner bark and sapwood on pole-timber size bitternut hickory. Ji-Hyun Park, a

Dead and dying bitternut hickory near Coggon, July 2008. Photo by Mark Vitosh.

Ph.D. student at the University of Minnesota who is working on the project, is currently preparing a Disease Note for publication on this work.

Evaluations were made of pole-timber size bitternut hickory inoculated in July 2008 at 5 and 50 points on the main stem with ascospores of C. smalleyi. The objective was to determine the relationship between Ceratocystis cankers and crown decline. No evidence of crown decline was observed fourteen months later; however, elongate diffuse cankers with reddish inner bark and outer sapwood were common. Effect of the 50 point inoculations on sap flow in the treated trees compared to water inoculated and negative control trees was the subject of two week field monitoring efforts in mid-September. Data are currently being summarized and analyzed.

An ongoing anatomical study is examining vessel occlusion by metabolic substances and occurrence of tyloses in response to fungus infection. Presence of the fungus in the sapwood associated with the infection sites has been documented.

Frequency of hickory bark beetle (Scolytus quadrispinosus) attack, life stages present, egg niche and larval gallery presence, and occurrence of associated lesions or cankers were documented for three pole-timber size bitternut hickory exhibiting 55 to 70% crown decline symptoms. Data were recorded for each variable for 1 m long stem sections from the tree base to tree top (stem diameter > 7 cm). Larval galleries were not found to coalesce. Hickory bark beetle attacks, ranging from aborted to full gallery establishment, numbered between 700 and 1400 per tree. Hundreds of stem lesions were found (commonly associated with the beetle attacks) and the margins of the lesions extended beyond any larval galleries present.

Bark beetles were emerged from stem sections obtained from declining bitternut hickory in late spring 2009. Of 150 groups of beetles (3 per group) from May collected logs, C. smalleyi was found for only one based on serial dilution plating of aqueous suspensions resulting from vigorous agitation of beetles in 1.0 ml sterile distilled water. F. solani was found more frequently and Penicillium-like colonies were even more common. Assay of beetles emerged from June collected logs is underway. Bark beetles attacking stems of declining bitternut hickory were collected from three locations in late August and early September 2009. Similar assays are being conducted with these specimens. Thus far, we have been successful in obtaining C. smalleyi from the collected attacking beetles (2 of 19 from southeastern MN location; 12 of 14 from a location east of Wausau, WI).

Of the three most commonly observed scenarios associated with hickory decline, dieback and mortality, the relatively rapid crown decline associated with S. quadrispinosus and diffuse stem cankers was most prevalent based on field surveys conducted in six states. Coalescing larval galleries is not what is killing the affected hickory - rather, it appears that either the coalescing of hundreds of stem lesions or cankers associated with beetle attacks is the cause. Preliminary results show C. smalleyi and F. solani are causes of these cankers. Other, as yet undetected, fungi may be involved. Further work is underway to test this hypothesis. However, control of hickory bark beetle is the key to managing hickory decline. Survey data suggests that reducing density of bitternut hickory in a stand may greatly reduce tree decline and mortality during bark beetle outbreaks. Sanitation is also recommended, but is difficult for landowners to accomplish.

The Forest Service will be formulating work plans for future seasons once they have processed all samples and summarized data from the 2009 field work. (Jenny Juzwik, 2009 Report).[37]

Juniper Mortality

Iowa DNR started receiving reports of Eastern red cedar and white cedar (arborvitae) declining throughout the state in late April of 2009. The symptomatic trees started out healthy, turned a pale green color, and completely browned by the second week in May; this entire process took about two weeks. Hundreds of calls and samples were submitted to the Iowa DNR since the original reports in May, and the decline continued to spread within the state.

Several fungal infections were identified on the declining trees, including Pestalotia twig blight (Pestalotiopsis spp.), Berckmann's blight (Seimatosporium berckmanssii), Phomopsis twig blight (Phomopsis juniperovora), and Kabatina blight (Kabatina juniperi). These fungal blights were identified on the branchlets and foliage, but not on the established twigs. In addition, twelve of the 173 trees that were destructively sampled had Annosum root rot (Heterobasidion annosum).

The abrupt and widespread nature of juniper mortality in Iowa, coupled with the fact that a single pathogen could not be identified on all declining trees, leads the DNR to believe that other factors could be involved in juniper decline. Many of the samples that showed decline had evidence of bark beetle activity. Bark beetles are typically only a secondary pest on junipers; however, the distribution of the dead and dying junipers discovered was sporadic, as, for example, only a few trees in a windbreak or other cluster of trees might have been affected. All of the affected trees examined did have some limited bark beetle activity, but the DNR does not feel that bark beetles were the cause. The roots and other plant tissues were sampled for signs of nematodes, which so far have also been ruled out as a potential factor.

The current management recommendation is to remove dead and dying junipers and destroy in-

[37]Juzwik, Jennifer et al. "Fungi Associated with Stem Cankers and Coincidental Scolytid Beetles on Declining Hickory in the Upper Midwest." <www.nrs.fs.fed.us/pubs/gtr/gtr-p-24%20papers/52juzwik-p-24.pdf>. January 11 2010.

Symptoms of juniper decline. Photo by Jeremy Cochran.

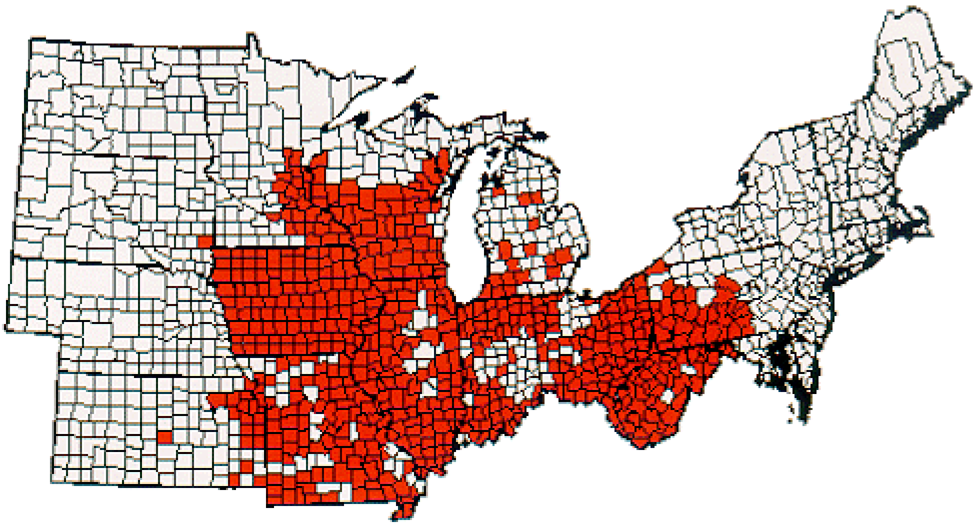
fected trees. Iowa DNR Forestry will continue to track the problem while keeping in mind that the mortality could be a result of the unusually cool and moist weather of the spring and early summer of 2009; such conditions allow various fungal diseases to thrive, and if no other damaging agents are determined to have made a contribution, this will be the most likely explanation for juniper mortality in Iowa.

Oak Wilt

Oak wilt (Ceratocystis fagacearum) is a fungus that has caused the mortality of thousands of oaks across the Midwest. In Iowa, aerial sketch mapping and ground checking from 1997 to 2009 showed that 2,380 new acres of red and white oak were infected with oak wilt. This disease is spread in two primary methods: through root grafts of like oak species and over land via a species of nitidulid beetles that make contact with the oak wilt fungus fruiting pressure pad and the spread to other pads some distance away. In Iowa, the spread of oak wilt through root grafts is slow and isolated due to heavy clay soils that minimize root grafts in natural stands. However, twenty to thirty year-old pure red oak plantations have been virtually wiped out by oak wilt via root grafting. Overland spread is a more serious concern in Iowa because it creates new scattered oak wilt infection centers or "pockets" some distance away from the original source. Currently the most common control recommendation is to cut the root grafts with a trencher or vibratory plow to a depth of three to five feet and then remove the infected trees. Oak wilt will continue to be monitored through aerial flights, ground checks, and reports from landowners. This disease is of particular concern in Iowa because of the prevalence of oak-hickory forest.

In Iowa, aerial sketch mapping and ground checking from 1997 to 2009 showed that 2,380 new acres of red and white oak were infected with oak wilt.

Figure 3.11 Counties in the United States that have Reported Oak Wilt.



Source: USDA-FS, www.na.fs.fed.us/spfo/pubs/fidls/oakwilt/oakwilt.htm.

Thousand Cankers Disease

Within the past decade an unusual decline of black walnut (Juglans nigra) has been observed in several western states. Initial symptoms involve a yellowing and thinning of the upper crown, which progresses to include death of progressively larger branches. During the final stages large areas of foliage may rapidly wilt. Trees are often killed within three years of observance of initial symptoms. Tree mortality is the result of attack by the walnut twig beetle (Pityophthorus juglandis) and subsequent canker development around beetle galleries caused by a fungal associate (Geosmithia sp.) of the beetle. A second fungus (Fusarium solani) is also associated with canker formation on the trunk and scaffold branches. The proposed name for this insect-disease complex is thousand cankers.

The DNR Forestry Bureau is currently working with regulatory officials to monitor the movement of walnut logs from the western states into Iowa. Foresters and landowners are concerned about this pest becoming established because black walnut is the most valuable timber species in Iowa, with some trees valued at more than $30,000. There are about 34 million black walnut trees in Iowa at risk to this disease.

Summary of Area of Forest Affected by the Above Insects & Diseases

Forest health issues are of increasing concern in Iowa. The front of the Gypsy moth infestation is moving slowly but steadily towards Northeast Iowa's mature oak-hickory forest. Emerald ash borer continues to expand its area of infestation throughout the Midwest and has established itself in four states adjacent to Iowa. Currently, there is an unidentified disease problem or syndrome causing patches of white oak mortality in northeast Iowa. The potential for serious economic damage and loss of species composition as a result of forest health threats makes their prevention extremely important.

Iowa lacks the inventory data necessary to determine the risk of insect and disease problems for different communities; however, the DNR Forestry Bureau estimates that an average Iowa community's tree stock is comprised of 20% ash and 50% maple, and that therefore most communities are probably at risk for insect and disease problems. Promoting diversity within communities and in forested areas is another way to improve forest health, as diversity can keep harmful levels of diseases and insects from building up and destroying particular species. The best long-term strategy for communities is to ensure that no more than 10% of their forest resources be made up of any one particular species.

Forest health surveys help to monitor where various insects and diseases are affecting the state's forest resources. Field days, workshops and publications are important and effective ways to keep forest landowners and urban homeowners aware of the steps they can take to keep their trees healthy; proper management is crucial as well. When it comes to managing their woodland, the two best tools that a landowner can possess are diverse woodlands and a goal-oriented management plan. Because such a significant portion of Iowa's forests are in the large size class category, it is crucial that landowners be educated about how to keep these mature, large trees healthy. Silvicultural practices like thinning can reduce basal area in these forests, which can in turn improve their health.

Ozone Pollution

Ozone pollution occurs when ground level ozone concentrations increase to phytotoxic levels. Elevated levels of ozone are a concern to foresters for several reasons: they can cause foliar injury to several tree species, they may cause growth loss and they can make trees more susceptible to insects and diseases. Ash and black cherry would be the first Iowa species to show damage, while shrubs like plum and blackberry are also sensitive. There are currently seven permanent bio-sites that are annually monitored by DNR Forestry staff for ozone in Iowa.

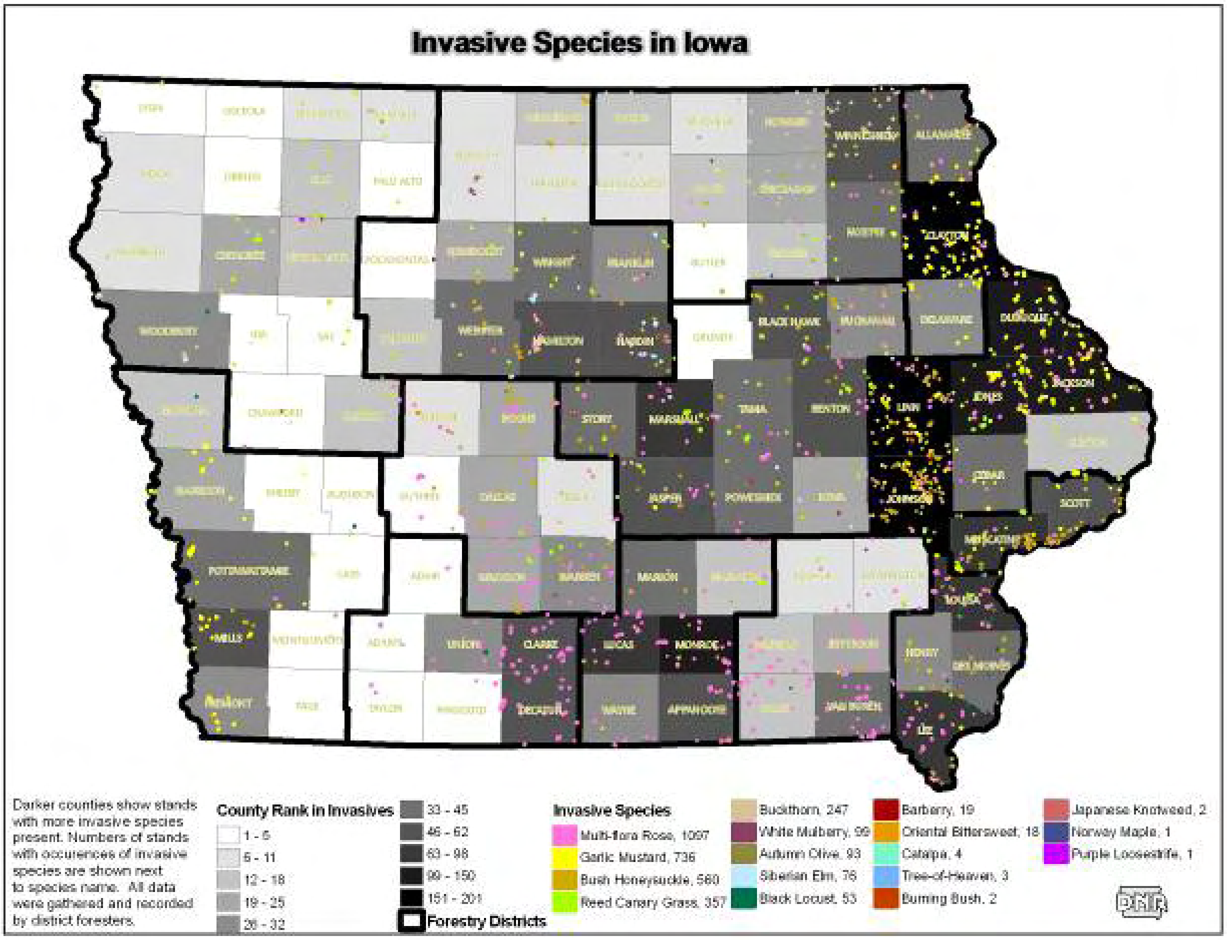
3.2 Invasive Plant Species

Invasive species described in this section are plants that are non-native to an ecosystem and cause or are likely to cause economic or environmental harm to humans, crops, livestock or natural plant and animal communities. Some examples of non-native species found to be a problem in Iowa forests are buckthorn, garlic mustard, honeysuckle, oriental bittersweet and multiflora rose. These invasive and exotic plants out-compete native forest species, diminish fisheries and wildlife habitat, reduce water quality, reduce economic returns from forest management and tourism and threaten long-term forest sustainability and bio-diversity. A list of invasive plants known to exist in Iowa is provided in Table 2 of Appendix G.

Invasive species are displacing native vegetation throughout Iowa's forests and reducing the biological diversity of the woodlands they invade. These non-native plants have several advantages over competing native plants, including prolific seed production, shade tolerance, earlier production of leaves in the spring and maintenance of leaves longer in the fall. All of these traits give invasive plants a competitive advantage over native tree seedlings and native understory plants, which leads to a reduction in both plant diversity and availability of suitable habitat for a variety of wildlife species.

District foresters have recently begun recording invasive plants in databases after visiting private landowners as part of stewardship plans. Figure 3.12 shows the list of invasive plants that are being observed during landowner site visits, with the darker color coding showing where more occurrences have been reported as a result of these visits. The map shows that the most invasive plants are being observed in the eastern half of Iowa. Although this is not a systematic survey, it is the best available information at the county level.

Figure 3.12 Invasive Species Reported by District Foresters in Stewardship Plans.



Source: Kathryne Clark using data collected from forest stewardship plans through 2009.

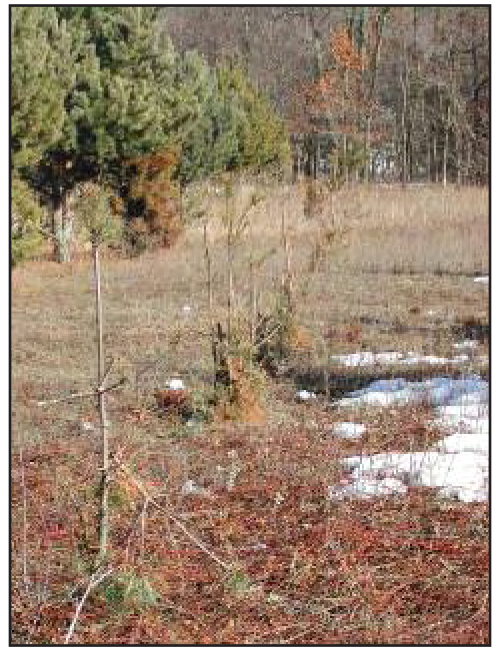
Garlic mustard is considered a severe threat because it out-competes native plants by aggressively monopolizing light, moisture, nutrients, soil and space. White-tailed deer facilitate its invasion by feeding on native plant species and avoiding it. Garlic mustard roots produce toxins that prevent the establishment of other plant species, including oak trees. Amur honeysuckle rapidly invades and overtakes a site by forming a dense shrub layer that crowds and shades out native plant species. Oriental bittersweet is an aggressive invader that threatens all vegetation levels of a forest. It grows over other vegetation, completely covering it and killing it through prevention of photosynthesis, girdling and forceful uprooting. The non-native variety appears to be displacing the native climbing bittersweet.

In the future, Iowa forests will be impacted by invasive species that are already establishing themselves in the state's woodland understory or that are established in neighboring states. Efforts to provide landowners with cost-effective solutions to these problems continue; however, significantly more energy and resources need to be directed to solving these problems before irreparable damage is done to Iowa's woodlands. No longer will passive management allow for woodlands to be "preserved" in the condition they are in today. Educating forest landowners about their woodlands and how each component affects another will make it easier for Iowa's woodlands to be managed for adequate long-term health. Through utilization of focused Stewardship funding, EQIP, WHIP, REAP, and FLEP efforts are under way to improve the health of Iowa's forests.

Animal Depredation

White-tailed deer (Odocoileus virginianus)

Where deer populations are high, deer browsing can impact plant species composition and community structure. Deer browsing has a profound impact on the establishment of regeneration, the density of hardwood seedlings and the presence of understory plants. Ironically, their impact is reducing biodiversity and hurting Iowa's largest forest type, the oak-hickory, the very habitat they depend on in the fall and winter for food and shelter. Deer also impact vegetation by moving parasites and invasive plant seeds, through bedding and by rubbing their antlers on trees. In the winter they seek shelter in forests, while during the growing season they feed on the herbaceous portion of woody plants under the shade of trees.



Deer damage to a young conifer planting. Photo by Bruce Blair.

Species that fall victim to browsing are unable to regenerate, while those that aren't browsed on, including invasive

Tree shelters are becoming more common in tree plantings because of high concentrations of deer. Photo by Cathy Marcotte.

Deer coming out of the woods to browse. Photo by Bruce Blair.

Lack of understory layer is evidence of an overpopulation of deer in this woodland. Photo by Bruce Blair.

plants such as garlic mustard, continue to thrive.
Over time, this selective browsing can lead to a reduction in forest biodiversity, which can then lead to a change in habitat. Reductions in understory plants, for example, can lead to declines in insect activities, including those of pollinators. Browsing activity also affects moisture at the forest floor and the vertical structure within the forest. Soil moisture and humidity decline as more light is able to reach the ground and heat up the area.

Rabbits and mice can do damage to new tree plantings. Unfortunately, they seem to show a preference for oak species, particularly white oaks. Rabbits eat the terminal leaders of seedlings during the winter, and their preference for oaks causes them to fall behind the growth of other tree species in plantings. Mice girdle seedlings during the winter, and their preference for oaks also

Tree shelters are now necessary for establishing seedlings in some parts of the state, but they provide new habitat for mice as well. Photo by Bruce Blair.

Open and forested-area ash tree shelters. Photo by Cathy Marcotte.

Forest Tree Mortality

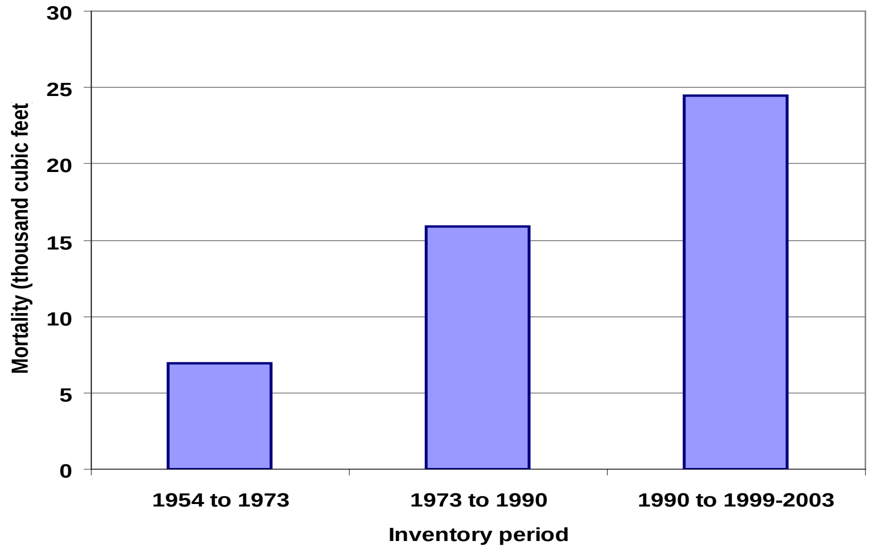
Trees can die from insects, diseases, weather (lightning, wind), physical damage, climate change and old age. The Forest Service monitors for mortality to compare how much volume of wood is being lost from forests due to forest health issues versus harvesting. This allows for independently monitoring changes to Iowa's forest resource. The remaining portion of this section will focus on mortality, not harvesting.

As Iowa's trees have matured the amount of mortality has steadily increased between 1955 and 2003. Figure 3.13 below shows the mortality trend through time. Reviewing the inventory data from 2008 shows a continued increase to over 36 million cubic feet.[38]

Mortality is expected to continue to climb in the future for many reasons. Iowa's forests are within 60 miles of established gypsy moth colonies in Wisconsin and 90 miles from where emerald ash borer has been found in Illinois. Flooding during the 2008 season will cause a decline for riparian species throughout the next 10 years. With most of Iowa's forest in the large size class, more of the forest is approaching the age where these trees are more vulnerable to a wide variety of insect and disease problems.

[38]Miles.

Figure 3.13 Average Annual Mortality of Iowa Trees, 1954 to 2003.

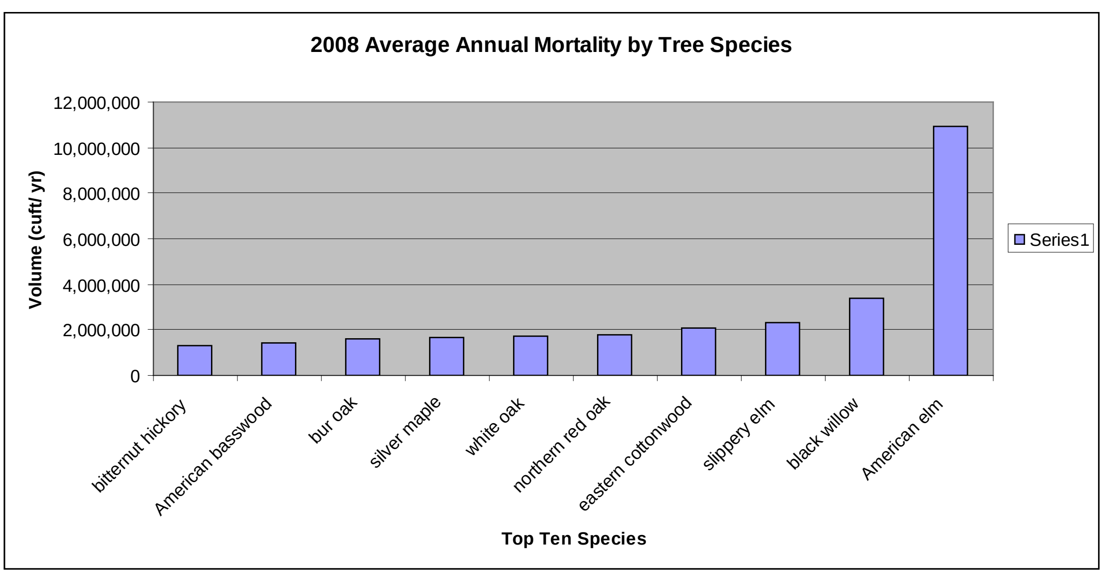


Source: Leatherberry et al.

Figure 3.14 shows the ten species that have experienced the greatest mortality. Comparing the growth to the mortality for each species growing in Iowa, only American elm, slippery elm and butternut are growing less volume in 2008 because of their higher mortality rates. Other species listed in the top ten include northern red oak, bur oak and white oak.

The high mortality for American elm is due to this being the most common tree in Iowa forests and the prevalence of Dutch elm disease since the 1950's. Butternut is dying from butternut canker that has been present in Iowa forests since the 1970's. The oak mortality is mostly a result of oak wilt or oak decline- a complex of problems that come together as oak trees get older under the right environmental stresses. Upland species are stressed more during drought situations similar to the late 1980's in Iowa. Bottomland species like silver maple, cottonwood and black willow can be stressed and weakened by exposure to high water tables and prolonged standing water during the growing season.

Figure 3.14 Average Annual Mortality by Tree Species, 2008.

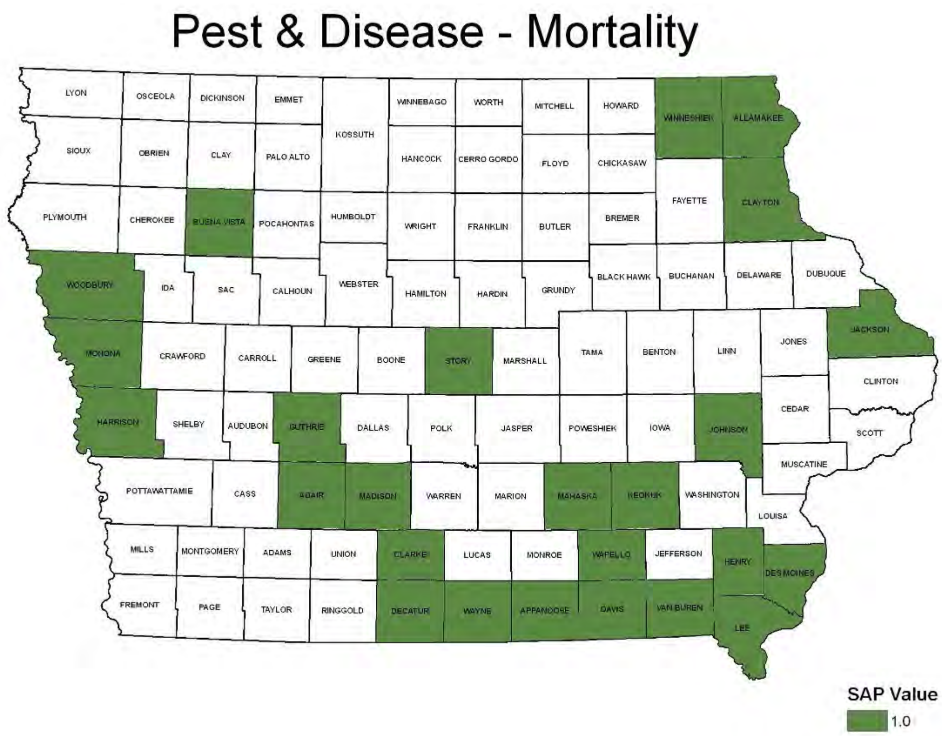


Source: Miles, P.D.

All trees in Iowa are at risk to insect and disease problems. Prioritizing which insects and diseases are impacting various tree species changes from year-to-year. Creating a priority map for this issue is really just taking a snapshot in time.

Figure 3.15 uses USDA-FS-FIA data to show where the highest levels of tree mortality were recorded for Iowa in 2008.

Figure 3.15 Forest Areas with the Highest Levels of Mortality.



Source: Kathryne Clark using 2008 FIA data.

3.3 Wildfire

Low-intensity, vegetation-renewing fires occurred over large areas of land in Iowa every one to five years prior to statehood. These fires moved rapidly across the land without penetrating into the soil very far; they killed most tree seedlings and removed the thatch of dead leaves, allowing early flowering spring wildflowers to grow. Oak and hickory are among the trees that evolved along with wildfire; their thick bark enabled them to withstand heat and flames and their underground storage structures allowed them to re-sprout vigorously as seedlings if burned off, which in turn allowed them to become large enough to withstand future fires.

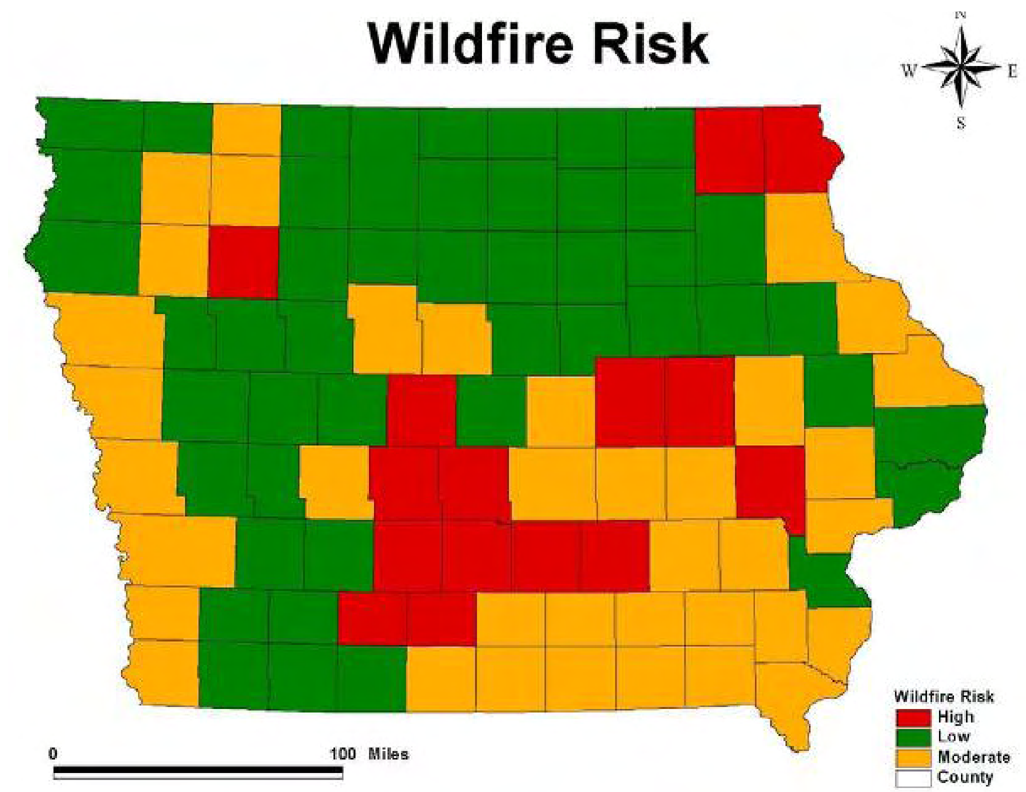
As European settlers arrived during the latter half of the nineteenth century, Iowa's landscape became altered as a result of agriculture and domestic livestock grazing, road creation and emergence of other firebreaks. By the turn of the 20th century, Iowa had lost over 95% of the native prairie and over 70% of the native forests, as land was cleared, drained and put into row crop production. The removal of fire from the natural ecosystem allowed plants and trees that were not able to survive the presence of fire to increase their populations. As a result, Iowa's forest composition has changed dramatically (see Chapter 2).

Wildfires are a natural force, influencing and even renewing forest ecosystems. However, decades of wildfire suppression have created conditions ripe for destructive wildfires on forests and grasslands. Over 90% of forest land in Iowa is privately owned, leaving only 9% in public ownership; furthermore, 450,000 acres of public land are in permanent grass or woodland vegetation. Between 1985 and 2008, millions of acres of permanent vegetation were added to the Iowa landscape with incentives from the Conservation Reserve Program (CRP). As of January 2010, Iowa had 1.6 million acres of land in CRP, with most of the vegetation in the form of cool and warm season grasses.[39] These areas are not typically burned, which allows dead thatch to build up for years on end, which leads to high risk for destructive wildfire.

Additionally, there are over 100,000 acres in federal properties owned by the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers and Department of Defense. Over 130,000 acres are in conservation easements in the Wetland Reserve Program and Emergency Wetlands Reserve Program. These federal lands and easements are mostly forested or grass ecosystems. Iowa also has over 12 million acres of corn planted annually, which can be a fire hazard under hot and dry condition in the fall.[40] With fire suppression over the last 160 years, the amount of large woody debris has increased on forest lands, allowing fires that go through these areas to burn longer and more intensively. Overall, there is approximately 24 million acres of flammable fuels that can burn throughout the state during any given year.

Figure 3.16 below shows wildfire risk in Iowa at the county level. Rankings were determined by reviewing State Fire Marshall data regarding wildfire occurrences between 1994 and 1999. Information about natural vegetation, like cool and warm season grasses and oak litter, and land coverage was utilized to help predict future risks. Iowa wildfire fuel conditions are often dry enough with seasonal winds and contiguous enough in the Moderate and High categories to require burning bans by the State Fire Marshall's office during the Iowa fire season.

Figure 3.16 Iowa Wildfire Risk Based on Historical Data.



Source: Kathryne Clark using Sate Fire Marshall Office data.

[39]<http://content.fsa.usda.gov/crpstorpt/rmepegg/MEPEGGR1.HTM>. March 5 2010.

[40]<http://extension.agron.iastate.edu/soils/PDFs/acretrends.pdf>. March 5 2010.

The Forestry Bureau of the Iowa Department of Natural Resources, per 456A.24 (9) of the Code of Iowa, is responsible to:

"Provide for the protection against fire and other destructive agencies on state and privately owned forests, parks, wildlife areas and other property under its jurisdiction, and cooperate with federal and other state agencies in protection programs approved by the department, and the consent of the owner, on private owned areas."

The Iowa DNR Forestry Bureau, in cooperation with the USDA Forest Service and other federal, state and local partners, work to provide assistance to rural volunteer fire departments through a variety of programs and activities in an effort to provide quality fire protection across the state. The state fire assistance program works to protect natural resources from fire on state and private lands through fire prevention and suppression, fuels management education, training and outreach opportunities.

Iowa's natural areas contain sizable amounts of flammable grasses and leaf materials. Prescribed fire has been promoted as one effective management tool in Iowa for ecological restoration, vegetation management and fuels reduction by federal, state and local agencies.

Prescribed Fire

Burning woodland to promote oak-hickory forest and suppress invasive plants. Photo by Bruce Blair.

Iowa's native oak woodlands, savannas and prairies are fire dependent ecosystems, and natural resource managers have developed a renewed interest in utilizing prescribed fire to maintain, enhance and restore these systems in recent years. The limited number of trained and National Wildfire Coordinating Group (NWCG) qualified fire fighters, squad bosses, burn bosses and fire crews have severely hampered efforts to expand the use of prescribed fire as a management tool. Equally concerning is the poor technique, lack of awareness and lack of training provided to the volunteer firefighters in prescribed and wildland fire suppression. Proper wildland fire training is a prerequisite to the implementation of prescribed fire. Restoration of fire adapted ecosystems, such as savanna and oak woodlands, and invasive species suppression can only occur with the expanded use of prescribed fire as a silvicultural tool. Most landowners do not possess the education and training necessary to safely perform prescribed burns independently.

Opportunities for prescribed fire applications are limited by three factors: a small weather "window", a limited number of certified and qualified burn bosses and crews and long distances between areas for application. The "window" of weather for safe burning conditions in Iowa is limited to approximately 16 days between winter and spring and 16 days between fall and winter. What's more, weather conditions are often difficult to predict and can vary across the state; prescribed fire crews often drive long distances to implement practices only to find weather or fuel conditions unacceptable for prescribed fire application.

Beneficial prescribed fire data is not easily obtainable because reporting is voluntary. Figure 3.17 shows the number of reported fire occurrences and acres burned over the last five years. Bringing prescribed fire back to forests and grasslands is a difficult challenge for many reasons. There are now over 150,000 forest landowners and many more landowners with grass or corn growing on their property, many of whom have built houses close to these flammable fuels. Convincing these landowners that burning is beneficial for their forest or grassland even though it puts their homes at risk to fire exposure is a challenge. As more people come to own smaller stands of forest, it becomes increasingly difficult to keep fires on individual properties from moving into other properties; it can also take more people and equipment to burn smaller areas, since they often lack the natural firebreaks contained in larger areas. Since most of Iowa's forests have not been burned for over 100 years, there are often large dead debris scattered on the forest floor; this allows fires in these areas to burn hotter and longer, causing more damage to the forest and increased difficulty of containment.

The concept of using prescribed fire as a management and fuel reduction tool in Iowa has been slow to be accepted among private landowners. Obstacles to the expansion of prescribed fire on private lands include a lack of insured and qualified private contractors, limited opportunities during the burning season, lack of awareness by private landowners about the benefits of prescribed fire and a lack of concise prescribed fire training for landowners.

Figure 3.17. Number of Prescribed Fires and Number of Acres Burned 2004-2009.

Year	Number of Prescribed Fires Reported	Number of Acres Reported Burned Using Prescribed Fire
2009	578	22,498
2008	175	2,186
2007	206	1,347
2006	202	3,096
2005	247	11,104
2004	447	1,356

Source: Gail Kantak, Iowa DNR Forestry Bureau Fire Supervisor.

Recently the USDA Natural Resource Conservation Service (NRCS) and the Farm Service Agency (FSA) in Iowa have supported the requirement that prescribed fire be used as a mid-term management practice to improve wildlife habitat on new CRP-contracted cool and warm season grasslands. These areas require either regular mowing or prescribed burning to keep woody vegetation from becoming established and to remain in compliance with FSA/ NRCS rules.

Iowa DNR Forestry is a member of the Big Rivers Forest Fire Management Compact. The compact has helped to expand training opportunities and distribute fire fighting equipment and clothing to state and county natural resource agencies and volunteer fire departments. Through opportunities provided by this compact, approximately 95% of the Bureau's field staff have taken approved basic fire fighting courses. Other Bureaus within the Division that are tasked with fire-related resource management are also utilizing such training opportunities.

Efforts to provide NWCG wildland fire training through regional and local partnerships have been provided through the Big Rivers Compact, the Loess Hills Alliance and the University of Northern Iowa Integrated Roadside Vegetation Management Program. Local instructors are limited in number and often have other full-time positions, which makes it difficult to offer the highly demanded NWCG courses on a regular basis and in convenient locations across the state. Due to a lack of standard wildland fire training, physical testing and qualification tracking, Iowa is one of the few states in the nation lacking organized wildland fire crews to assist federal agencies and other states with wildfire control issues. Since 2006 the DNR Forestry Bureau has had a dedicated fire training coordinator to offer regular NWCG wildland fire training, to improve safe prescribed fire use and to reduce hazardous fuel situations in Iowa's WUI. This person is now able to coordinate with local partners to provide training, contract with NWCG qualified instructors to provide training in a variety of wildland fire classes, purchase educational materials for those classes, track the number of participants that receive certification from these classes, encourage reporting of prescribed fire accomplishments, develop a network of in-state NWCG instructors for program expansion and establish an-Iowa based, red-carded wildland fire fighting crew.

The DNR Forestry Bureau fire team has been able to annually provide base-level (100 and 200 level) NWCG Firefighter training and annual refreshers, as well fitness and endurance testing; it has also maintained a resource list of qualified NWCG agency and volunteer personnel for use on interagency out-of-state assignments and compact activations. The amount of training that has been provided in recent years is summarized in Figure 3.18.

Figure 3.18. Fire Training Figures, 2005-2009.

Training Season	Number of Courses	Number of Students	Seat Hours	Est. Value of Seat Time (Basic FF2 AD Rate)
2008-09	27	593	6183	$86,314.68
2007-08	21	550	7231	$98,630
2006-07	38	612	7602	$88,791
2005-06	23	552	8424	$98,392

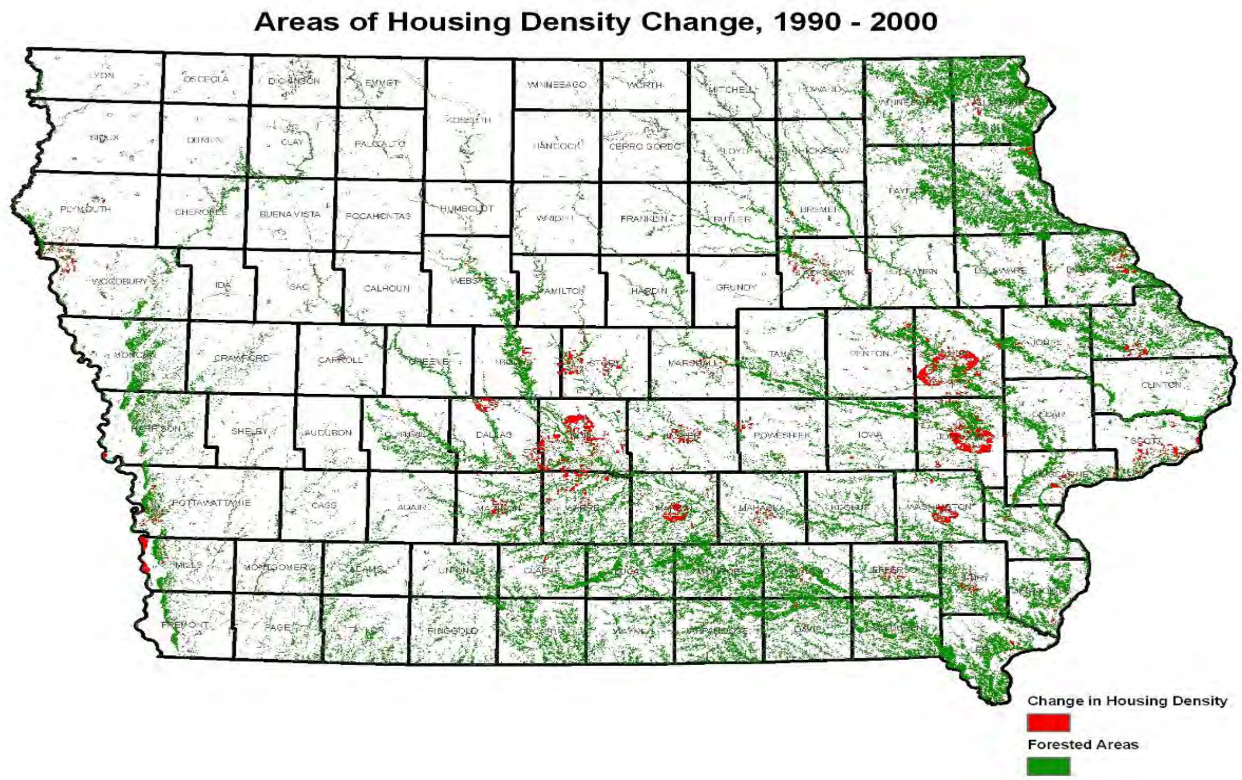
Source: Gail Kantak.

Increasing professional opportunities for continuing education involving prescribed fire in the WUI is a goal of the Forestry Bureau, which has expanded the wildland fire and prescribed fire management program through increased awareness, training, coordination and equipment. Training for natural resource managers and volunteer fire department personnel is available through classes like Wildland Fire Operations, Wildland Fire Engine Operations and Tactics and Prescribed Fire. Promotional efforts have involved publications, general seminars, fire discussions with interested partners and Firewise training and awareness opportunities. The DNR Forestry Bureau Fire Program staff have utilized NWCG curriculum for field staff and individuals interested in pursuing red cards. They have also developed a wildfire operations and tactics curriculum specific to volunteer fire department needs and a prescribed fire curriculum specific to natural resource manager needs.

Wildfire is the responsibility of over 850 rural, mainly volunteer fire departments scattered across the state. Volunteer fire fighters in Iowa are decreasing in number, and many lack appropriate wildfire training and equipment to deal with the issues of the wildland urban interface. Concerns also exist about the appropriate use and timing of prescribed fire, because of the issues of smoke management, air quality and maintaining control of the area to be burned. It is estimated that over 90% of wildfires involve grassland, cropland or forested areas, many of which occur within the wildland-urban interface.

Figure 3.19 shows areas of the state where communities expanded into existing forest between 1990 and 2000; such growth has contributed to an increase in the wildland-urban interface. Residential homes that are built in rural areas with forest or grass cover are often surrounded by lots of flammable fine fuels. It is a challenge for fire departments in these areas to access property with their equipment and to have enough water resources to control fires. The issue of wildfire in Iowa is receiving a renewed look as residential housing encroaches onto natural areas of grasses and trees. The threat of wildfire to people and personal property is a concern for both fire departments and people living on acreages surrounded by permanent vegetation. Furthermore, lack of awareness of firewise concepts in road and water source layout as well as other aspects of development increases the risk of wildland fire hazards.

Figure 3.19 Areas of Housing Density Change, 1990-2000.



Source: Kathryne Clark using 9HD0030 housing density change provided by the US Forest Service and satellite land cover from 2002.

The Iowa DNR Forestry Bureau, the U.S. Forest Service and a wide range of other federal, state, and local partners are working to encourage homeowners and communities to be proactive in identifying and mitigating situations that may prevent effective fire protection in the rural and wildland urban interface locations.

During 2001, the Iowa Department of Natural Resources Forestry Bureau led an effort to determine the cities in Iowa most at risk to wildfire. This listing took into consideration availability of fuels, new residential development into natural areas, topography and history of wildfire; furthermore, communities were listed even if only portions of them were considered to be at risk. Many updates have occurred since 2001, giving a total of 31 communities along with 15 townships that have been selected, and they are listed in Figure 3.20.

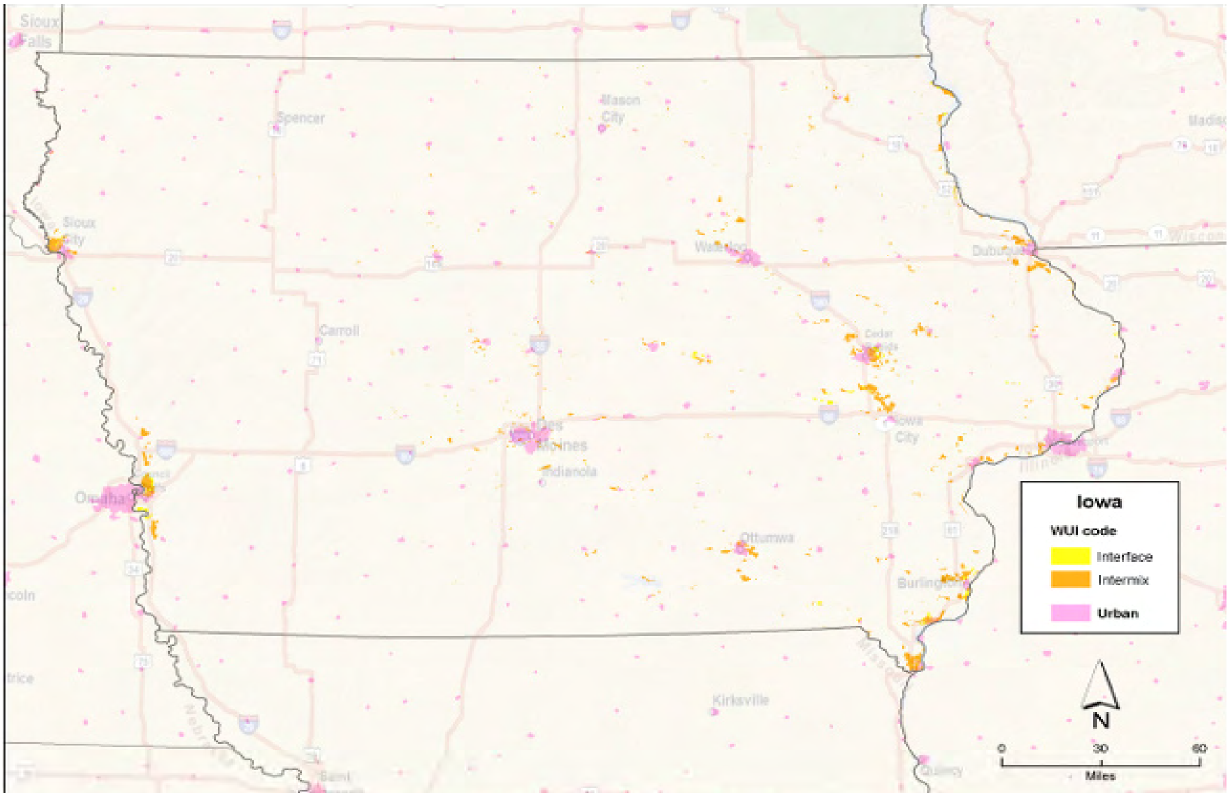
Figure 3.20. Iowa Communities Most at Risk of Wildfire Event.

Community	County
Ankeny	Polk
Belle Plaine	Benton
Belmond	Wright
Boone	Boone
California Jct	Harrison
Carlisle	Warren
Chelsea	Tama
Coralville	Johnson
Fredonia	Louisa
Hartford	Warren
Iowa City	Johnson
Johnston	Polk
Knoxville Rural	Marion
Koszta	Iowa
Madrid	Boone
Marquette	Clayton
Mesquakie	Tama
Mesquakie Indian Reservation	Tama
North Liberty	Johnson
Pella	Marion
Polk City	Polk
Prairie City	Jasper
Solon	Johnson
Spirit Lake	Dickinson
Swan	Marion
Swisher	Johnson
Tama	Tama
Vandalia	Louisa
Wapello	Louisa
Marengo	Iowa
Diamond Lake TWP	Dickinson
Spirit Lake TWP	Dickinson
Center Grove TWP	Dickinson
Richland TWP	Dickinson
Excellsior TWP	Dickinson
Lakeland TWP	Dickinson
Superior TWP	Dickinson
Lost Island TWP	Palo Alto
Highland TWP	Palo Alto
Ruthven	Palo Alto
Lake TWP	Clay
Freeman TWP	Clay
Summitt TWP	Clay
Riverton TWP	Clay
Jefferson TWP	Louisa

Source: USFWS.

The Iowa DNR Forestry Bureau has developed Community Wildfire Protection Plans (CWPP) for communities in Linn, Harrison, Johnson, Pottawattamie and Polk counties. These plans provide communities with information about how to reduce their wildfire risk. Figure 3.21 shows communities that have been identified to be at most risk of wildfire events and that would therefore also benefit from CWPPs.

Figure 3.21. Iowa Wildland and Urban Interface Risk Map.



Source: Kathryne Clark using Forest Service Fire Program data.

Figure 3.21 shows where there is a mix of housing and natural vegetation, which is referred to as a wildland-urban interface (WUI). The data behind the map tells us there are 84,982 people who live in these areas, which depend primarily on volunteer fire departments for their fire response needs.

Preparedness

Iowa's fire department firefighters are the front line of wildfire protection in Iowa. According to the State Fire Marshall's Office, there are 80,000 firefighters in Iowa; of these, approximately 20% or 16,000 receive some form of monetary compensation and the remaining 80% or 64,000 do not. There are approximately 850 community and rural fire departments in the state; of these, only 35 are career-track, most of which are located in larger cities and suburbs. Each fire department has equipment usable for both structure fires and wildfire, and most of Iowa's firefighters are trained or have experience in dealing with structure fires. Many Iowa firefighters have experience with wildfire, but few have formal training or equipment. Several State Fire Schools are coordinated by the State Fire Marshall's Office in cooperation with the Joint Fire Chiefs Council, Iowa State University and

The area classified as wildland-urban interface represents 262,803 acres in Iowa.

community colleges across the state. According to Response 2020, Iowa's fire departments are beset by the following problems:

- Lack of recruitment and retention of personnel
- Lack of daytime coverage
- High cost of training and equipment
- Increased hazards of responses
- Unfunded mandates
- Time constraints
- Administration demands
- Lack of available resources

Through the efforts of the State Fire Marshall's Office, DNR Forestry Bureau, Iowa Firemen's Association, Iowa Association of Professional Firefighters and many others, efforts to expand training, funding and equipment for wildfire management and control are underway for Iowa's fire department firefighters.

All 99 counties in Iowa have County Conservation Boards (CCB's) to manage their park, forest and wildlife areas; employee numbers range from two in Monroe County in southern Iowa to 40 in Polk County, and depend upon populations and the extent to which individual counties value their natural resources. The CCB's have long had interests in the use of prescribed fire as a management tool for prairie and savanna restoration efforts, and many of their employees have wildfire training and management experience.

A fire management plan has been created by a working group to guide fire policy for the state. Iowa's Wildfire and Prescribed Fire Management Goals:

- To protect public safety and property from wildfires
- To provide for firefighter safety through education and training, awareness and access to appropriate equipment
- To suppress all unwanted and undesirable wildfires regardless of ignition source protect the public, check fire spread and protect natural, cultural and historic resources
- To use prescribed fire where and when appropriate to meet natural resource management objectives
- To reduce wildfire hazards around developing areas using examples and education
- To facilitate open communications and cooperative efforts with all firefighting agencies and organizations to avoid duplication
- To advance overall wildfire management in Iowa
- To develop a Iowa Wildfire Action Plan for the DNR and the State of Iowa

Prescribed Fire Council

It is important to establish a viable statewide prescribed fire council in Iowa in order to increase professional awareness and networking and to promote safe use of prescribed fire for fuel reduction and ecological restoration in the WUI; such a council is also important because it provides an opportunity for agencies with conflicting agendas, such as those that promote prescribed fire and those in charge of suppressing it, to work together.

Many groups and individuals who embrace conservation and environmentalism in Iowa support the use of prescribed fire for ecological restoration of prairie and forests; however, these groups typically fail to recognize or acknowledge the possible health and safety impacts of fire on WUI's. Volunteer fire departments, county emergency management directors and elected local officials are often suspicious of prescribed fire use because of such concerns; these agencies have the authority to issue county burn bans even when prescribed fire can reduce wildland fire hazards. Developing a positive, long-term relationship between structural fire services and conservation organizations will benefit agencies that suppress fire as well as groups who support the use of prescribed fire in natural areas. Utilizing traditional Firewise concepts in Iowa is difficult because of the fragmentation of continuous fuels due to agriculture. Incidents of wildland fire or escaped prescribed fire are increasing as more and more of the remaining natural landscape is being developed into acreages with homes.

Rural Fire Departments in Iowa must be prepared to deliver fire suppression to areas that are beyond the reach of municipal water systems. The lack of available water resources for use against wildfires or escaped prescribed fire is a problem for rural fire departments across the state. When hauling large volumes of water to remote locations in tankers is not feasible, dry hydrants that have been established in existing water sources can be used to reduce the hauling distance for tanker trucks to fires.

Fire Assistance Programs

The goal of the rural fire program, through the cooperative State Fire Assistance (SFA) and Volunteer Fire Assistance (VFA) programs of the USDA-FS, is to protect Iowa's wildlands, forests and non-forests from damage from wildfire. The State and Volunteer Fire Assistance programs are geared toward providing Iowa communities of fewer than 10,000 residents with the training, organization and equipment necessary for adequate wildfire protection.

The SFA program focuses on wildfire prevention through the development and distribution of prevention materials; it also prioritizes the acquisition and distribution of federal excess property such as trucks, pumps, and breathing apparatuses. The Forestry Bureau fire staff provide wildfire training for volunteer firefighters, as well as state, county and community emergency personnel and natural resource managers. The VFA program works to increase the ability of Iowa's rural volunteer fire departments to protect lives, structures, and natural resources in rural and wildland-urban interface areas; it does this by providing financial, technical and other assistance to State Foresters, who then pass these resources on to local fire departments and fire training academies. Additionally, the program provides Federal Excess Personal Property (FEPP) and Department of Defense Firefighter Property DOD-FFP to volunteer fire departments and provides Smokey Bear fire prevention materials, which are used during promotions such as Fire Prevention Week.

Depending on the availability of funding, fire departments are able to purchase wildland gear, communication equipment, hand tools, portable tanks, portable pumps, small diameter hose and slip-on units and other types of equipment. The VFA program makes approximately $200,000 of federal funds available annually through grants to volunteer fire departments; a fiscal report of such funding is shown in Figure 3.22.

Figure 3.22. Distribution of VFA Funds to Rural Fire Departments.

Federal Fincial Year	VFW & VFA-NFP Funding made Available for Volunteer Fire Dept. Grants	Number of Iowa Volunteer Fire Dept. Provided Grant Funds
2004	$220,926	109
2005	$215,611	108
2006	$223,135	97
2007	$219,868	108
2008	$216,313	100

Source: Gail Kantak.

The General Services Administration (GSA) Federal Supply Service offers wildfire protection equipment and supplies to federal, state and municipal fire agencies and other organizations that operate under formal agreements with the U.S. Forest Service. The DNR Forestry Bureau, as an affiliate of the U.S. Forest Service, can assist fire departments in purchases of fire associated gear from the GSA Federal Supply Service.

Federal Excess Personal Property (FEPP) is acquired on behalf of the U.S. Forest Service and loaned to state forestry agencies and cooperators such as volunteer fire departments for use in providing wildland and rural community fire protection. Since 2004 a FEPP screener and equipment manager has been working with volunteer fire departments to help them with their equipment needs. The FEPP program has been a tremendous asset to the fire service community in enhancing the overall fire protection capabilities within Iowa. Currently there are 697 long-term inventory items valued at over $15.6 million being utilized by volunteer fire departments in Iowa. Figure 3.23 shows the amount and value of FEPP equipment annually acquired in Iowa between 1999 and 2008.

Figure 3.23. Value of FEPP Equipment Annually Acquired by Iowa Fire Departments.

FY	Number of FEPP Inventory and Non-Inventory Items Acquired	Value of FY Acquisitions
1999	76	$1,265,061
2000	138	$1,360,144
2001	46	$750,021
2002	36	$696,398
2003	80	$1,378,890
2004	41	$1,305,820
2005	66	$1,990,017
2006	49	$1,389,181
2007	36	$925,064
2008	21	$1,037,126

Source: Gail Kantak.

In August 2008, the Forestry Bureau entered into an agreement with the U.S. Forest Service that authorized the bureau to participate in the Department of Defense Firefighter Property (DOD-FFP) program. This program is similar to the FEPP program, with the exception that once the equipment is modified, ready to put into service and inspected by a DNR Forestry fire staff person, title is transferred to the fire department using the equipment. From October 2008 through December 2009, the Forestry Bureau has acquired 121 line items through DOD-FFP valued at $2,561,674.

Wildfire Risk

There are 438,760 acres of forest in the moderate to high risk category, and 118,842 acres in the very high to extreme category.

The map in Figure 3.24 below shows where forests in Iowa are at most risk for wildfire according to three weighted layers: the 40 Scott and Burgan Fire Behavior Fuel Model - Drought Condition (80%), Wildland-Urban Interface (10%), and Topography (10%). There are 438,760 acres in the moderate to high category, and 118,842 acres in the very high to extreme category.

Figure 3.24. Statewide Wildfire Risk Assessment.

Source: Kathryne Clark using satellite land cover from 2002 and Scott Burgan Fire Behavior Fuel Model.

Iowa has five weather stations located in Moderate and High wildfire risk locations; these stations are linked to satellites and are available as web-based applications for reporting and data sharing for all governmental agencies and non-profit organizations. The stations are located in Loess Hills, Shimek, Stephens, and Yellow River State Forests and in Broken Kettle Grassland.

Woodland burning. Photo by Bruce Blair.

3.4 Weather

According to NOAA National Climatic Data Center figures, averages for temperature and precipitation in Iowa have steadily increased from 1895 to 2008. Since record keeping began, temperature has increased in the state by an average of 0.10 degrees Fahrenheit (F) per decade, a trend reflected in Figure 3.26. In 2006 Iowa experienced the 5th warmest year on record with a statewide average of 50.3 degrees F. Three of the five warmest years on record have occurred since 1987; Figure 3.25 shows average temperatures for four of these five years, along with how that year ranks among the 113 years records are available to compare.

Figure 3.25. Selected Statewide Average Temperatures in Iowa.

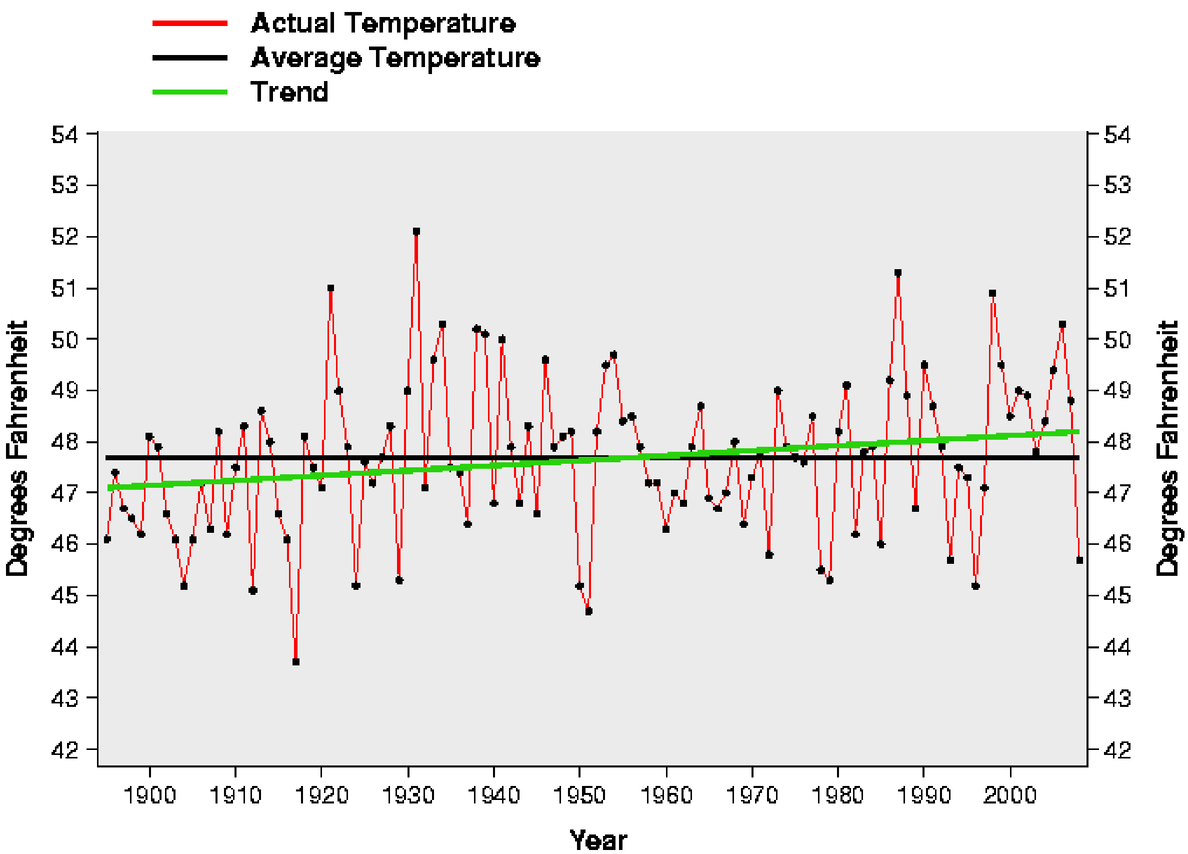
Year	Average Statewide Temperature (degrees F)	Historical Ranking (1895-2008)
2006	50.3	5
1998	50.9	4
1987	51.3	2
1931	52.1	1

Source: National Climatic Data Center, www.ncdc.noaa.gov/oa/ncdc.html.

Figure 3.26. Historical Temperature Trends for Iowa.

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)
National Climatic Data Center
U.S. Department of Commerce

Annual 1895 - 2008 Average = 47.67 degF
Annual 1895 - 2008 Trend = 0.10 degF / Decade



Source: National Climatic Data Center, www.ncdc.noaa.gov/oa/ncdc.html.

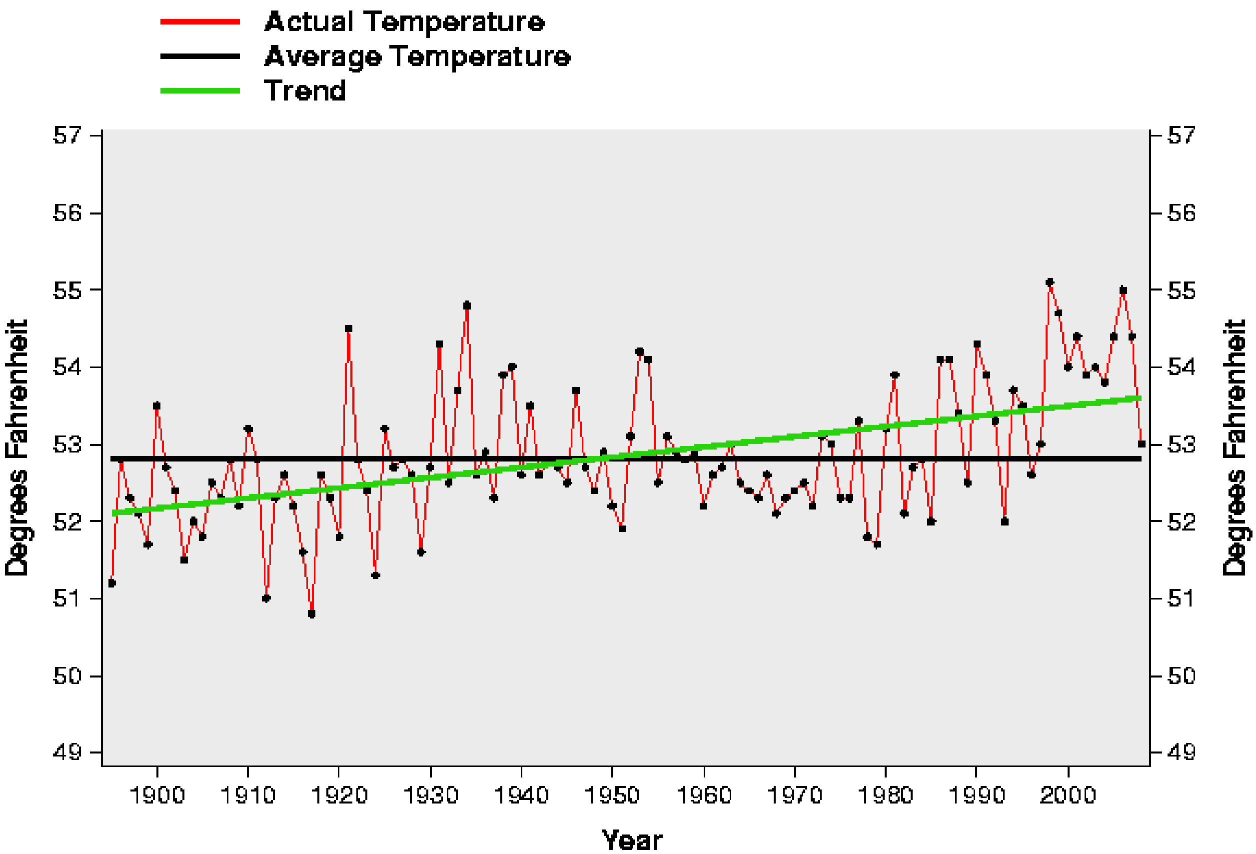
Figure 3.27 shows average national temperature trends over the same period as in Figure 3.26. It is worth noting that Iowa's average decade temperature increase of 0.10 degrees F is slightly lower than the national average of 0.13 degrees.

Figure 3.27. Historical Temperature Trends for the U.S.

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center
U.S. Department of Commerce

Annual 1895 - 2008 Average = 52.85 degF
Annual 1895 - 2008 Trend = 0.13 degF / Decade



Source: National Climatic Data Center, www.ncdc.noaa.gov/oa/ncdc.html.

Precipitation increased by an average of 0.35 inches per decade in Iowa from 1895 to 2008. Four of Iowa's five wettest years occurred from 1993 to 2008, including the wettest year on record (2008). Four of the state's wettest years, the amounts of precipitation in these years, and their overall historical rankings are given in Figure 3.28.

Figure 3.28. Selected Statewide Average Rainfall in Iowa.

Year	Average Statewide Precipitation (inches)	Ranking (1895-2008)
2008	43.07	3
2007	42.99	4
1998	40.31	8
1993	48.23	1

Source: National Climatic Data Center, www.ncdc.noaa.gov/oa/ncdc.html.

Figure 3.29. Historical Precipitation Trends for Iowa

NOAA Satellite and Information Service

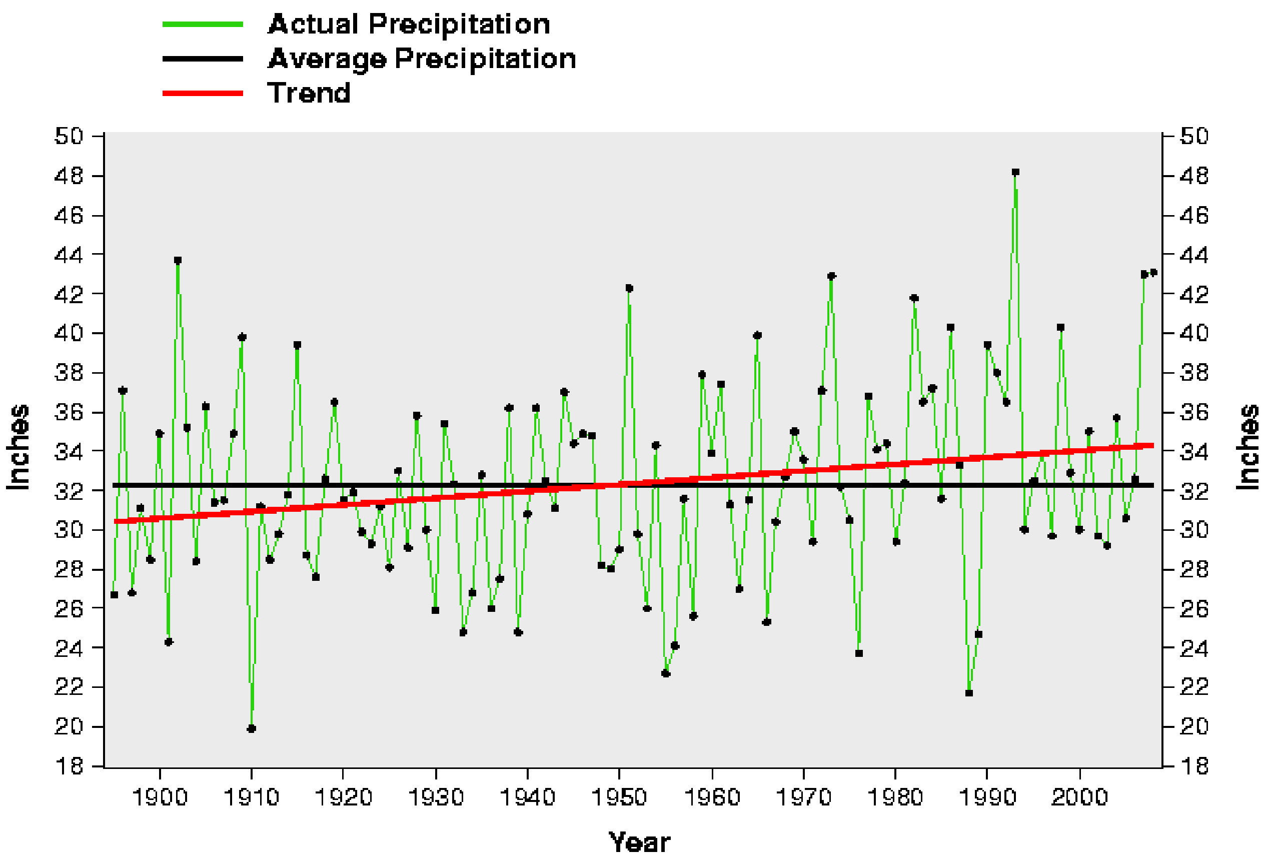
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center

U.S. Department of Commerce

Annual 1895 - 2008 Average = 32.35 Inches

Annual 1895 - 2008 Trend = 0.35 Inches / Decade



Source: National Climatic Data Center, www.ncdc.noaa.gov/oa/ncdc.html.

Figure 3.30 shows historical trends in precipitation for the U.S. as a whole. The average per-decade increase in precipitation in Iowa over this time period is more than twice that of the entire U.S.

Figure 3.30. Historical Precipitation Trends for the U.S.

NOAA Satellite and Information Service

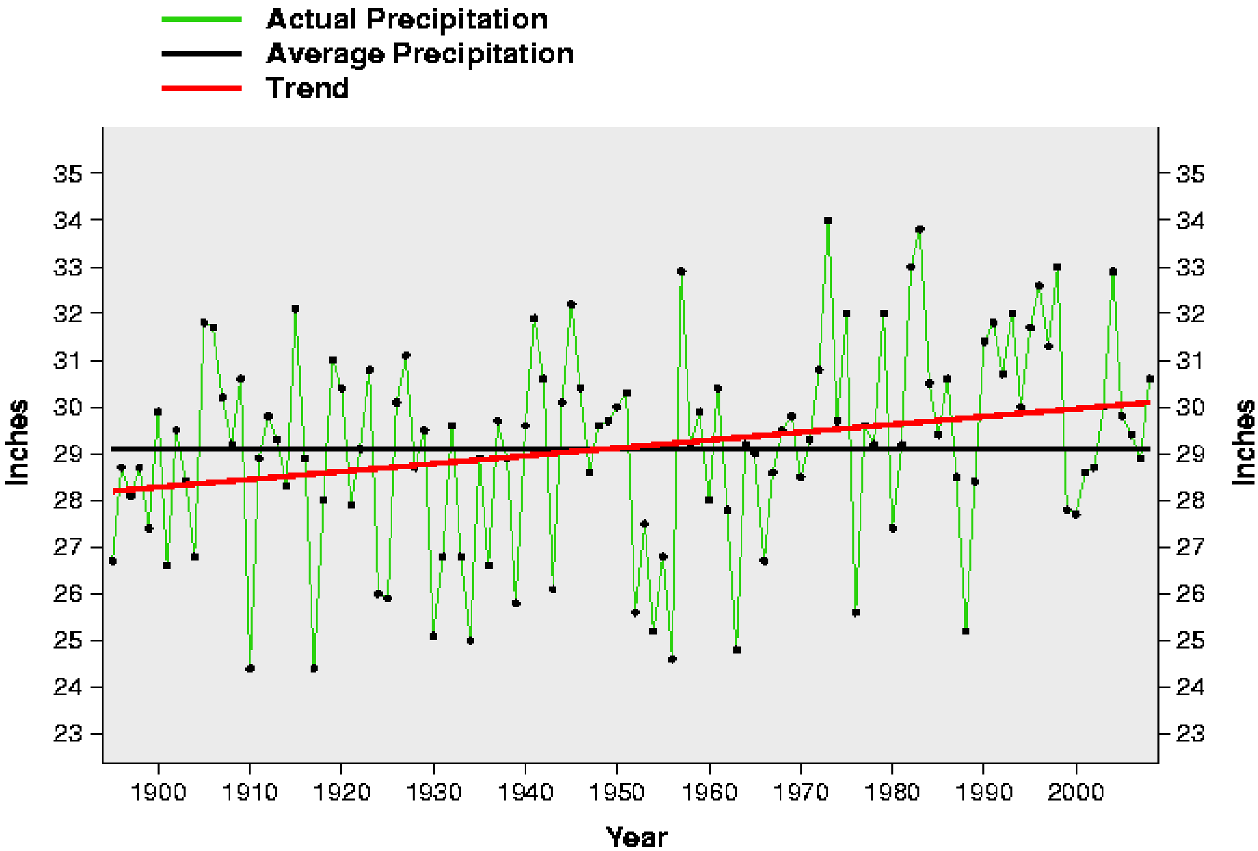
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center

U.S. Department of Commerce

Annual 1895 - 2008 Average = 29.14 Inches

Annual 1895 - 2008 Trend = 0.17 Inches / Decade



Source: National Climatic Data Center, www.ncdc.noaa.gov/oa/ncdc.html.

The trends reflected in the precipitation data indicate a need to maintain or improve the water holding capacities of existing rivers and floodplains. Topsoil erosion, water quality reduction, aquatic wildlife decline and increased expenses for water treatment plants and dredging operations will likely result if excess rainfall is not better managed. Although local weather conditions cannot be controlled, people can minimize the costs and affects of weather by using land appropriately, particularly along rivers.

3.5 Highlights of Issues Affecting Forest Ecosystem Health and Vitality

Threats to Iowa's forest resource include both native and non-native insects and diseases.

Lack of tree diversity and lack of available native growing stock put communities at risk to forest health threats.

Survey, outreach, detection and prevention efforts are crucial for keeping Iowa's forests healthy.

Iowa's average annual temperature and rainfall have been increasing since 1895, with rainfall increasing by twice the national average.

Ozone pollution causes growth loss and makes trees more susceptible to destructive insects and diseases.

Species that are not native to an ecosystem are likely to cause economic or environmental harm to people, crops, livestock and natural plant and wildlife communities.

Depredation reduces biodiversity and alters the species composition and structure within a forest ecosystem.

A lack of dedicated fire personnel reduces the ability of volunteer fire departments to react to wildfires in a timely manner.

Construction of homes and other establishments in the Wildland-Urban Interface (WUI) without consideration for wildfire threats puts people and property at risk to fire.

Lack of prescribed fire contributes to species composition changes in Iowa's forests.

Volunteer fire fighters in Iowa are decreasing in number, while those that remain often lack appropriate wildfire training and equipment.

4.0 Conservation and Maintenance of Soil and Water Resources

Soil and water are the foundation for all other forest resources. Soil, which has both living and nonliving elements, holds water between rainstorms and stores nutrients for plants and animals; it also acts as an anchor for vegetation and a seasonal or permanent home for a variety of burrowing animals, insects, and microscopic creatures. Soil conservation means maintaining site productivity and soil resource functions. Even though it can be formulated and restructured to support plant growth, soil is not considered a renewable resource because it takes thousands or even millions of years to develop.

Water resources include the physical features, habitat, and inhabitants of lakes, streams, and wetlands, as well as water itself. Forests and trees, whether urban or rural, help reduce storm water runoff, filter pollutants, store water and nutrients, clean and cool water, protect municipal water supplies, reduce flooding, replenish groundwater and provide fish habitat. Water quality depends upon the extent to which the watershed from which it comes is disturbed by pollution, bacteria and other factors.

The quality of Iowa's water is only as good as the quality of the soil that filters it. The topsoil that once grew prairies, forests and wetlands and which once purified water across the state has been eroding away since the time the state was first settled; in fact, half of the topsoil that existed prior to statehood has been lost in most of the state's sloping cropland. This productive soil has been washed into streams and blown across fields and ditches; as a result of this, aquatic systems have been choked and fertilizers and pesticides have damaged water sources and other natural areas.[41]

4.1 Iowa's Water

Programs and efforts designed to improve water quality are crucial for maintaining safe, healthy drinking water. Forest riparian buffer and bottomland hardwood tree planting practices, funded through the Conservation Reserve Program, are one way of using sound forest management practices to promote and improve water quality. In Iowa, however, the importance of tree planting and forest management practices to improve water quality is often overlooked. Emphasizing efforts in watersheds that provide domestic water supplies and watersheds containing impaired waters are good places to prioritize reforestation activities.

While certainly not pristine, Iowa lakes and streams may be cleaner than in the early 1900's, when they were polluted with sewage and industrial wastes. Federal studies of Iowa's surface waters in recent years have noted contaminants such as fertilizer, agricultural chemicals, industrial wastes, sewage and livestock manure. The need to remove excess water as quickly as possible to promote high yielding food crops has led to the tiling of millions of acres of agricultural crop land; there are currently over 800,000 miles of drainage tile lines, which is 7 times the length of Iowa's current road system.[42]

[41]Stone.
[42]Stone.

The removal of natural systems along water corridors leads to negative long-term consequences. The channelization of streams to increase cropland has reduced the water holding basin of most streams in Iowa and increased the likeliness of flooding in many areas across the state. This has led to a decrease in the amount of stream length available for water holding during rain events. During periods of heavy rainfall, areas with reduced storage capacity overflow, causing flood damage to agricultural fields and property. Remedies for such problems include wetland restoration and establishment of riparian buffer strips, which can increase water holding capacity during heavy rain events.


Photo by Photographic Services, University of Iowa.

Another consequence of stream channelization is increased water velocity, which accelerates the process of stream bank cutting. When these channelized streams meet natural, meandering streams, the increased energy is dissipated, but not before damaging the interface with the natural system. Over time, damage to the natural system results in decreased habitat for both terrestrial and aquatic creatures.

More time and money are required if monitoring of livestock wastes, urban runoff, pesticides, sewage facilities and non-point pollution is to be effective. River and lake protection can be achieved through watershed safeguarding, wetland restoration, and channelization prevention. The most economical way to address the problems created by improper land and water use is to teach landowners about the ways that their habits can affect the functioning of natural systems, and how damage to such systems can come back to harm them in the future.


Photo by Gary Hightshoe, Iowa State University.

According to NOAA, Iowa receives an average of 34 inches of rainfall each year; about two inches of this evaporates from trees and plants and returns to the atmosphere, four inches runs directly into rivers and lakes and another two inches soaks into the groundwater system. The rest is available for plants, trees and agricultural crops that produce valuable crops for the landowners that own them.[43]

Before Iowa's permanent vegetation was removed, water was usually slowly filtered and absorbed by soil structure that was seldom disturbed. Some of the water moved through the soil profile to underground aquifers providing clean drinking water that citizens still benefit from today. This clean source of water has become more important as the difficulty and costs of cleaning surface water increases. Now surface water carries fertilizers, chemicals, soil, and other pollutants due to the over 60% of the land under agricultural production and 700 communities not having adequate sewage systems.[44] The costs to correct and prevent problems with water quality as a result of land use decisions will continue to follow each generation that lives in Iowa.

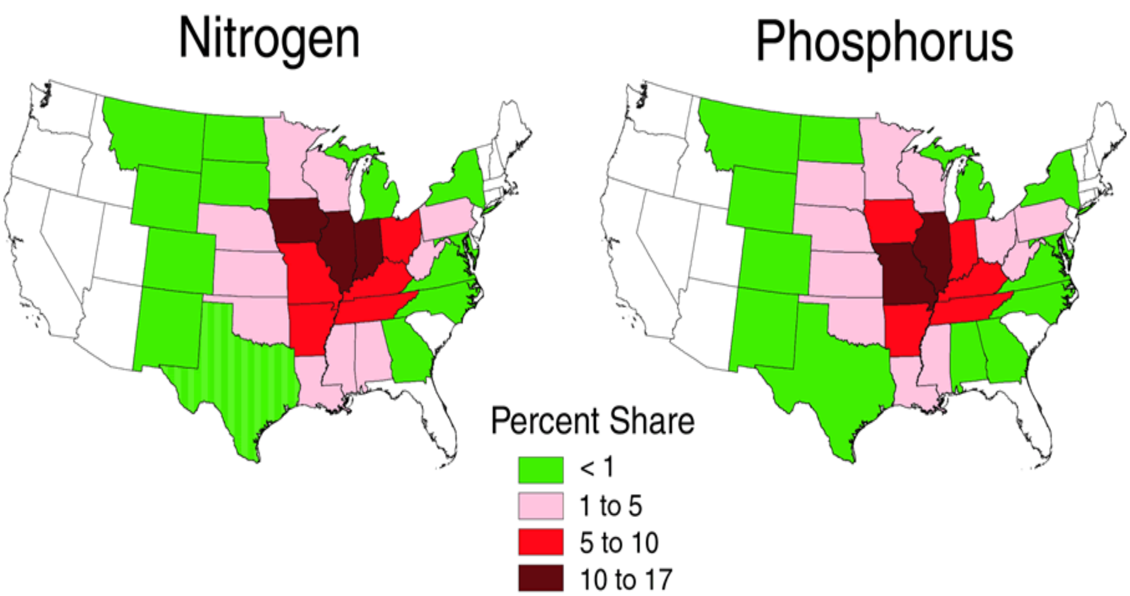
[43]Stone.
[44] <www.water.iastate.edu/Documents/SWCC_Soil_Water.pdf>. April 15 2010.

There are two sources of water pollution: point source pollution, which is poured directly into a water source from a pipe or other device, and nonpoint source pollution, such as sediment, nutrients, and bacteria, which washes into water sources from fields and other areas. While point source solution can be a problem, most water quality problems in Iowa are caused by nonpoint source pollution. Such pollution comes from watersheds, which are areas of land that drain into lakes or streams. To improve Iowa's water quality, watersheds need to be stabilized with permanent native vegetation to keep sediment, nutrients and bacteria from washing into streams and lakes.

Iowa farmers annually apply more than 3 billion pounds of chemical fertilizers and 45 million pounds of pesticides to agricultural fields. It is therefore no surprise that agricultural pesticides are detected in nearly every sample of rainfall taken during the growing season, in 26 percent of groundwater samples and in 78 percent of surface waters samples.[45] There have been a lot of studies reviewing the impact of agricultural chemicals on human health and the environment. Although the results vary, there are few who dispute that dispersal of these chemicals is widespread.

A computer modeling software program called SPARROW gives regional interpretations of water-quality monitoring data. The model relates in-stream water-quality measurements to spatially referenced characteristics of watersheds, including contaminant sources and factors that influence terrestrial and aquatic transport. SPARROW empirically estimates the origin and fate of contaminants in river networks and quantifies uncertainties in model predictions. Figure 4.1 shows which states contribute the greatest amount of nitrogen and phosphorus to the Gulf of Mexico.

Figure 4.1 Estimates of Nitrogen & Phosphorus Contributions to the "Dead Zone" in the Gulf of Mexico.



Source: USGS, water.usgs.gov/nawqa/sparrow/gulf_findings/by_state.htm.

Nitrogen from farm and lawn fertilizers, livestock manure and municipal and industrial wastes are expelled into Iowa's rivers and eventually travel down the Mississippi River system. The accumulated discharges of these pollutants into the Gulf of Mexico have reduced the amount of oxygen there, which has led to the development of the hypoxic zone or "Dead Zone". Roughly the size of New Jersey, this area gets its name from the near-complete lack of shrimp, fish and other marine life found there during the spring and summer months.[46]

[45]Stone.
[46]Roach, John. "Gulf of Mexico 'Dead Zone' Is Size of New Jersey." National Geographic News. May 25 2005. <news.nationalgeographic.com/news/2005/05/0525_050525_deadzone.html>.

The best way to improve Iowa's waterways is to permanently establish buffers of a certain width around lakes and on both sides of streams. The width of these buffers would depend upon soil type and land slope. Permanently establishing vegetation like trees along all water bodies and corridors would provide multiple long-term benefits to humans and wildlife.

Source: EPA, www.epa.gov/gmpo/nutrient/hypoxia_pressrelease.html.

Though installation of buffers between agricultural land and streams can help to decrease the amount of harmful chemicals that reach the water supply, tile systems can reduce the effectiveness of buffers by simply causing polluted water to flow underneath them. One solution to this problem is to break tile lines within buffers and allow the water to drain into natural or man made wetlands, which can then filter it before it flows back into streams. This would improve Iowa's streams while still allowing for the removal of excess water from cropland.

Forested wetlands are beneficial for improving water quality in the watersheds where they occur. Figure 4.2 shows the locations of forested wetlands in Iowa. The map was created using 2002 aerial photography as well as 1984 National Wetlands Inventory information provided by the U.S. Fish and Wildlife Service.

Figure 4.2. Forested Wetlands in Iowa.

Source: Kathryne Clark using satellite land cover from 2002 and National Hydrologic dataset.

Sediment deposition on an agricultural field located in a flood plain. Photo by Bruce Blair.

Toxic byproducts from human activity and excess silt take their toll in the form of fish kills. Photo by Ron Johnson.

Forest and wetland ecosystems have the ability to filter, trap and recycle sediment and other forms of pollution. However, having fewer of these systems in place has several consequences. One, there are not enough forests and wetlands to filter polluted water into a cleaner state. Second the forests and wetlands that remain are often damaged by being overwhelmed by the quantity of water being directed their way. For example, gullies develop within forests, when agricultural fields are adjacent and uphill to them. The agricultural fields do not have adequate soil structure because of tillage practices, causing water to runoff and down hill shortly after it begins raining.

The Influence of Pasturing on Water Quality

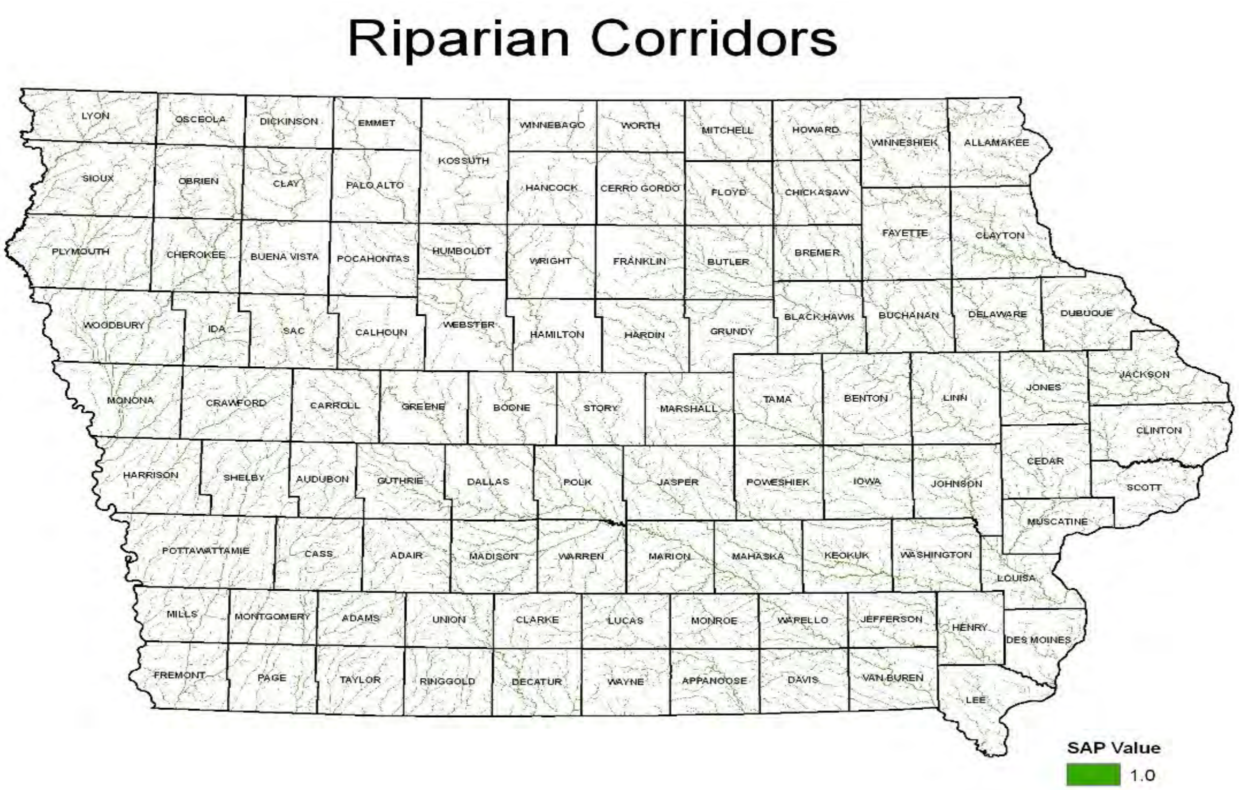
Streams that pass through pastures are often regarded as free water sources for livestock. Access to streams is usually unrestricted, which allows livestock to not only drink stream water but to walk and cool down within it as well. This activity accelerates erosion on soil-exposed stream banks and leads to the detriment of aquatic life and the plants that grow within or along the adjacent riparian corridors. These disruptions are often carried downstream, which leads to destruction of aquatic and plant life away from the initial source. An effective way to guard streams from livestock pollution and physical damage is to fence them off. Shade from tree plantings along these fences could provide an alternative to standing in the stream during the hotter summer months.

Establishing Buffers to Improve Water Quality

Buffers provide many benefits, including soil erosion control, improved water quality through removal of sediment, fertilizers, pesticides and other runoff pollutants, improved air quality, enhanced fish and wildlife habitat, flood control, energy conservation, beautification, improved farm safety and protection of buildings, roads and livestock.

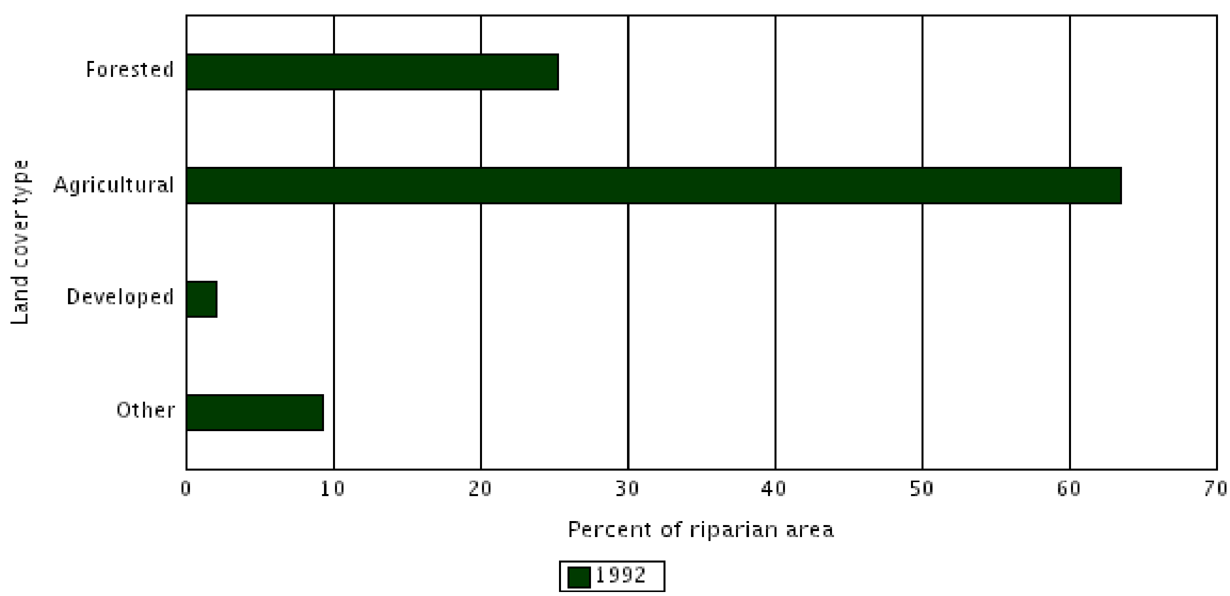
The National Hydrologic Dataset provides the most detailed water layer available for Iowa. Since floodplain information isn't available in digital format for most Iowa counties, stream order is the best indicator of riparian habitat potential. The higher the stream order, the greater the potential for that floodplain to support larger stands of bottomland forest. First order streams were excluded from Figure 4.3, which shows existing riparian corridors in Iowa. As of 2002, there were 435,000 acres of riparian forest, and historical data has shown that more than 100,000 of such acres have been lost since Iowa was first settled. If all the streams in the state had buffers of 25 meters, there would be 1,555,498 acres of riparian corridors.

Figure 4.3 Existing Riparian Corridors in Iowa, 2002.



Source: Kathryne Clark using National Hydrologic dataset.

Figure 4.4 Percentage of Forest and Other Land Cover Types in Iowa Riparian Areas.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

As Figure 4.4 indicates, agriculture was the land use in over 60% of the riparian area in the state in 1992. Tile lines are often used to improve crop yield through the removal of excess water, which keeps the roots of crops out of standing water. Channelization puts pressure on existing streams to hold water that is being removed from cropland at a faster rate than would occur within a natural system. Increased flooding has resulted from the alterations made to hydrological drainage systems that existed prior to agricultural development. Due to the removal of permanent vegetation for the sake of agriculture, there is a large number of impaired waterways in the state.

If every stream with a defined channel in Iowa had a 25 meter buffer, there would be 1,555,498 acres of water quality protection and aquatic habitat for a variety of species. This would not only provide long-term water quality benefits but would also cut down on nitrogen runoff. There would be less strain on water treatment plants because agricultural runoff could be intercepted within the buffers. Using trees in buffers deters landowners from converting the land to other uses while providing important aesthetic views and wildlife corridors. Reforestation of riparian areas could reduce flood damage to private property so long as houses and business were not allowed to be constructed within these zones.

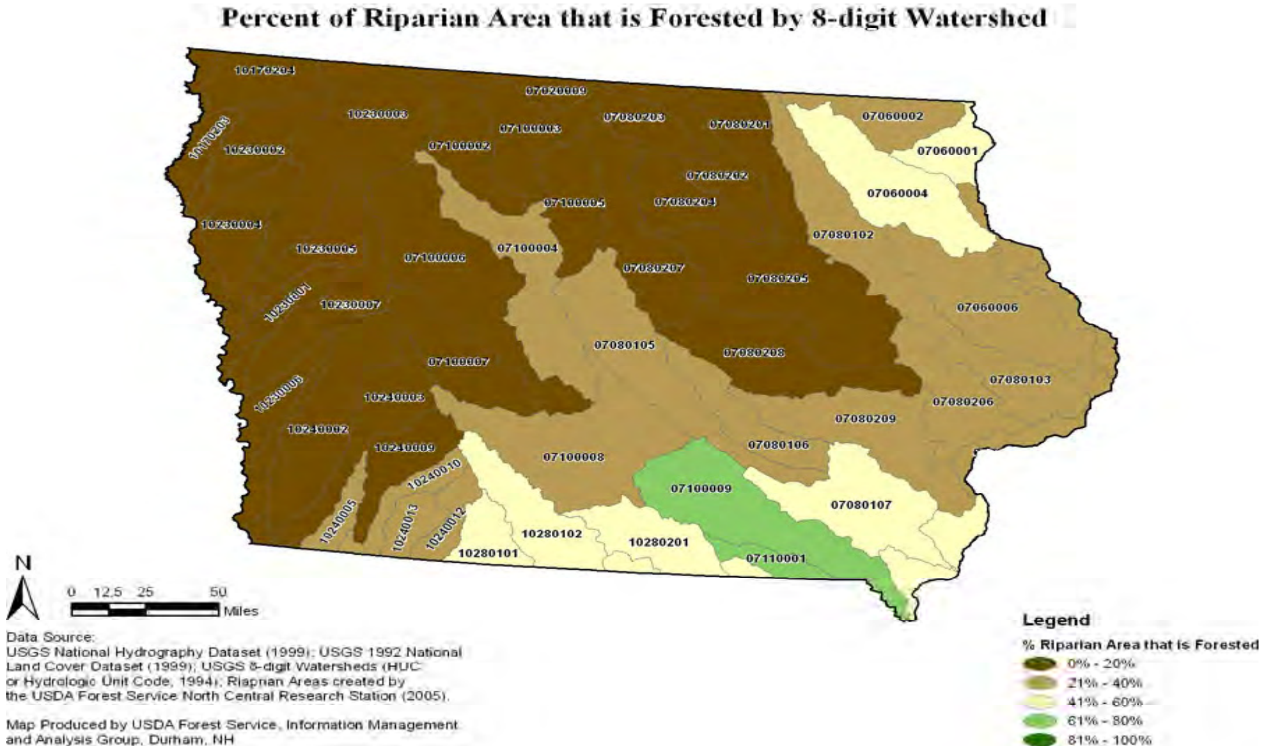
Buffers can cut sediment in surface runoff by as much as 90%, cut nitrogen and phosphorous runoff by 80%, and support five times the number of bird species as cropped or heavily grazed land. Additionally, buffers remove nitrates from the groundwater, reduce streambank erosion and increase soil organic matter.[47]

Streamside forests support healthy fish by supplying essential woody debris and adequate organic food. The loss of trees along streams results in fluctuating water temperature, as water heats up from the sun during the day and then cools off significantly at night; such fluctuations make it difficult for fish to breed successfully, and can therefore adversely affect populations. Trees also provide debris critical for the successful maintenance of cold-water fish such as trout and serve as habitat for insects, which are an essential part of the food chain in aquatic systems.

The watershed map in Figure 4.5 shows that most of Iowa's riparian areas are not forested; the most heavily forested riparian areas are in southeast Iowa, while the least-heavily forested areas are in northern and western Iowa.

[47]<www.buffer.forestry.iastate.edu/Assets/10_things.pdf>. April 15 2010.

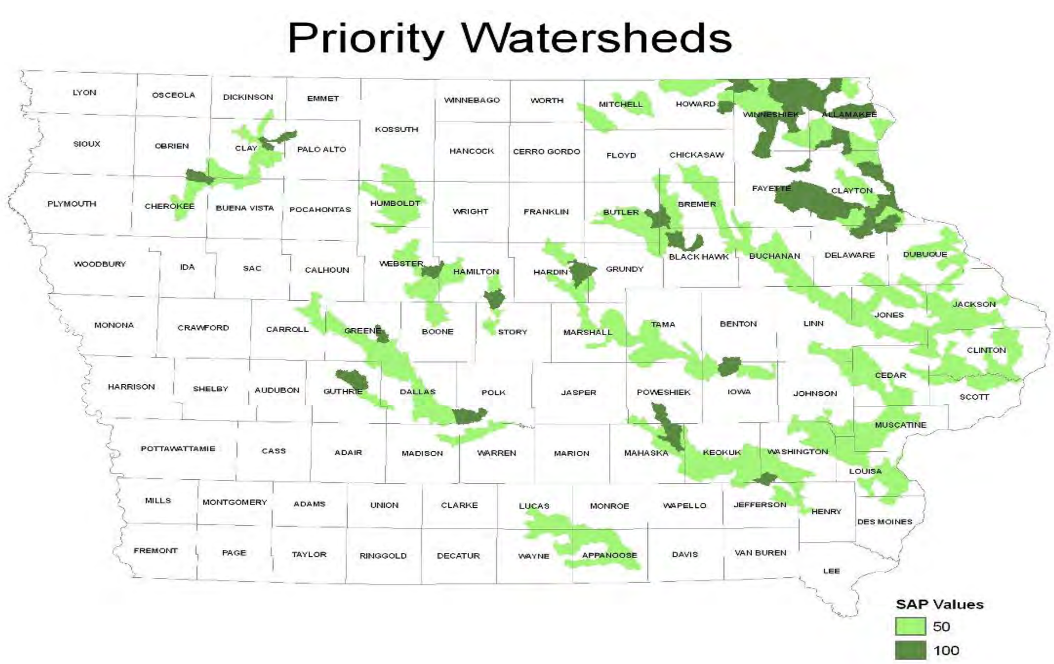
Figure 4.5 Percent of Riparian Area that is Forested by 8-digit Watershed.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Water quality depends on the way that land within watersheds is used, and surface water quality is one of the most serious and pervasive environmental issue facing Iowa. Figure 4.6 shows watersheds in the state that contain high quality resources, have significant public-owned lakes, supply drinking water to communities and are impaired because of excess sediment. It is difficult to prioritize watersheds because of changing environmental and land use factors from one year to the next.

Figure 4.6. Priority Watersheds in Iowa.



Source: Kathryne Clark using impaired streams classified under 303d from 2002, significant public lakes in Iowa, impaired streams from 2002, and water use for surface water intakes.

Lack of permanent vegetation for Iowa's waterways, rivers, and soil makes water more expensive. As Figure 4.7 shows, water treatment plant costs increase by about 25% for every 10% of forest that is removed from the watershed that supplies the drinking water for a particular community.[48]

Figure 4.7. Water Treatment Cost based on Percentage of Watershed that is Forested.

Percentage of Watershed Forested	Chemicals and Treatment Costs	Average Treatment Costs/day	Percentage Increase in Cost
10%	$115	$2,530	24%
20%	$93	$2,046	27%
30%	$78	$1,606	26%
40%	$58	$1,276	26%
50%	$46	$1,012	24%
60%	$37	$814	

Source: Trust for Public Lands & The American Water Works Association.

Community Stormwater

Stormwater is created when rain falls on roads, driveways, parking lots, rooftops and other impervious surfaces that do not soak up moisture. When dealing with stormwater, communities are faced with the challenge of moving water away from existing infrastructure quickly in order to avoid damage without flooding and polluting already degraded lakes and streams; untreated stormwater that is not filtered before it enters streams causes damage to aquatic habitat and wildlife that depend on safe water for survival.

Each time it rains the water within a community collects and transports pollutants to community wastewater receptacles that eventually drain into manmade ditches or natural water systems. Many different pollutants, including sediment, nitrogen, phosphorus, bacteria, oil, grease, trash, pesticides and metals, are found on impervious surfaces. Research has shown that there is a direct correlation between the amount of pollution and the amount of impervious cover within a community.[49]

Encouraging new developments to create better filters for stormwater runoff is one approach to dealing with this problem. Using green infrastructure such as trees, forests and other vegetation and their associated soils to absorb and filter stormwater is the best alternative to "hard infrastructure" like pipes, pumps and storage chambers. It is also economical, as it spares communities from having to continuously spend money updating exhausted infrastructure. In addition to its benefits for stormwater runoff, green infrastructure also provides public places for recreational activities and can improve community aesthetics. Finally, trees improve air quality, provide shade to impervious barriers that reduce air temperatures, reduce heating and cooling costs nearly 30% for businesses and residents, increase property values by as much as 15%, provide habitat for wildlife and hide water treatment plants and other eyesores.[50]

Despite the numerous low-cost benefits that trees provide, most communities are too focused on the short-term goal of regulating pollution levels from water treatment plants to consider the long-term strategy of using trees to prevent such pollution. Unfortunately, leaving green infrastructure in tact to address stormwater runoff is not a top priority for developers either, who are more concerned with trying to maximize the number of housing units they can build in a parcel of land.

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[48]Trust for Public Lands. <www.tpl.org/tier3_cd.cfm?content_item_id=21899&folder_id=1885>. March 4 2010.
[49]"Watershed Forestry Resource Guide - 2008." <www.forestsforwatersheds.org/reduce-stormwater/>. March 9 2009.
[50]Stone.

4.2 Soil Quality

Soil quality refers to the capacity of a soil to function within ecosystem and land use boundaries, to sustain biological productivity, to maintain environmental quality, and to promote plant and animal health. To grow crops, support plants and animals, and process water and air, soil must be a dynamic resource, filled with essential living organisms. There are ways to protect soil health from the ailments of erosion, chemical overuse, weed infestations, and loss of organic matter. Like a person's skin, topsoil is a fragile layer that defends the integrity of a complex, living organism, and future generations depend upon its condition.[51]

Corn stubble left on fields during the winter holds soil and moisture in place, helps prevent wind erosion, benefits wintering wildlife, and adds nutrient material to the soil in spring. Photo by Photographic Services, University of Iowa.

As with crops, the quality and quantity of trees in a particular area are directly proportional to the quality and quantity of the soil in which they grow. Trees growing on sites with deep, fertile, well-drained soils grow taller and broader than trees growing on sites with shallow or compacted soils and eroded areas. There are over 18 million acres of land in Iowa with soils suitable for growing more than 200 board feet and over 28 million acres capable of growing more than 150 board feet of wood per acre per year. Trees also grow better in areas with little competition from grass, weeds and other vegetation, as such areas allow them to access light and moisture easily and early in their development. This is valuable from an economic standpoint because it allows a tree to put on diameter growth sooner and more quickly, which in turn shortens the time it takes for it to reach a merchantable size. Despite all of this, convincing landowners that they can improve their stocking levels through better management continues to be a challenge in the state.

Aerial view of cropland interrupted by a stream, a drainage ditch, and a fence line. Iowa's land is working land - most of it is used, not idled, and it is focused on nurturing cultivated plants from extraordinarily productive soils. Photo by Drake Hokanson.

Soil productivity has influenced the vegetation grown on almost every acre of Iowa's soils since 1850, and the issues of erosion, degraded water quality and wildlife habitat have faced every landowner since. It has been determined

[51]Stone.

There are almost 29 million acres of soil suitable for growing trees in the state.

that by 1936, 87% of Iowa's land showed signs of erosion resulting from land cover conversion; it was also predicted that 35% of the original surface soil had already been washed or blown away.[52]

History and research has shown that maintaining permanent vegetation like trees and native prairie grasses on highly erodible soils benefits the fish that live downstream and the wildlife living in the area; it also leads to better water absorption, provides wood materials for lumber and firewood and protects against wind. Unlike agriculture, which requires high input costs and favorable weather conditions, relies on monoculture, alters habitat and soil and often fails to produce a profit, maintenance of healthy forest land can provide numerous resources for human consumption, habitat for wildlife, and maintenance and improvement of highly erodible soils.

There are almost 29 million acres of soil suitable for growing trees in the state. Figure 4.8 shows the number of acres in the state for each of 10 woodland suitability units (WSU), a measure that groups various soil types together based on their ability to grow a certain volume of wood during a year. Iowa's productive soils could provide benefits to the forest products industry and to landowners wishing to grow trees because, as the figure shows, the most productive WSU category contains the greatest number of acres of land of any category for the state.

If all of the soils listed in Figure 4.8 had trees established and growing on them, they could yield over $2 billion worth of timber annually (assuming a value of $0.30 per board foot); even more impressive is that this number doesn't take into account ecosystem services such as improved air and water quality, increased carbon sequestration, improved wildlife habitat and greater recreational opportunities. Unfortunately, people still fail to see the benefits, including monetary ones, provided by such services in addition to the better-understood monetary benefits of timber itself, which is one reason that trees continue to lose out to crops in Iowa.

Figure 4.8. Number of Acres for Growing Trees in Iowa by Soil Suitability Rating.

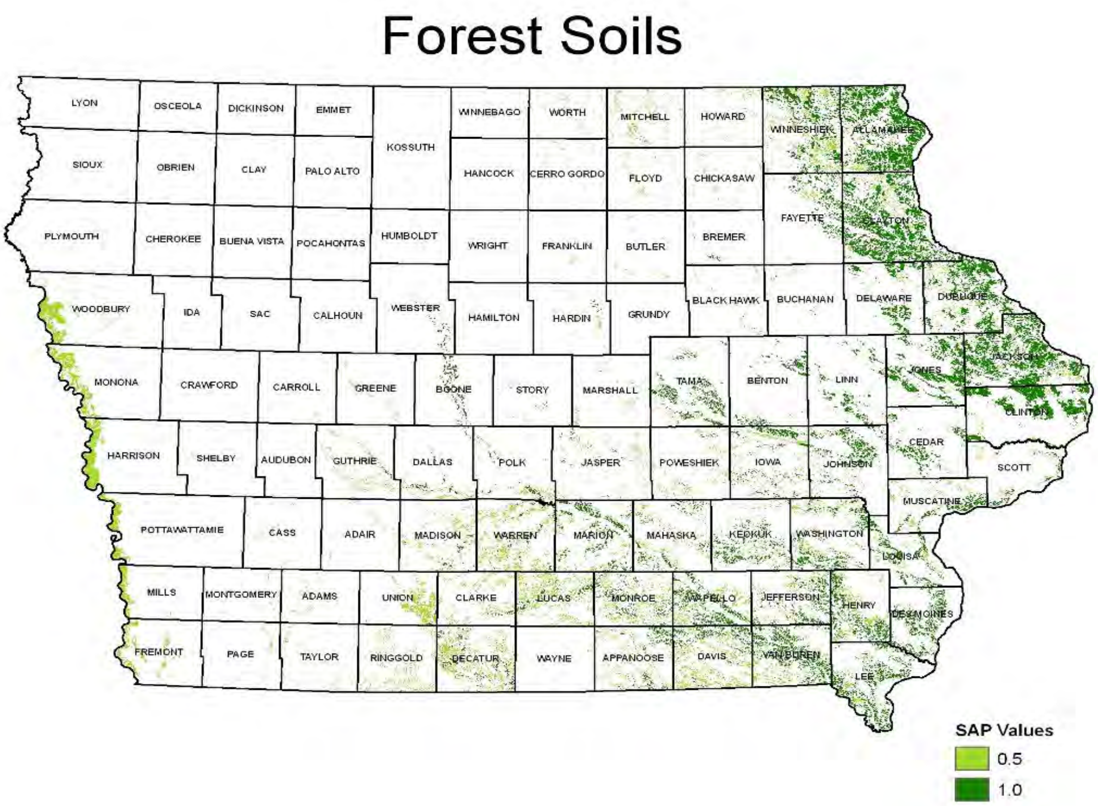
WSU	Acres	Annual Growth bdft/year	Value at $0.3 per bdft	Production (bdft/ac/yr)
1	8,259,349	1,445,386,075	433,615,823	150-199
2	9,058,360			
3	15,820,675	4,350,685,625	1,305,205,688	250-300
4	2,515,764	566,046,900	169,814,070	200-249
5	1,200,503	210,088,025	63,026,408	150-199
6	437,545	98,447,625	29,534,288	200-249
7	565,704	70,713,000	21,213,900	100-149
8	1,882,026			
9	2,385			
10	684,167			
Total			**$2,022,410,177**	

Source: Kathryne Clark using Iowa cooperative soil survey and Iowa DNR geological survey data.

[52]Walker, R.H., and Brown. P.E. "1936 Soil Erosion in Iowa." Journal of Geography 36 (1937): pp. 118-120.

Knowing where soils that were developed under forest conditions are located is a good historical reference when deciding where to prioritize returning areas lost to other land uses back to forests. The forest soils map in Figure 4.9 uses the SSURGO soils data revised by the Natural Resources Conservation Service to show areas of the state where soils were developed by forests; based on this information, a total of 8,883,857 acres were developed in this way. Transitional soils, shown on the legend by the value 0.5, represent 4,888,604 acres while forested soils, shown by the value 1.0, represent 3,995,253 acres.

Figure 4.9 Soils Developed by Forests in Iowa.

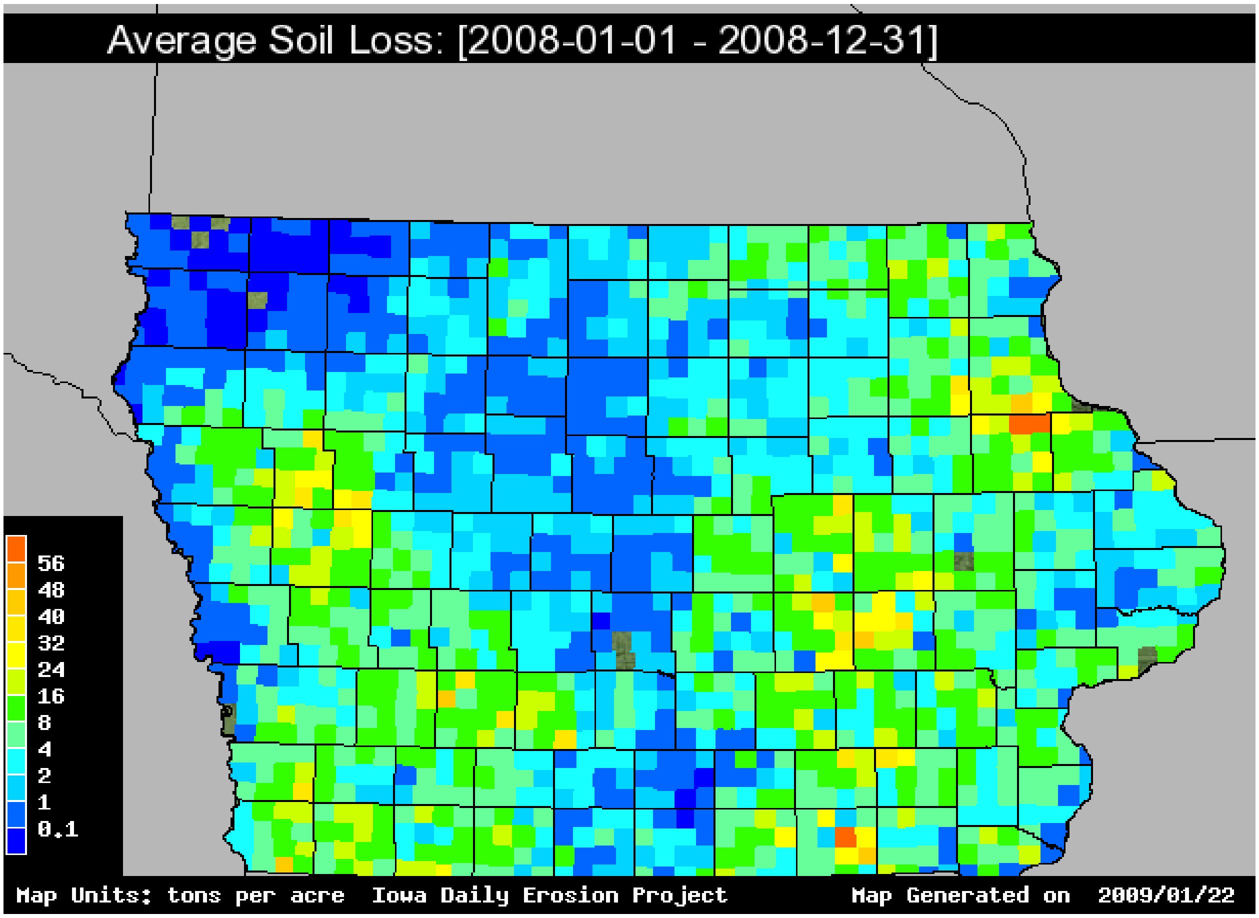


Source: Kathryne Clark using Iowa cooperative soil survey and Iowa DNR geological survey data.

4.3 Soil Erosion

Soil erosion occurs when the rate of soil loss is greater than the rate of soil formation for a particular site. Reductions in productivity from erosion reduce the value of that land as well as limit the vegetation that can grow on it. Figure 4.10 shows the estimated amount of soil loss for Iowa in 2008 in tons per acre. The map is generated from rainfall and climate information, characteristics about the land and information about land-use management practices. As the legend shows, the southwest and southeast quarters of the state had the most erosion in 2008. Looking at the state as a whole, there was an average of at least one ton of soil erosion per acre of land during this time period. Clearly this is not a sustainable loss that will allow Iowa to remain a leader in agricultural production.

Figure 4.10 Average Soil Loss in Iowa for 2008.



Source: Iowa State University, wepp.mesonet.agron.iastate.edu/GIS/erosion.phtml?pvar=avg_loss_acre&dstr=03/04/2008.

Soils represent the basic support system for terrestrial ecosystems because of their role in providing nutrients, water, oxygen, heat, and mechanical support to vegetation. Any environmental stressor that alters the natural function of the soil has the potential to influence the productivity, species composition, and hydrology of forest systems.

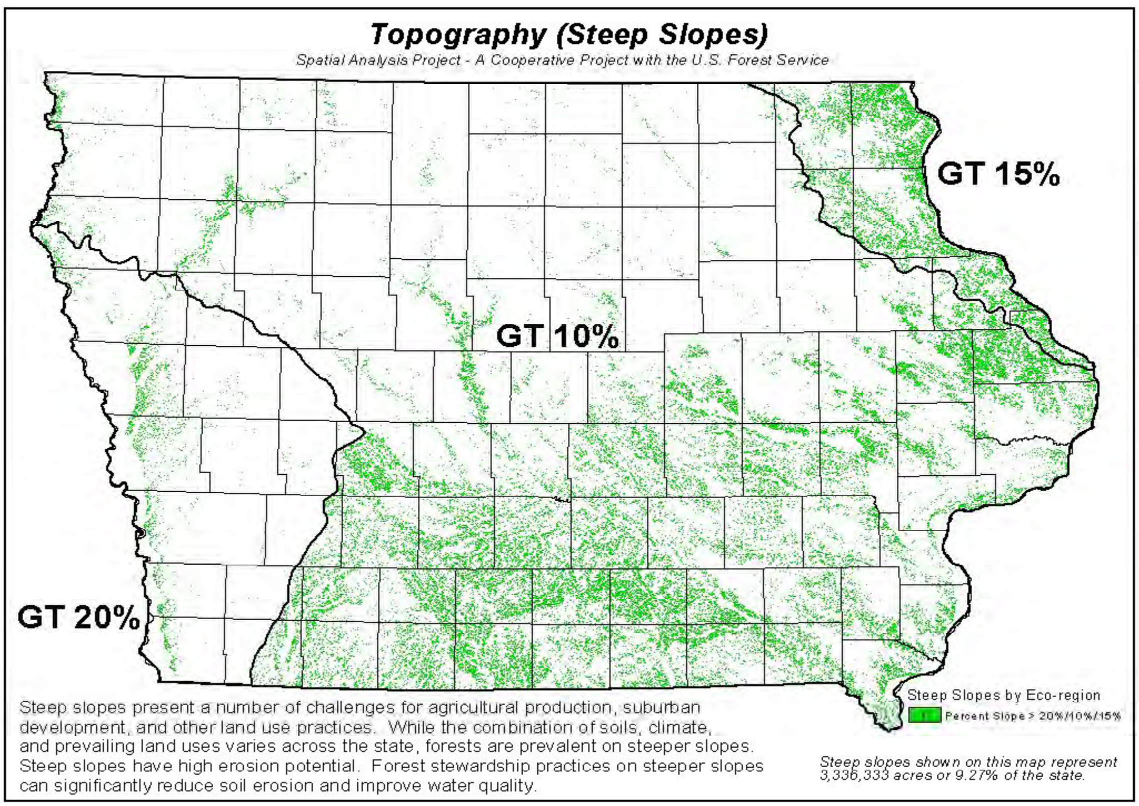
Soil in the state is so rich, productive and plentiful that it is often taken for granted that it will always be there for future generations. Unfortunately, the desire of farmers to derive as much income from agriculture as possible each year usually conflicts with practices that conserve the environment, and put the state's soil at risk to erosion and degradation. Growing permanent vegetation like trees on sensitive soils is one way to permanently conserve soils that are prone to erosion problems; it also makes agricultural production less attractive because it requires such a significant investment of time and money for land conversion. Furthermore, cost-share opportunities can provide landowners with monetary incentives to grow trees on their property, which makes the farming less attractive as well. On the other hand, if grasses are planted rather than trees, plowing becomes much easier and it is more likely that such land will simply revert back to farmland.

Forests on sensitive soils, or soils comprised of more than 10% sloping land, benefit from having all of the water on their upper slopes intercepted and diverted by buffers or terraces. Forests on highly erodible soils require buffers between them and adjacent agricultural fields in order to prevent gullying and scouring of their soils. With proper buffering, forests can hold onto these thin soils, which are sometimes located on very steep terrain, while providing valuable wildlife habitat and improving water quality.

Figure 4.11 shows the slopes estimated from the National Elevation Dataset (NOTE: GT stands for "Greater Than"). Slope is a major determinant of land use and susceptibility to erosion. Soils and general terrain relief of a region largely determine land uses and the amount of erosion that is thereby produced. The colored areas on the map show where there are slopes greater than the number associated with each of the three sub-regions displayed. According to these slope criteria, more than 3.3 million acres of land in Iowa are considered to have steep slopes.

Trees growing on productive soils experience healthy levels of growth. Photo by Bruce Blair.

Figure 4.11 Slope Land Percentage in Iowa.



Source: Kathryne Clark using USGS National Elevation dataset.

Air is critical for plant root respiration and nutrient absorption, and soils should ideally be comprised of roughly 50% air by volume. Encouraging loggers to harvest only when the ground is frozen and to follow other sound management practices is necessary to prevent forest soils from becoming compacted, which causes them to lose the air so crucial for healthy plant growth. Though soils do rebound from the negative effects of compaction, this usually takes quite a while.

Figure 4.12 shows that between 1850 and 2002, most forests growing on soils with very little slope were lost in Iowa. Such soils tend to be highly agriculturally productive, while steeper slopes are more likely to remain forested because they are not suitable for growing crops. As this figure shows, Iowa has lost at least 9% of its forest for each slope category since 1850.

Figure 4.12 Number of Acres of Forest Land on Different Slopes in Iowa, 1850 and 2002.

Slope	Forest Acres in 2002	Percentage Found on Each Slope 2002	Forest Acres in 1850	Forest Acres Lost 1850-2002
A (0-2%)	877,829	30.7	1,961,756	-1,083,927
B (2-5%)	333,050	11.7	974,850	-641,800
C (5-9%)	274,927	9.6	1,082,614	-807,687
D (9-14%)	367,044	12.9	1,063,993	-696,949
E (14-18%)	298,744	10/5	556,837	-258,093
F (18-24%)	382,434	13.4	506,287	-123,853
G (24% +)	321,205	11.2	334,779	-13,574

Source: Kathryne Clark using Iowa Cooperative Soil Survey, Iowa DNR Geological survey data and General Land Office (GLO) maps as surveyed from 1836-59.

Figure 4.13 shows that more than 25% of forests growing on slopes of 18% or greater have been lost in Iowa since 1850. Not only does such forest loss lead to a reduction in wildlife habitat, but removal permanent vegetation on such steep slopes negatively impacts water quality, which leads to a reduction in suitable habitat for aquatic organisms. Furthermore, the more sedimentation, nitrogen and chemical runoff that enters into Iowa's rivers, the greater the cost to taxpayers who must bear the financial burden of the larger and more sophisticated water treatment plants required to make their drinking water safe.

Figure 4.13 Percentage of Forest Land on Different Slopes in Iowa, 1850 & 2002.

Slope	Forest Acres in 2002	Percentage Found on Each Slope 2002	Percentage of Forest lost 1850-2002
A (0-2%)	877,829	30.7	55.3
B (2-5%)	333,050	11.7	65.8
C (5-9%)	274,927	9.6	74.6
D (9-14%)	367,044	12.9	65.5
E (14-18%)	298,744	10.5	46.3
F (18-24%)	382,434	13.4	25.5
G (24+)	321,205	11.2	4.1

Source: Kathryne Clark using Iowa Cooperative Soil Survey, Iowa DNR Geological survey data and General Land Office (GLO) maps as surveyed from 1836-59.

According to Figure 4.14, slightly more than 667,000 acres of land with a slope greater than 14% and over 2.6 million acres with a slope greater than 9% were farmed in 2008. These are areas where permanent vegetation could have the most positive impact on wildlife habitat, soil erosion and water quality.

Figure 4.14 Percentage of Agricultural Land in Production on Various Slopes.

Slope	Agriculture Acres 2002	Percentage found on each slope 2002
A (0-2%)	10,112,056	45.0
B (2-5%)	6,286,462	28.0
C (5-9%)	3,354,199	14.9
D (9-14%)	2,056,826	9.2
E (14-18%)	526,436	2.3
F (18-24%)	118,814	0.5
G (24+)	22,543	1.0

Source: Kathryne Clark using Iowa Cooperative Soil Survey and Iowa DNR Geological survey.

Pasture land is another example of land that would benefit from establishment of permanent vegetation. Compaction by livestock leads to trails, which can turn to depressions and then become gullies if land usage and soil are conducive to such an outcome. Over the years these gullies will cut deeper and deeper, degrading the quality of the pasture and the water due to soil loss. Tree root systems are deeper and therefore hold soil in place better than the cool season grasses and alfalfa typically found in pastures. As Figure 4.15 indicates, there are over one million acres of pasture land on slopes greater than 9% in Iowa.

Figure 4.15 Percentage of Pasture Land in Production on Various Slopes.

Slope	Pasture Acres 2002	Percentage found on each slope 2002
A (0-2%)	465,776	18.4
B (2-5%)	444,643	17.6
C (5-9%)	529,407	20.9
D (9-14%)	571,112	22.6
E (14-18%)	306,402	12.1
F (18-24%)	158,875	6.3
G (24+)	54,856	2.1

Source: Kathryne Clark using Iowa Cooperative Soil Survey and Iowa DNR Geological survey.

Planting permanent vegetation on slopes greater than 9% across the state is a great way to stabilize sensitive soils and allow for the development of a soil structure that is better able to absorb rainfall and reduce sediment and nutrient runoff; this would in turn improve water quality, which is not only important for wildlife and aquatic habitat but important for human consumption as well.

A piece of land is only as valuable as the soil that it contains. Landowners who work to conserve and enhance the quality of their soil will be able to derive more long-term income from their land than those who sacrifice long-term soil quality for short-term financial gain. The harsh reality is that Iowa will probably never again have as much permanent native vegetation as it had 160 years ago; however, prioritizing land use based on soil quality, slope and position in respect to rivers and other bodies of water is one way to ensure the regeneration of sensitive soils for the future. Financially speaking, soil conservation would help landowners maintain their land values, reduce water treatment costs and reduce damage to personal property from flooding. If you add these benefits to the aforementioned environmental ones, it becomes evident that soil conservation is a win-win situation for both people and the earth.

4.4 Highlights of Issues Affecting Conservation and Maintenance of Soil and Water Resources

It is necessary to develop programs that provide landowners with monetary incentives for good conservation practices.

Forest cover is generally not recognized as a viable option for improving water quality.

High levels of pollution such as coliform bacteria, pesticides and excess nitrates have taken time to build up in Iowa's water, and improving the state's water resources for this and future generations is a long-term, on-going process.

If all streams in Iowa of an order greater than 1 contained a 25 meter buffer, there would be over 1.5 million acres of riparian buffers, or more than three times as many acres as currently exist.

Because Iowa has lost more than 56% of its forest cover since 1850, Iowans are forced to pay an average of 125 -150% more for their clean water than they would have to pay if these forests still existed.

Green infrastructure is not well incorporated into community storm water management plans.

In 2008, Iowa lost at least one ton of soil per acre statewide to wind and rain erosion.

Due to long payback periods and lack of incentives for tree growth, most landowners choose to devote their land to growing crops instead of healthy forests.

Encouraging loggers to harvest only when the ground is frozen and to follow other sound management practices is necessary to prevent soil compaction.

From 1850 to 2002, Iowa lost more than one million acres of forest to agriculture on land with slopes greater than 9%.

Since 1850 Iowa has lost more than 25% of its forest on slopes 18% or greater.

Over one million acres of land is currently being used for pasture on slopes greater than 9%.

5.0 Maintenance of Forest Contribution to Carbon Cycles

Carbon dioxide, methane and nitrous oxide, the so-called “greenhouse” gases, have changed the composition of the earth’s atmosphere and are strongly implicated as potential sources of climate change. The concentration of carbon dioxide has been increasing since the 18th century, and greenhouse gases warm the earth by allowing sunlight to reach the earth’s surface while simultaneously blocking heat from escaping; some of the gases also thin the ozone layer that shields the earth from harmful solar radiation.

Growing forests store carbon naturally in both the wood and soil in a process called carbon sequestration. Trees are about 50 percent carbon, and wood products from harvested trees continue to store carbon throughout their lives as well. In general, forest activities such as tree planting increase carbon sequestration, while activities such as prescribed burning release carbon into the atmosphere. Increasing carbon stored in urban and rural trees and forests is usually an inexpensive way to mitigate increasing atmospheric greenhouse gases (GHG). In addition to sequestration, planting and maintaining trees in communities, especially around buildings, to provide shade or block prevailing winds can moderate temperatures and substantially reduce energy demands and related greenhouse gas emissions.

In 2007, Iowa conducted an inventory of the greenhouse gases that were being emitted within the state using different criteria than had been used in previous surveys. Details from this survey, called the 2008 Greenhouse Gas Emissions from Selected Iowa Source Categories, can be found at: www.iowadnr.gov/air/prof/ghg/files/2008_Greenhouse_Gas_Inventory.pdf The EPA’s Greenhouse Gas Equivalencies Calculator estimates that the total greenhouse gas emissions from major sources’ fossil fuel combustion in 2007 for Iowa was 55.48 MMtCO2e, or the equivalent of carbon sequestered by 1,422,564,103 tree seedlings grown for 10 years.[53]

Forecasting

The DNR’s 2008 inventory does not include any direct forecasting. However, the Center for Climate Strategies (CCS) forecasted Iowa’s anthropogenic greenhouse gas emissions and carbon sinks to 2025 in their comprehensive Iowa Greenhouse Gas Inventory and Reference Case Projections 1990- 2005, which was prepared for the Iowa Climate Change Advisory Council (ICCAC). The DNR chose to use CCS’s forecast because it was the most comprehensive, accurate forecast that was readily available. The CCS report shows that Iowa’s gross GHG emissions increased by 20% from 1990 to 2005 to 119.5 MMtCO2e. Assuming that nothing changes in the way of policy and human attitude, CCS projects that by 2025 Iowa’s gross GHG emissions will grow to more than 50% of 1990 levels.[54]

[53]<www.epa.gov/cleanenergy/energy-resources/calculator.html>. February 27 2009.
[54]<www.iaclimatechange.us/ewebeditpro/items/O90F20675.pdf> . April 15 2009.

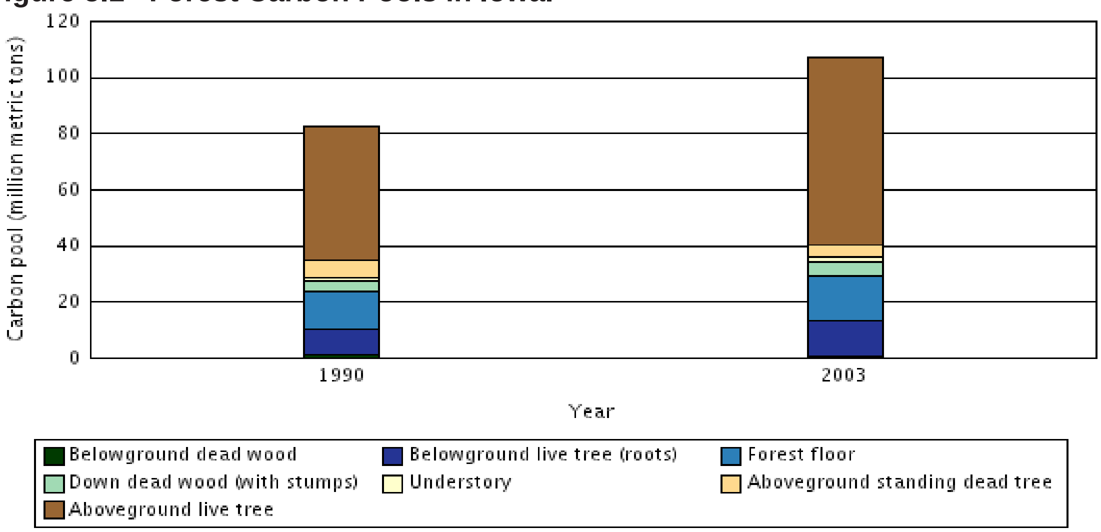
5.1 Forest Ecosystem Biomass and Forest Carbon Pools

According to 2007 USDA-FS-FIA data, Iowa had more than 114 million metric dry weight tons of carbon stored within 3 million acres of forest. Figure 5.1 compares stored carbon quantities for 1990 and 2003; it also gives a breakdown of the amounts of carbon stored in each part of a forest. The figure shows that the overall amount of carbon stored in forests in Iowa increased by more than 39% over this time period.

Total forest ecosystem biomass includes all tree parts, dead trees and saplings growing in an area. As Iowa's trees continue to grow larger in size, the above ground storage of carbon increases the most of any type of storage; other storage areas generally increase as a result of expanding forest area rather than increased tree size. Forest carbon storage is influenced by the rates of forest growth, harvest activity, loss of forest land due to conversion to other land uses and loss of forest cover due to fire or other natural disturbances. The amount of carbon Iowa forests store is greatly dependent on private forest landowners, since they own over 90% of the state's forest resources. Forest landowners would likely take more interest in managing their forests if they were rewarded for the positive benefits, such as clean oxygen and carbon storage, that their forests provided.

The average person produces 9.41205 metric tons of carbon dioxide each year according to EPA estimates. With a population of nearly 3 million people, this means that Iowa is responsible for producing more than 28 million metric tons of carbon dioxide each year, a number that doesn't even take into account the output of carbon dioxide from businesses. Only 32 million additional metric tons of carbon dioxide were stored in Iowa's forests between 1990 and 2007, meaning that only a little more than a year's worth of carbon dioxide emissions were offset through carbon sequestration over a seventeen year period. Clearly Iowa has a long way to go to becoming a net carbon sink, an area where more carbon is stored than is produced; in order for this to be achieved, there will need to be a dramatic decrease in carbon dioxide emissions, a significant increase in stocking levels on Iowa forests or some combination of these two things.[55]

Figure 5.1 Forest Carbon Pools in Iowa.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Factors that influence carbon storage in Iowa forests include land-use changes, timber harvesting,

[55]<www.epa.gov/cleanenergy/energy-resources/calculator.html>. February 27 2009.

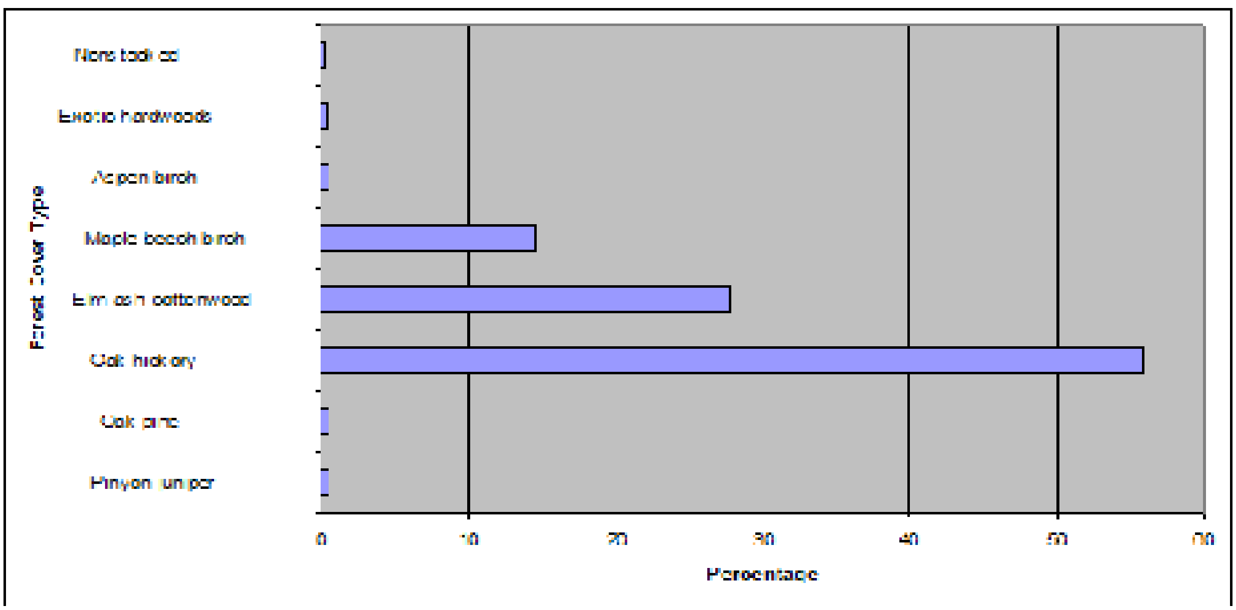
natural disturbances, increasing atmospheric carbon dioxide, climate change, nitrogen deposition and ozone in the lower atmosphere.[56] Sound forest management activities can improve the carbon sink within existing forest land by allowing for increased stocking levels in existing forests. Many forests continue sequestering significant amounts of carbon for 125 years or more after being established; as they mature, sequestration levels off to a state where carbon uptake is nearly equal to release.[57]

Carbon from forests can remain stored in forest products long after forests are harvested and the wood is processed. For instance, carbon stored in trees harvested to build houses in the early 1900's is still stored in these houses. Harvested carbon can be tracked in four general categories: wood products, landfills, wood burned for energy (which substitutes for fossil fuel), and carbon emitted from wood not used as an energy source.

5.2 Forest Carbon by Forest Type

Figure 5.2 reflects the fact that most carbon in Iowa is stored in the oak-hickory forest type. Some of the oaks in this forest type are the oldest and longest-living trees in the state, which means their value as carbon sinks is relatively high. It is also important to note that the long life cycle of trees minimizes their ability to adapt to quickly changing conditions in the local climates in which they grow.

Figure 5.2 Carbon Stored in Iowa by Forest Cover Type, 2003.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

[56]Birdsey, Richard A. et al. "North American Forests." The First State of the Carbon Cycle Report (SOCCR). November 2007. p. 117. <www.climatescience.gov/Library/sap/sap2-2/final-report/sap2-2-final-all.pdf>.
[57]Birdsey, Richard A et al. p. 119.

5.3 Iowa Forest Contributions to Carbon Sequestration

Maintaining the number of acres of existing forest in Iowa is a simple way of keeping the state's stored carbon from being released. Increasing the productivity within existing forest lands can actually increase Iowa's capacity to store carbon without adding more forested land; for oak trees, this benefit is even greater because oaks longer life cycles than other trees in Iowa.

Substituting bio-fuels, particularly cellulosic ethanol from wood fibers, for fossil fuels would help local economies by creating markets for under utilized wood products, and would allow for better, more productive management of the state's existing forests. If it were logistically feasible to remove all trees except crop trees from forested lands, material for cellulosic ethanol could be supplied from smaller trees while wood production could still be maximized on the best crop trees.

5.4 Urban Community Role in Carbon Sequestration

It is important to plant trees within urban corridors in order to ensure that there are adequate replacements for older trees; this is especially important in communities with growing populations or those expanding into existing forests. Benefits from urban trees are well documented and include pollution control, noise barriers, crime reduction through aesthetic enhancement, shade from hot summer days and wind protection during the winter.

One way to determine the value of carbon storage and sequestration is to run an analysis through i-Tree, a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that quantifies the environmental values tree provide to people. Figure 5.3 gives a ranking by species of the trees best adapted to carbon storage. Attributes selected for comparison for i-tree analysis include the following: land use= single family residential; site location= front yard; DBH= 18-24"; maintenance record= mature trees with routine maintenance; priority task= no maintenance needed; sidewalk damage= none; wire conflict= none; wood condition= no apparent problems; and leaf conditions= no apparent problems. Figure 5.3 indicates that the species best suited for carbon storage in urban areas are generally shade intolerant, which has implications for forest setting situations as well.

Figure 5.3 Best Tree Species for Carbon Storage in Urban Areas, 18-24" Size Category

Species	Carbon Stored (lbs)
Black Walnut	16,915
Honey Locust	13,485
White Ash	8,458
Bur Oak	8,458
White Oak	8,458
Eastern Cottonwwod	8,458
American Sycamore	8,458
Kentucky Coffietree	8,458
Green Ash	8,458
Hickory	8,458

Source: USDA Forest Service, I-Tree Version 1.0.

5.5 The Role of Nurseries

As providers of growing stock for community tree plantings, nurseries play a large role in the long-term biodiversity of communities. Most Iowa nurseries bring in nursery stock from out-of-state and then finish growing the trees for a year at most. Many of these trees are cultivars, which are propagated from a single genotype for aesthetics and fast growth. By reducing the genetic variation of a species, the ability for that cultivar to adapt to fluctuations in the weather is limited; this is especially troubling when the same cultivar is planted in each lot of an entire subdivision. This lack of genetic and species diversity places such an area at a greater risk to destructive insects, diseases or devastating climatic changes resulting from global warming. Reducing genetic diversity decreases the chance for a cultivar to adapt to change.

Converting non-forested land to forest land is one way of increasing Iowa's carbon storage capacity. Iowans have planted over 150 million trees since 1940, which has helped to compensate for some of the 3,627,874 acres of forest land cleared for agriculture. Converting land on sensitive soils and steeper terrain to forest can help Iowa increase its net carbon sequestration, protect soils, improve water quality, create wildlife habitat and add more aesthetics to the countryside. While increasing forest acres takes away from land being used for pasture or crop production, the reduction could help reduce overproduction of food crops and would provide the multiple benefits mentioned above.

5.6 Highlights of Forest Contribution to Global Carbon Cycles

Iowa is a net producer of carbon.

Increasing stocking levels within existing forests would increase Iowa's capacity to store carbon without adding more forested land.

Increased tree planting within urban and rural areas would increase carbon sequestration potential.

Reducing genetic diversity within landscape nursery stock decreases the chance for a cultivar to adapt to a change.

Converting the less productive agricultural land located on sensitive soils to forests can help increase net carbon sequestration.

6.0 Maintenance and Enhancement of Long-term Socioeconomic Benefits of Forests

Many people depend on forests for their livelihood or for their physical and mental well-being, and forests in urban and rural areas contribute significantly to the economic base of many communities; additionally, urban and community trees and forests provide cooling, storm water reduction and other benefits. Tracking these values, as well as monitoring shifts in demand for products and services, provides useful insights for the future; changes can indicate potential drains on the forest resource or highlight management opportunities.

Iowa's forests produce a multitude of goods and services—everything from timber and mushrooms to recreation and water. Sustainable forestry requires diverse, strong markets for a wide variety of products. Market forces are often the dominant influence on resource-based goods and services, but nonmarket forces—such as the desire to sustain biological diversity or the opportunity to dwell in or visit a natural place—are also important factors influencing investments in goods and services. Most forests can provide multiple goods and services simultaneously; however, there will always be situations where multiple activities and desired uses are incompatible.

Forest products in the state include wood products such as sawlogs, veneer, pulpwood and fuelwood and non-wood products such as pine cones, berries, mushrooms and ginsing. Iowa has the enviable distinction of possessing the soil and climate necessary for growing some of the finest hardwoods in the world; black walnut, for example, attracts buyers from around the globe.

6.1 Wood Product Production, Consumption and Trade

Wood products make a significant contribution to the Iowa economy. Iowa forests provide veneer and quality lumber to sawmills, which provide secondary processors that create value-added finished products for many different industries located throughout the state. Furniture, crafts, cabinets, novelties, carvings, pallets and cooperage are some examples of useful wood products in addition to firewood.

Forest crops are a long-term investment, as many species are 80 to 120 years old before they reach a merchantable size. Most trees will have some lumber volume and value as they reach 16 inches in diameter but will attain even greater volume and value as they get even larger. The value of a tree is affected by its species, its quality, the ease with which it can be logged, and the size and restrictions of the timber sale at which it is sold.

Forests also provide environments for medicinal plants and other non-wood products. Maintenance of biological diversity or scenery are goals for many forest landowners that keep some forest products from going to market. But those forests are still providing important functions and potential income for non-traditional wood products.

Industrial roundwood products include saw logs, pulpwood, veneer logs, poles, commercial posts, pilings, cooperage logs, particleboard bolts, shaving bolts, lath bolts, charcoal bolts, and chips. All roundwood in Iowa comes from hardwood species, as there are no markets for the relatively few types of softwood that grow in the state. According to a survey conducted in 2005, Iowa had 29 sawmills that produced 16 million cubic feet of industrial roundwood; comparatively, there were 59 sawmills that produced 17.6 million cubic feet of roundwood in 2000. This represents a 9% decrease in production and 50% decrease in the number of producers over a mere five-year period.[58] In the 1940s there were over 1,000 sawmills throughout Iowa that provided jobs for 3,000 to 4,000 people.[59]

Figure 6.1 shows roughly how much Iowa forest landowners earned from timber for several different years. In 2005 Iowa forest landowners were collectively paid approximately $20 million by sawmills for logs harvested from their land. The little data that exists shows that the average earnings per board foot increased from $0.08 in 2000 to $0.09 in 2006.

Figure 6.1 Value Paid to Iowa Forest Landowners for their Timber.

Year	Value Paid to Forest Landowners	Average value paid to Forest landowners for Timber ($/bdft)
2007	$21.8 million	
2006	$19.5 million	0.09
2004	$20.7 million	
2003	$15.0 million	
2000	$17.3 million	0.08
1999	$12.5 million	

Source: Aron Flickinger.

Portable sawmill. Photo by Bruce Blair.

Technological improvement, aging work forces and exhausted equipment have led to the consolidation of the sawmill industry in Iowa. Though it is difficult to track data for portable sawmills, a May 2007 directory indicates that there at least 47 such sawmills in the state.[60] As the wood industry continues to shrink, the value of timber in Iowa woodlands will decrease because it will be more difficult to transport products to markets. The cost of hauling equipment to cut and remove logs from a forest will become an inhibiting factor as well if the industry continues to dwindle, as forest landowners will no longer be able to justify the costs associated with forest stand improvement.

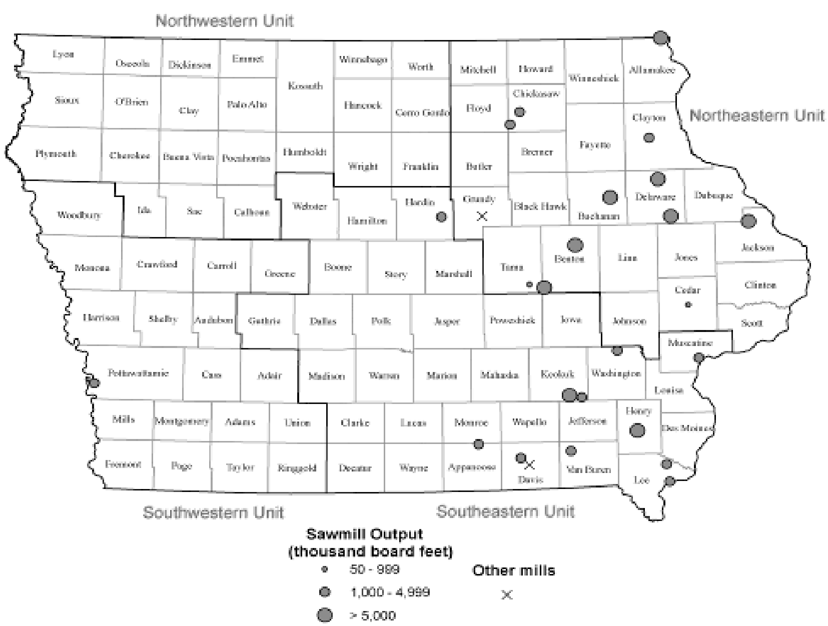
[58]Haugen and Michel.

[59]A Recommended Forestry Program for Iowa. Society of American Foresters, Iowa Chapter. Isaac Walton League of America, Inc. December 1950.

[60]Forestry Extension Notes – Directory of Sawmills in Iowa (Iowa State University Forestry Extension). <www.extension.iastate.edu/forestry/publications/F-301.pdf>. March 5 2010.

Figure 6.2 shows the locations of primary sawmills in the state along with boundaries to indicate which counties are included in each of the four Forest Service-defined regions or units. The "other" category in Grundy County marks a veneer mill and no data was available for the mill in Davis County.

Figure 6.2 Sawmill Locations in Iowa, 2005.

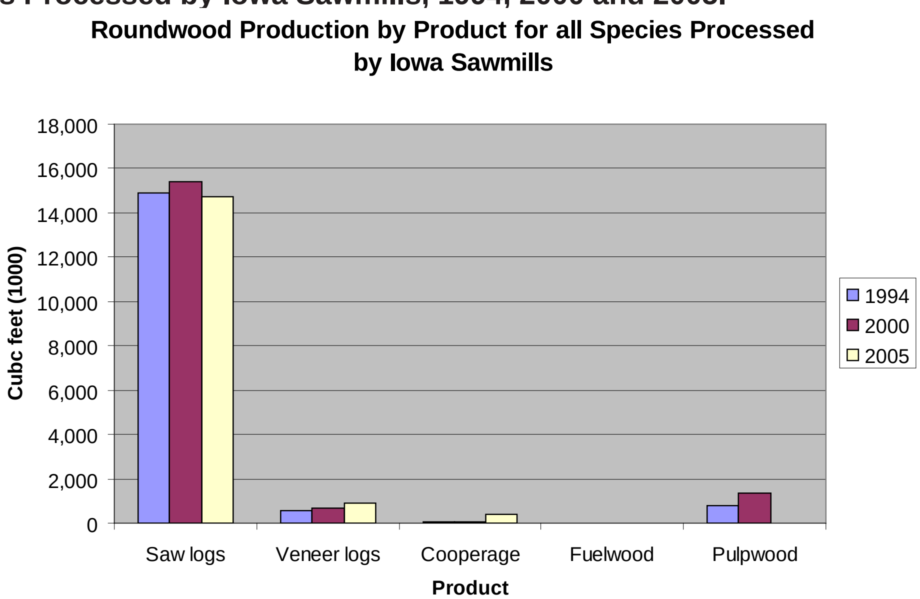


Source: Leatherberry et. al., p.75.

Figure 6.3 shows that output for wood product and furniture producers increased between 1994 and 2005. The value that these businesses generated also increased during this time period, as is indicated by Figure 6.4. In 2002 alone, the economic value for wood-related products in Iowa was over $3 billion.[61]

In 2002 alone, the economic value for wood-related products in Iowa was over $3 billion.

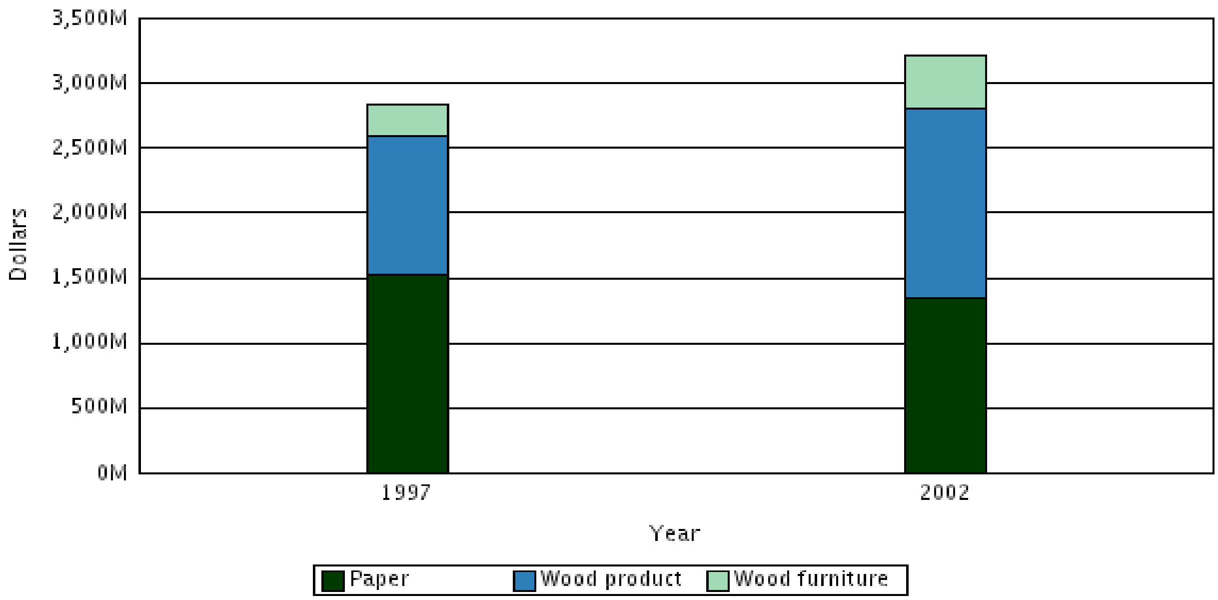
Figure 6.3 Roundwood Production by Product for all Species Processed by Iowa Sawmills, 1994, 2000 and 2005.



Source: Haugen and Michel.

[61]"Annual Survey of Manufactures: Geographic Area Statistics: Statistics for All Manufacturing by State: 2006 and 2005 ." U.S. Census Bureau – American Fact Finder. <factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=04000US19&-filter=&-ds_name=AM0631AS101&-dataitem=GEO_ID$|NAICS2003|NAICS2003$|RCPTOT|PAYANN|EMPSMAO|YEAR&-NAICS2007=>.

Figure 6.4 Iowa Wood Industry Value based on US Economic Census, 1997 and 2002.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

6.2 Production and Consumption of Timber

In 2002, there were 186 wood product businesses in Iowa that generated $1.5 billion, an increase of $400 million or 36% from 1997 levels.[62] These businesses employed 10,964 employees and had a total payroll of $386 million. In 2002, the annual payroll for these businesses was $386 million for 10,964 employees, compared to $225 million for 8,298 employees in 1997. This represents a 32% increase in workforce and 72% increase in payroll over this timeperiod, and shows that despite the decrease in the number of employers, workforce and salaries are on the rise.

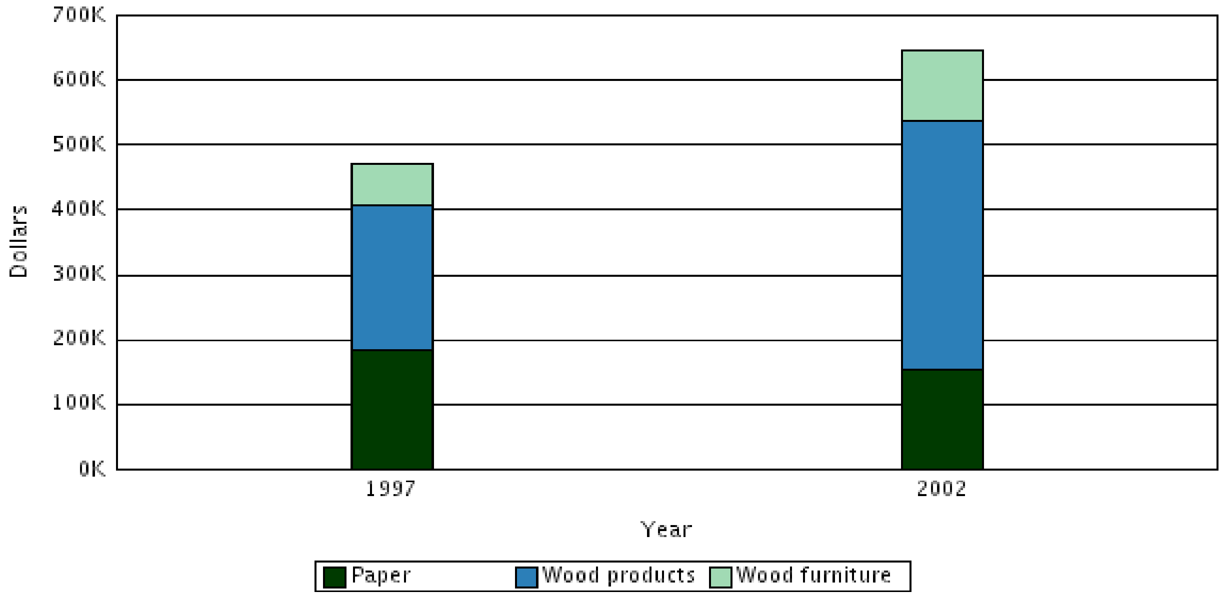
In 2002, there were 186 wood product businesses in Iowa that generated $1.5 billion, an increase of $400 million or 36% from 1997 levels These businesses employed 10,964 employees and had a total payroll of $386 million.

In 2002, sawmills produced $54.2 million worth of goods and paid out $10.9 million to 379 employees (Unfortunately, there is no data available from either 1997 or 2007 to use for comparison). In 1997 paper manufacturing companies employed 5,480 people who were paid a total of $183 million; by 2002, both employment and payroll had dropped, to 4,186 and $152 million, respectively. These companies produced $1.5 billion worth of goods in 1997 and $1.3 billion in 2002.

The wood furniture industry saw a 51% increase in sales from 1997 to 2002, from $224 million to $338 million; employment also rose by 28%, from 2,473 to 3,158, and payroll increased by 52%, from $57.8 million to $88.1 million.[63] Figures 6.5 and 6.6 show payroll and wage trends for the industry over this time period.

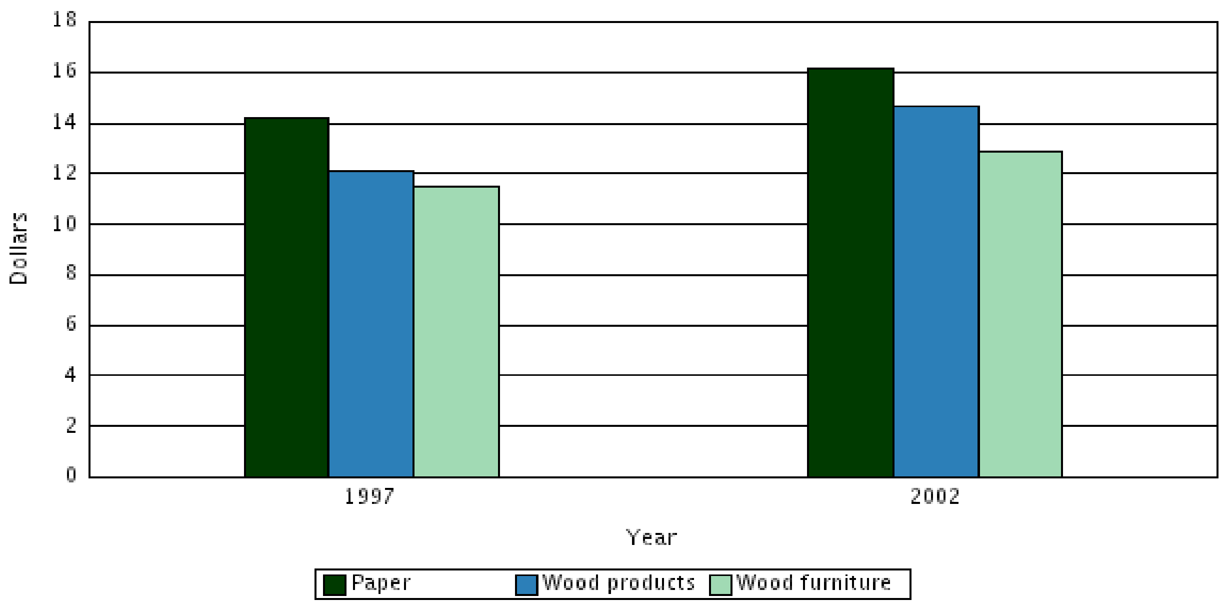
[62]"Annual Survey of Manufactures: Geographic Area Statistics: Statistics for All Manufacturing by State: 2006 and 2005 ."
[63]"Annual Survey of Manufactures: Geographic Area Statistics: Statistics for All Manufacturing by State: 2006 and 2005 ."

Figure 6.5 Iowa Wood-related Products Manufacturing Annual Payroll, 1997 and 2002.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Figure 6.6 Iowa Wood-related Products Manufacturing Average Hourly Wages, 1997 and 2002.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Wood related products are an important piece of the overall manufacturing sector in Iowa. The annual payroll was 8 percent of the overall payroll for all of the manufacturing sectors in 2002. The wood related manufacturing payroll increased by more than 25% between 1997 and 2002, with the majority of the increase coming from wood products companies.

Economic opportunities are important for the sustenance of rural areas, for the retention of forests, for sustainable forest management and for employment within the wood products industry. From 1991 to 2003, $6.2 million in federal funding yielding over 500 new and retained jobs, $10 million in annual products and services, $10 million in annual additions to businesses and $27 million in annual economic activity in rural areas. Unfortunately, these funds are no longer available.

Though relatively small, Iowa's wood industry makes a major contribution to both the economy and, through the production of beautiful products from diverse woodland species, aesthetics of the state. Without the economic incentives provides by a viable wood products industry, forest landowners have little reason to properly manage their forests. Unfortunately, USDA-FS-FIA data indicates that low to medium stocking levels are prevalent across the state, and such do not lead to the production of high-quality hardwoods.

6.3 Non-timber Forest Products

From 2002 to 2007, the number of farms growing Christmas trees decreased from 271 farms harvesting 57,254 trees on 2,578 acres, compared to 196 farms harvesting 39,575 trees on 1,552 acres in 2007. Christmas tree farms in the 10-19 acre size category dropped the most, from 83 farms in 2002 to 42 farms in 2007. Figure 6.7 below gives a breakdown by farm size of the number of Christmas tree produced for the two years mentioned.

Figure 6.7 Iowa Christmas Tree Farm Comparison, 2002 and 2007.

Farm Size (acres)	Number of Farms in 2002	Number of Farms in 2007	Number of Trees Harvested in 2002	Number of Trees Harvested in 2007
1-2	79	50	4,027	-
3-4	42	50	3,218	4,498
5-9	83	42	12,715	9,570
10-19	30	30	11,406	6,971
20-49	28	23	17,438	13,583
50-99	7	1	-	-
100+	2	0	-	-

Source: Mike Bevins, Iowa Department of Agriculture.

Fruit and nut trees also provide locally grown products that can benefit Iowans and wildlife. In 2004, Iowa apple orchards were 28th in the nation in production with a total output of 262,000 bushels.

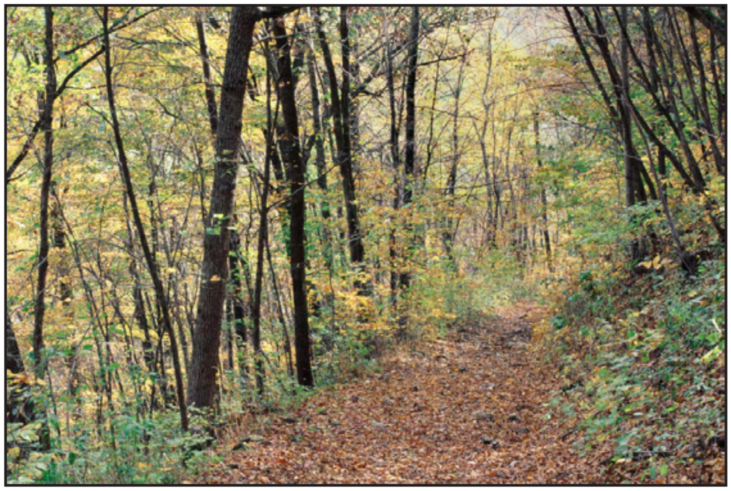
Non-traditional forest goods and products include ginseng, morel mushrooms, wildflowers, berries and wild fruits, aromatic compounds, cones and seeds, forest botanicals, honey, nuts, syrup, weaving materials and dyes. Production figures for these products are not kept, which makes it difficult to determine how they contribute to the state's economy. Such products are important for both consumers and producers, and like many of the services trees provide, these products add to the quality of many people's lives.

Ginseng earned harvesters more than $749,000 in 2008.

The one item that is reported in Iowa is ginseng. In 2008, there was 775 dry weight pounds of ginseng harvested from Iowa forests, and harvesters earned more than $749,000. Thirty-six counties reported ginseng harvests, with Clayton, Allamakee and Muscatine counties all reporting over 100 pounds harvested that year (a table listing all of the counties that had ginseng harvested in 2008 can be found in Appendix H).

6.4 Outdoor Recreational Participation and Facilities

Dr. Thomas H. Macbride, President of the University of Iowa from 1914 to 1916 and considered by many to be the father of conservation in Iowa, spoke out in the June 1931 Palimpsest about the need to start conserving pieces of Iowa land for public recreational, educational, and scientific uses. He believed that "this establishment of parks, would promote public health and happiness, serve as community object lessons in forestry, and preserve to those who come after us something of the primitive beauty of this part of the world." When the first of Iowa's 84 state parks was finally dedicated in 1920, the local citizens, politicians, bands, and conservationists came out en-force to celebrate, as Dr. Macbride put it, a new "place of quiet beauty" preserved for all future Iowans. These were places where families explored, picnicked, and relaxed. They were local tourist areas and by the early 1930s they were a popular state institution. In the early 30's there were 36 dedicated state parks that had about 180,000 people visiting; only half that many people visited all of the national parks at that same time.



Trail at Yellow River State Forest. Photo by Bruce Blair.

Photo by Mark Vitosh.

Iowa's park system has been evolving for the last 80 years. So too have the social and economic factors affecting people's leisure time. Over those years the public has continued to express its desire and increasing demand for outdoor recreation services and facilities that are provided by both the private and public sectors.

Outdoor recreation has numerous benefits for both the public and the environment. Recreation areas provide the public with places to gather with family and friends, places to relax and places that promote physical activity. These places add to the quality of life of the people and places that surround them. Recreation areas also help to shape a community through planning efforts to provide adequate recreation spaces and facilities. Parks and open spaces can also provide environmental benefits such as buffers between conflicting land uses.

A healthy, vibrant state park system with beautiful natural areas is important to the physical, spiritual and economic well-being of the citizens of Iowa. The DNR manages 85 parks and recreation areas, several state forest campgrounds and 92 state preserves spanning 63,000 acres. Within

Photo by Ken Formanek.

those areas are 72 cabins, 26 day-use lodges, 34 beaches, 5,100 campsites and shower buildings in 62 campgrounds, numerous open picnic shelters and park office maintenance buildings. These parks provide important cultural and recreational opportunities to approximately 14 million visitors annually. Parks are significant contributors to local economies; Iowa parks and recreation areas generate $155 million in economic activity annually, much of which is spent in local communities. (A party of 4 spends $51.50 with each visit.)

Iowa ranks 49th in the nation for percentage of land that is available for public recreation. Seeking public support for a sustained, dedicated funding source to maintain and upgrade recreational trails would improve the management of the natural resources people are coming to visit and enjoy. By creating more access to natural resources, those areas are more vulnerable to invasive species, increased water runoff, increased erosion. This side effect creates more management to maintain the ecosystem as it was discovered originally, now that the ecosystem has been altered by trails, buildings and roads.

One example of an issue occurring on state forest lands is the impact of equestrian riding. When these trails are not maintained, equestrian users travel around bad spots, creating new, less adequate trails, not to mention damaging more of the ecosystem they came to experience. Trails that are built and maintained properly will lessen the impact to the ecosystem and provide a better experience for the users.

The need to provide Iowans with quality outdoor recreation opportunities remains very high. There are several factors contributing to the demand for outdoor recreation. The rapid expansion of urban areas puts great stress on nearby existing areas and often reduces the amount of land available for park and recreation developments. The continual increase in the use of existing parks and recreation areas is evidence that there is great demand for outdoor recreation opportunities.

Further evidence lies in the fact that outdoor recreation habits are ever-changing, as activities such as soccer, skating and off-road vehicle riding have become increasingly popular. Each year the amount of funding requested for recreational programs increases while the amount available decreases, leaving many recreational needs unfulfilled. In 2000, the State of Iowa had $248,500 available through the Land and Water Conservation Fund but had over $2 million in requests. Also in 2000, the State of Iowa had $3 million available through the Recreation Infrastructure Grant Program but had over $5.3 million in requests.

Hikers, campers, canoeists, boaters, snowmobilers, equestrians, bikers, hunters, picnickers and bird-watchers have access to 1,350 miles of shared trails, including 645 miles of hiking trails in State Parks and 90 miles in State Forests. In addition there are 254 miles of equestrian trails in State Parks. In the winter there are 5,000 miles of snowmobile trails and 8 ATV parks with approximately 1,560 acres for riders to enjoy. There are also 32 archery and shooting ranges.The 66 state parks and recreation areas, with more than 53,000 acres, host 10 to 15 million visitors each year. Nearly 2,000 miles of trails traverse those parks and forests.

County conservation boards manage numerous outdoor recreation areas, wildlife habitats and preserves containing hundreds of acres of wetland and riparian areas. Conservation boards manage these areas for their multiple-purpose values, including recreation, habitat, environmental quality and environmental education. Many county conservation boards also cooperate with other public natural resource agencies and private conservation groups to assist private landowners in the development, protection and management of wetland and riparian areas. Iowa's innovative County Conservation Board system provides close-to-home recreation. The 99 boards manage nearly 1,500 diverse areas. Private conservation groups also identify and protect natural areas and wildlife habitat.


Photo by Greg Ludvigson.

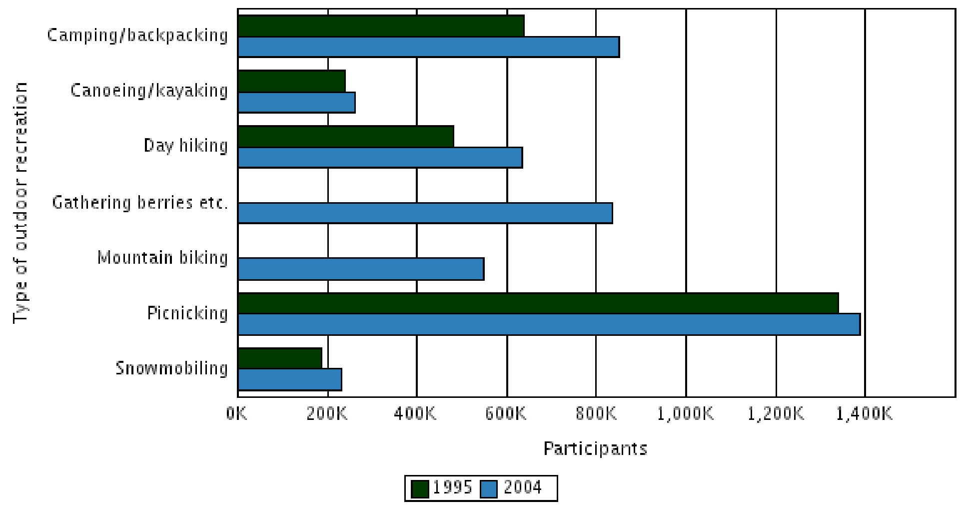
Within the 20 states comprising the northeast region, there are 1.2 acres of forest per citizen; this is compared to a national average of 0.56 and an Iowa average of 1.0. Most of Iowa's forest land is in private ownership, which leaves only a small amount for public use.

Canoe, kayak and inner tube rental businesses generate more than $1 million in rental fees, which in turn generates $4 million in related spending, according to a new survey conducted by Iowa Department of Natural Resources' Rivers Program in conjunction with Iowa State University's Department of Landscape Architecture. The survey was administered as part of the water trails and low-head dam safety statewide planning process initiated by the Iowa General Assembly in 2008. The following are some of the highlights of the survey:

- Liveries contribute $5.14 million to Iowa's economy, including $1.14 million in rental receipts and $4 million for related spending (i.e. lodging, auto-related expenses, food and drink).
- Four rivers – the Upper Iowa, Des Moines, Maquoketa and Iowa– accounted for $650,000, or 57 percent, of the total estimated receipts.
- Liveries use public accesses, and some have requested additional public services, including water trail development, law enforcement and hazard mitigation.
- Canoeing accounted for 48 percent of the total estimated 41,713 trips per year. Inner tubing accounted for 44 percent of the total trips, and kayaking accounted for 8 percent.

The entire report is available on the web at: www.iowadnr.gov/watertrails/planning.html.

Figure 6.8 Outdoor Recreation Participation in Iowa, 1995 and 2004.

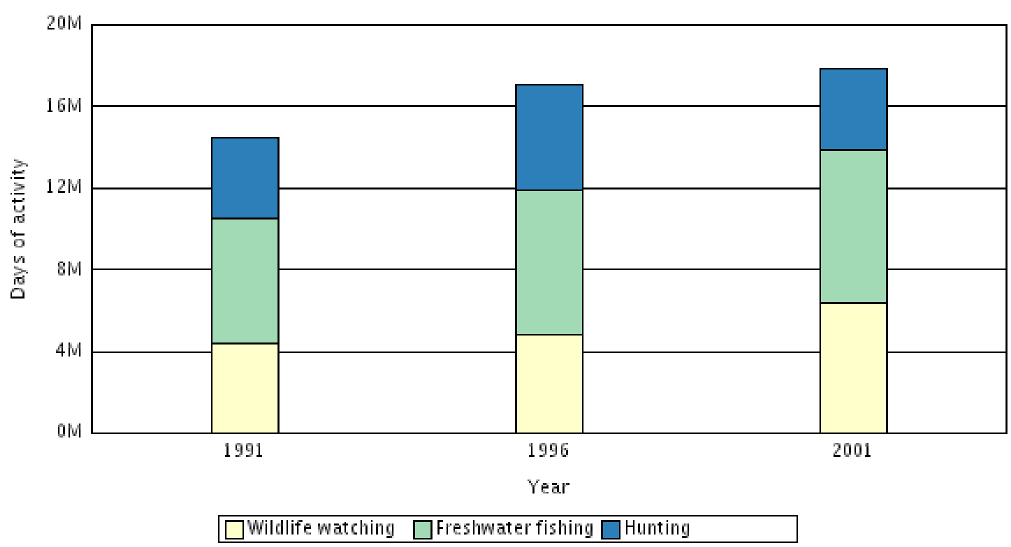


Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Figure 6.8 above shows recreation participation rates on both forest and non-forest land in Iowa for 1995 and 2004. The most popular type of recreation continues to be picnicking followed by camping/backpacking, gathering berries etc., day hiking, mountain biking, canoeing/kayaking and snowmobiling. All activities have shown an increase between 1995 and 2004.

In 2008, the average visitor to Iowa spent $291.34 over the course of 4.4 days.[64] The average age of the visitors surveyed was 52 years and the majority traveled with their families. Most visitors came from Minnesota, Illinois, Nebraska, Wisconsin, Missouri, Kansas and South Dakota (ordered from most to fewest visitors). In northeast Iowa, it is estimated that tourists spend $6 million annually while viewing fall color in the autumn.[65] Bird watching has also become extremely popular in the state and, along with general wildlife viewing, generates more than $300 million annually.

Figure 6.9 Days of Participation in Freshwater Fishing, Hunting and Wildlife Watching in Iowa for all Participants, 1991, 1996 and 2001.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

[64]Iowa Department of Economic Development, Tourism. <http://www.traveliowa.com/welcomecenters.aspx>. March 11 2010.
[65]Stone.

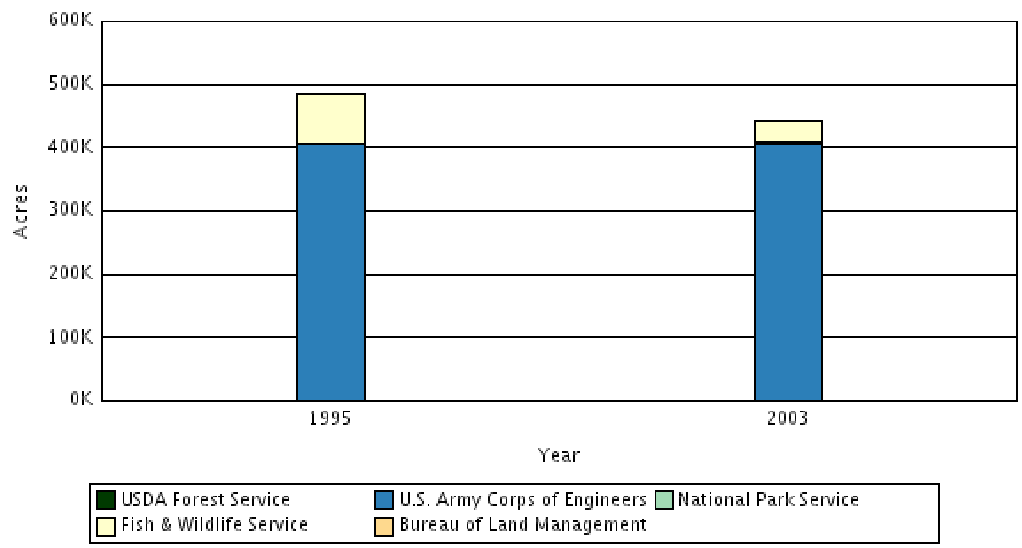
According to Figure 6.9, which shows the total number of days that all outdoor recreation enthusiasts spent fishing, hunting and wildlife viewing for three years in Iowa, wildlife viewing is the fastest growing outdoor activity in the state; hunting, on the other hand, has experienced a decline over this time period.

In 2006, roughly 250,000 hunters generated more than $450 million in economic activity for the state.[66] Maintaining habitat that is supportive of wildlife for hunting is difficult given the limited amount of available public land; as a result of this, it has been necessary to offer educational and financial incentives to private landowners who allow people to hunt on their lands.

Federal Land Open to Recreation

Figure 6.10 below shows the amount of federal land open to outdoor recreation in Iowa in 1995 and 2003. According to the figure, more than 90% of recreation land is owned and managed by the U.S. Army Corps of Engineers, while the rest is under the jurisdiction of the Bureau of Land Management. Compared to other states, Iowa ranks quite low in terms of land available for outdoor recreation.

Figure 6.10 Amount of Federal Land Open to Outdoor Recreation by Agency in Iowa, 1995 and 2003.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

[66]Stone.

6.5 Investments in Forest Health, Management, Research and Wood Processing

Nursery Sales

The State Forest Nursery provides low-cost native tree and shrub material to encourage more planting in the state. Without it, forest landowners would be forced to pay more to plant trees on their property and in many cases would likely revert to buying their trees from out-of-state nurseries to get lower prices. In addition to bolstering the state's economy, use of native tree material ensures that insects and diseases that are not established are not brought in; moreover, seedlings from outside of Iowa may not be as adapted to the state's climate and may therefore be more susceptible to such problems because of stress. Non-native seedlings are often less productive at growing wood and mast as well.

One of the goals of the Iowa DNR Forestry Bureau is to promote the State Forest Nursery as the best source of native seedlings. Unfortunately, Iowa Code specifies that the nursery's budget for growing costs be dependent upon its seedling sales within a particular fiscal year, which makes for serious financial stress during years with poor sales. State rules and economic and political restraints can also make it difficult for the nursery to market its product and cover its operating costs.

Trees were planted on approximately 3,631 acres in Iowa between 1998 and 1999, which ranked the state 6th out of the twenty northeastern states for tree planting during this period. During years in which conservation programs promoting tree planting are particularly successful or widespread, State Forest Nursery sales are typically above average. Conversely, when conservation programs can't compete with commodity prices, tree sales go down. With a legislatively mandated requirement to operate at the cost of growing trees, the viability of the State Forest Nursery is a challenge because demand for seedlings is dependent on many programs outside of its control.

Conservation Practices

The Forest Land Enhancement Program (FLEP) has not received the intended funding for private forest landowners to improve their woodlands that it was originally supposed to receive, and as a result it is therefore no longer in existence. Only $146,000 was available to Iowa in 2003 and funding has decreased even more in subsequent years.

The Wildlife Habitat Incentive Program (WHIP) began in 2003 and, for the most part, has provided steadily increasing funding for Iowa (from $52,000 in 2003 to $93,000 in 2006). This federal program is administered through the NRCS with technical assistance provided by foresters, wildlife biologists or NRCS staff. Programs eligible for this funding assistance include tree planting, forest stand improvement and brush management.

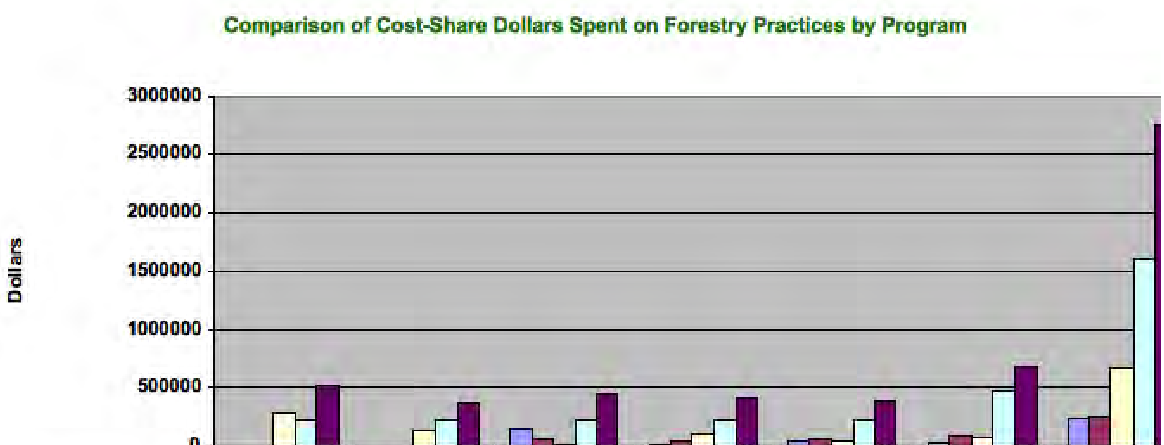
The Environmental Quality Incentive Program (EQIP) has provided variable funding for forestry practices through the years and has provided funding for projects similar to those funded by WHIP. In 2001 over $288,000 was provided to forest landowners, the most offered in any year through

2006. In 2009 and 2010 approximately $500,000 per year of EQIP funding was set aside for forestry practices on private lands.

The Resource Enhancement and Protection program (REAP) is a state program that has provided funding for forest landowners to get trees planted or to improve the woodlands on their property. As its name implies, REAP invests in the enhancement and protection of the state's natural and cultural resources. Iowa is blessed with a diverse array of natural and cultural resources, and REAP is likewise diverse and far reaching. Depending on the individual programs, REAP provides money for projects through state agency budgets or in the form of grants. Several aspects of REAP also encourage private contributions that help accomplish program objectives.

REAP is funded from the State's Environment First Fund (Iowa gaming receipts) and from the sale of the natural resource license plates. From 2001 to 2005 an allocation of $225,500 was available annually, and 2006 saw an increase to $473,000. The program is authorized to receive $20 million per year until 2021, but the state legislature sets the amount of REAP funding every year. In 2009 REAP was appropriated at $18 million plus $1 million from license sales for a total budget of about $19 million. REAP is expected to be funded at $9 to $12 million in state fiscal year 2011. Figure 6.11 below shows how much money was spent on forestry projects for the aforementioned environmental enhancement programs in Iowa from 2001 to 2006.

Figure 6.11 Comparison of Cost-Share Dollars spent on Forestry Practices by Program



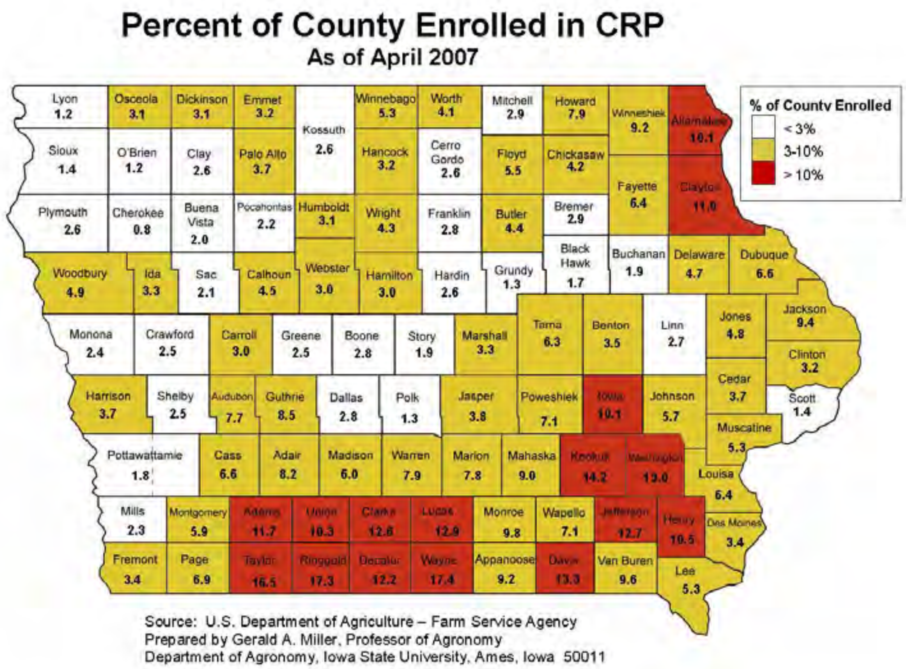
	2001	2002	2003	2004	2005	2006	Total
FLEP	0	0	146,080	22,000	45,870	24,921	238871
WHIP	0	0	52,878	50,997	63,354	93,211	260440
EQIP	288,987	132,463	15,490	105,255	41,585	81,540	665,320
REAP	225,500	225,000	225,500	225,500	225,500	473,342	1,600,34
Total 2001-2006	514487	357463	439,948	403,752	376,309	673,014	2,764,97

Source: State Forester, Paul Tauke.

A summary of Conservation Reserve Program (CRP) enrollment from the July 2009 report shows that Iowa had the most rental payments of any state with $197,520,000. These rental payments were associated with 105,241 contracts on 52,965 farms protecting 1,705,312 acres.[67] Within the protected areas, 28,550 acres, or 1.7% of CRP acres, were planted for trees. If 700 trees were planted on each of these 28,550 CRP acres, nearly 20 million total trees would be planted.

[67]USDA, FSA, CRP, July 2009 Monthly Summary. <www.fsa.usda.gov/Internet/FSA_File/july2009.pdf>. April 16 2009.

Figure 6.12   Percent of County Enrolled in CRP as of April 2007.



Source: Iowa State University, Department of Agronomy, Gerald A. Miller.

A program like CRP benefits water quality and provides long-term soil protection on highly erodible soils. Landowners are less likely to remove trees after a 15-year contract that provides society a better return than that provided by agriculture since those trees will continue to protect the soil, water, sequester carbon and provide wildlife habitat. Trees make sense for long-term protection of sensitive land because, once established, they are more difficult to remove; planting grass provides many good benefits but may not provide them for the same amount of time since it is much easier to remove. Nurseries that provide conservation seedlings and consultants that plant these seedlings for landowners benefit from tree planting incentive programs as well.

A lack of federal and state cost-share incentives makes it difficult to entice forest landowners to invest their time and money in improving their forests. With better prices for commodities and land, taking land out of row crop agriculture for permanent vegetation like trees, which have such a long time horizon for payback, is an ideal that most landowners can't afford to achieve on their own. Those landowners interested in installing more conservation on their land are often ineligible because of restrictions dictated by the Farm Bill. Moreover, cyclical conservation practices are difficult because of unstable funding, as opportunities that are available during one year may dry up the next due to lack of resources. This cyclical nature also hurts nurseries, who's sales fluctuate from year-to-year in response to this changing funding.

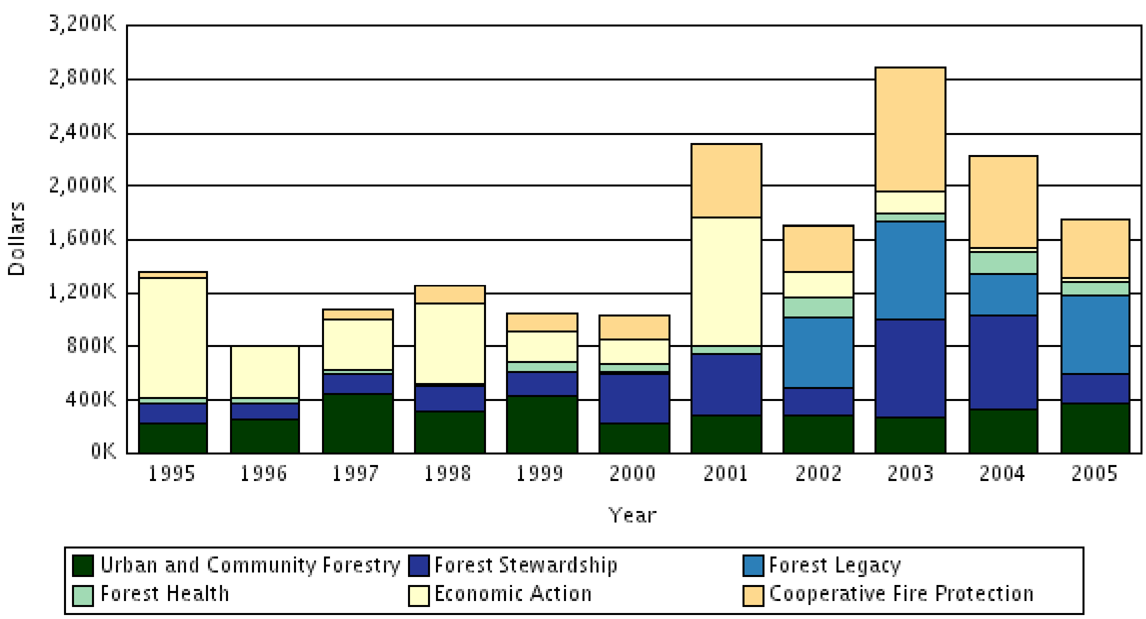
USDA Forest Service Funding

Iowa receives funding from the U.S. Forest Service to offer programs that address forest resource issues in a number of different ways: the Urban and Community Forestry statewide program works with communities to improve their tree resource; the Forest Health statewide programs works on detection and prevention of new insects and diseases that could cause detriment to the forest resource; the Forest Stewardship statewide program offers assistance to Iowa's 150,000 forest landowners; the Cooperative Fire Protection statewide program helps with fire departments education and equipment needs to help with fire suppression and prescribed fire; and the Forest Legacy program help forest landowners with easements.

There are several programs for which the U.S. Forest Service does not offer funding, and which the DNR Forestry Bureau believes provide important functions: the state lands management program guides management on forest land in the Forestry Bureau's operation; the State Forest Nursery grows native seedlings at a low cost to help landowners plant more trees on their land; the Tree Improvement program works to preserve the genetics of black walnut and butternut; the Utilization and Marketing program administers the bonded timber buyer program and keeps the wood industry up-to-date on issues that could both benefit and harm Iowa's wood industries; and conservation education is administered through funding from Iowa utility companies who work primarily with schools to educate children about the importance of tree planting and general conservation.

Figure 6.13 shows how federal funding for programs has varied between 1995 and 2005. The category for economic action disappeared for 2005 even though it provided the bulk of federal funding only ten years earlier. Though Forest Legacy has increased the overall federal allocation of money to Iowa, it hasn't helped to leverage the capacity of existing programs to increase or improve their effectiveness because the money is used to purchase conservation easements from private forest landowners. Varying levels of funding within programs makes it difficult to achieve thier long-term goals.

Figure 6.13 USDA Forest Service Funds Given to Iowa, 1995-2005.



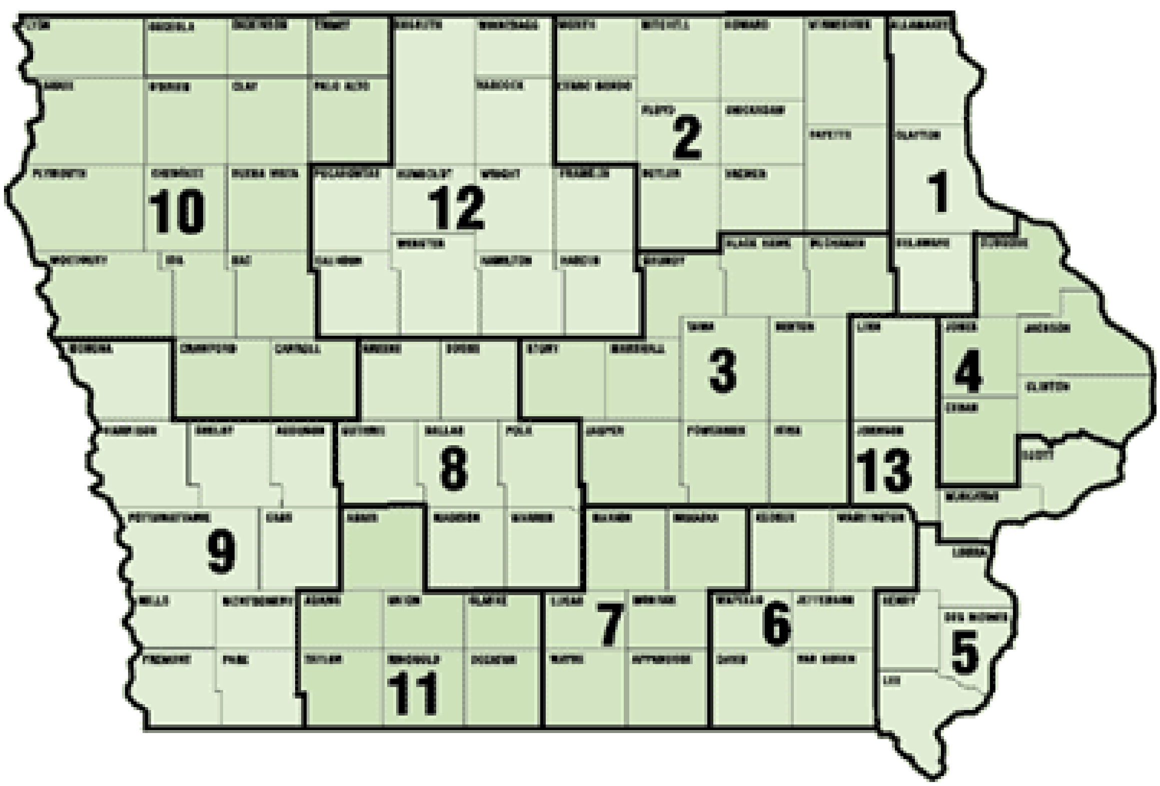
Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

State of Iowa Forestry Staff

The Iowa DNR consists of about 970 permanent and 250 seasonal employees. There are a number of different bureaus that specialize in managing the state's natural resources for many different users.

Within the Forestry Bureau there are 16 district foresters located throughout the state who help the more than 150,000 private forest landowners manage their forest land and successfully establish tree plantings. Figure 6.14 shows how Iowa's 13 forest districts are divided up (some districts have more than one district forester).

Figure 6.14 Forest Districts in Iowa.

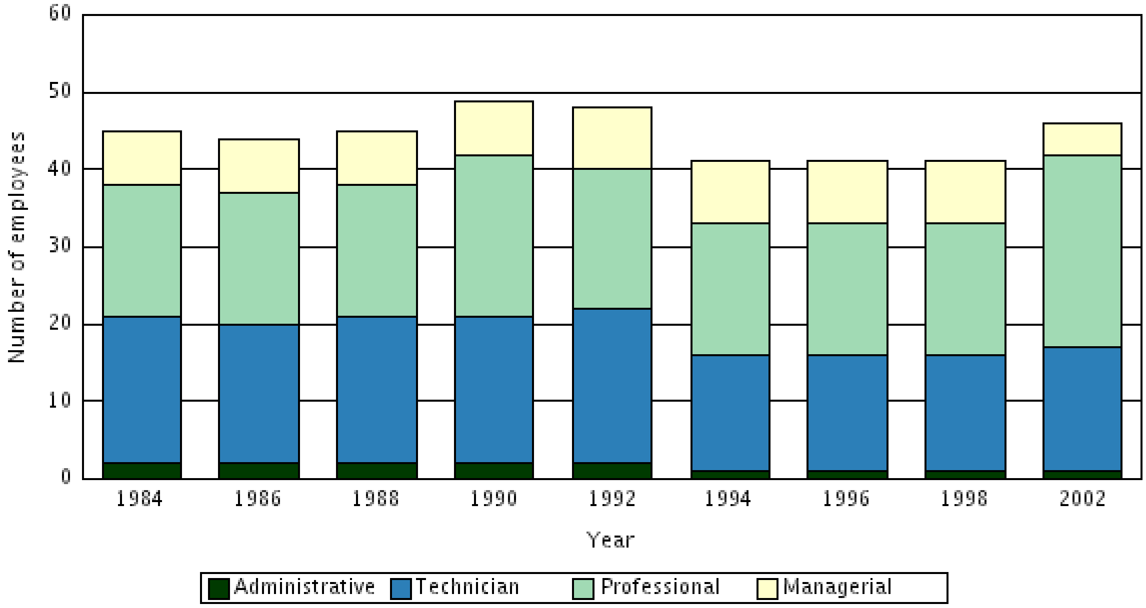


Source: Kathryne Clark.

There are a total of four area foresters and 9 natural resource technicians who manage over 45,000 acres on Iowa's four state forests. District foresters and area foresters are supervised by the Private Lands Forest Supervisor and State Forest Section Chief, respectively. Four more specialized foresters oversee forest health, fire, urban and special projects issues. The State Forest Nursery is also managed by the Private Lands Forest Supervisor as well as a secretary, a nursery forester, three natural resource technicians and an inmate crew capable of growing and shipping up to 4 million tree seedlings per year. Finally, the bureau as a whole is under the direction of the Forestry Bureau Chief.

In 2009 the Iowa DNR Forestry Bureau had 29 foresters, 16 natural resource technicians and one secretary to help Iowans with their forest land. Current state budget reductions may reduce the forestry staff described above. Figure 6.15 below shows the number of people employed by DNR Forestry Bureau per year from 1984 to 2002.

Figure 6.15 Permanent State Forest Employees in Iowa, 1984 to 2002.



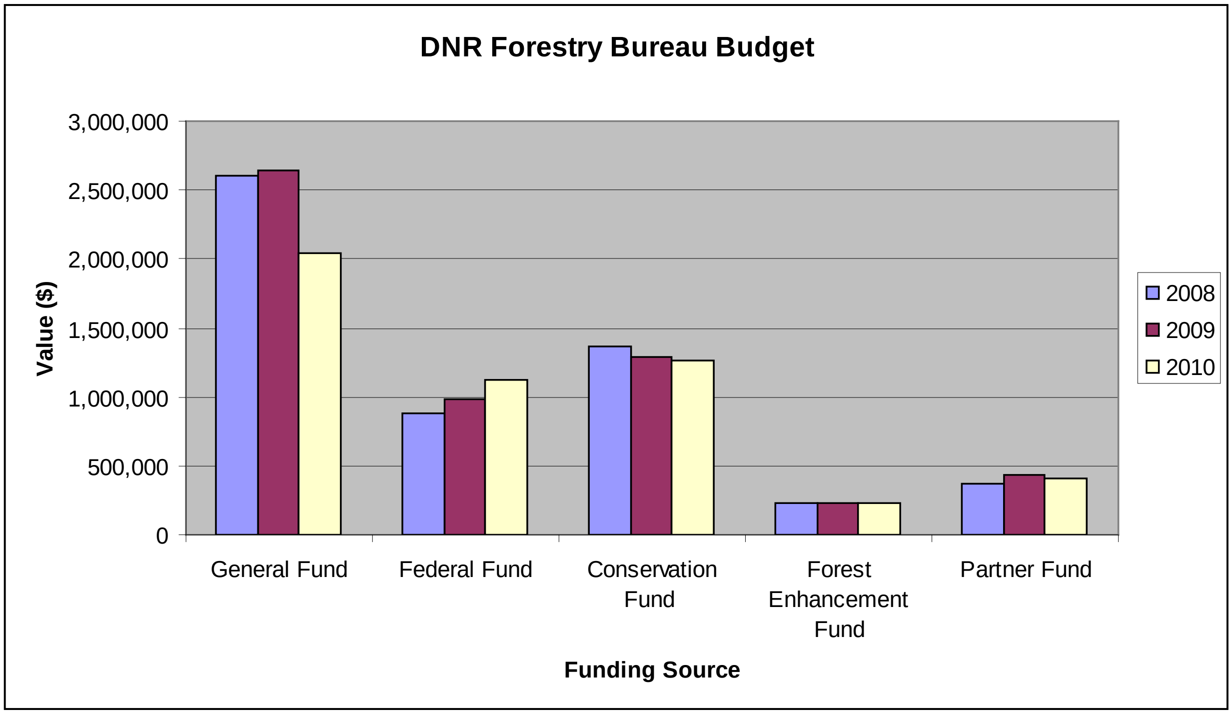
Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

State Funding for Forestry

There are five general sources of funding for the Forestry Bureau: general fund income, which is allocated by the state of Iowa through the Legislature and Governor's Office; federal funding, provided by the U.S. Forest Service to support priority programs; conservation funding, generated by the State Forest Nursery; the Forest Enhancement Fund, which provides $0.05 for every seedling sold to support district forester positions in Northeast Iowa; and partner funding from organizations such as Alliant Energy, Mid-American Energy, Black Hills Energy, Trees Forever, Iowa Woodland Owners Association, Iowa Tree Farm and Iowa Bankers Association. Partner funding is dedicated to producing educational materials for the Trees for Kids and Trees for Teens programs and the majority of such funding goes toward residential tree distribution programs.

Figure 6.16 gives a breakdown of the DNR Forestry Bureau budget for 2008, 2009 and 2010. The budget for the bureau was about $5.5 million per year for fiscal years 2008 and 2009. Unfortunately, due to across-the-board budget cuts, the bureau lost over $550,000 in general funding during fiscal year 2010, though it was able to compensate for this somewhat due to an increase in federal funding of approximately $250,000. Overall, the forestry bureau saw a net decline of roughly $367,000 from former levels during fiscal year 2010.

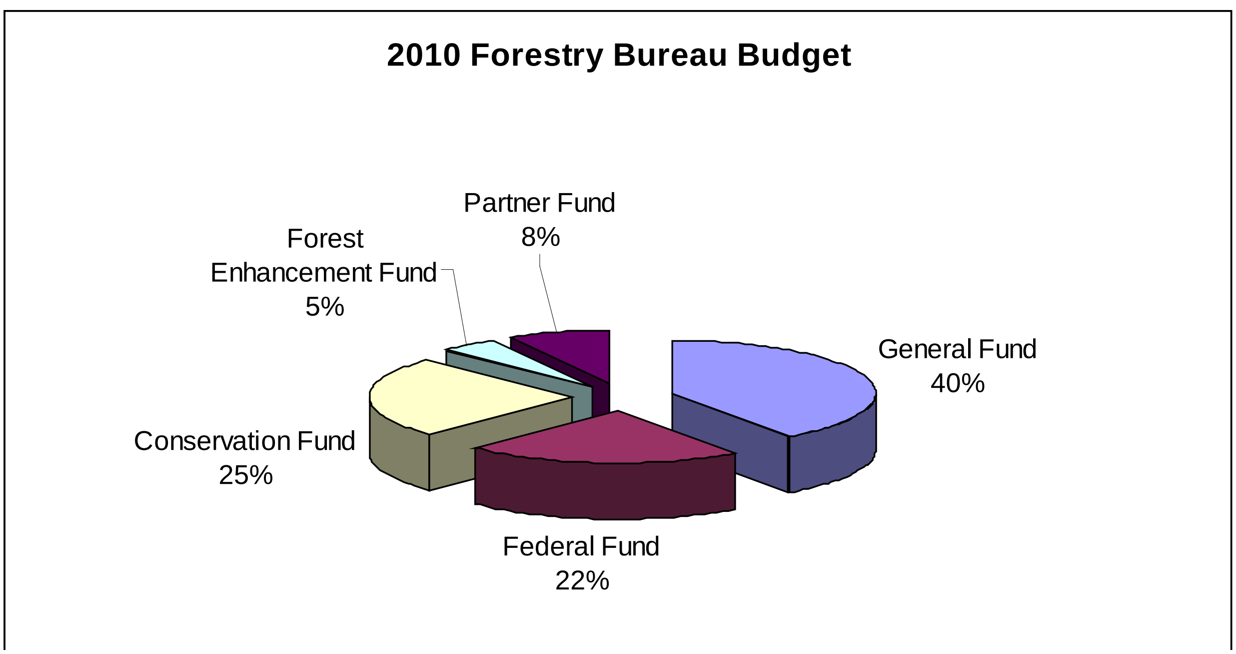
Figure 6.16 Budget Breakdown for Iowa DNR Forestry Bureau, 2008-2010.



Source: Paul Tauke.

General fund dollars are especially important for use in matching federal funding, and there could come a point when there are not enough general fund dollars available to match available federal funds. Currently, the DNR Forestry Bureau is able to bring in $1.86 to $2.05 of federal funding for every general fund dollar it receives. Figure 6.17 shows the breakdown by percentage of how the forestry bureau was funded for fiscal year 2010.

Figure 6.17 2010 Forestry Bureau Budget.



Source: Paul Tauke.

A study funded by the National Alliance of Forest Owners (NAFO) found that for every 1,000 acres of private working forest, eight jobs are created with a total annual payroll of $270,000 and $9,850 in annual state taxes. It has been estimated that 10% of private forest land in Iowa meets the definition of working forest and that Iowa's forests annually provide a payroll of more than $70 million to roughly 2,200 employees who contribute over $2.7 million in state taxes. Turning the roughly 90% of private forest land that is not currently working forest into working forest could create nearly 20,000 more jobs, an annual payroll of $667,035,000 and over $24 million more in annual state taxes. This shows just how much economic activity Iowa's forests could generate if properly managed.[68]

The Forestry Bureau received $1,128,461 in federal funding to supplement stewardship, forest health, urban, and fire programs during fiscal year 2010. Additionally, the Forestry Bureau passes through an average of $425,000 per year in federal funds to partners outside the DNR to perform important forest-related activities. These partners include volunteer fire departments, forestry contractors, RC&D's and Iowa State University.

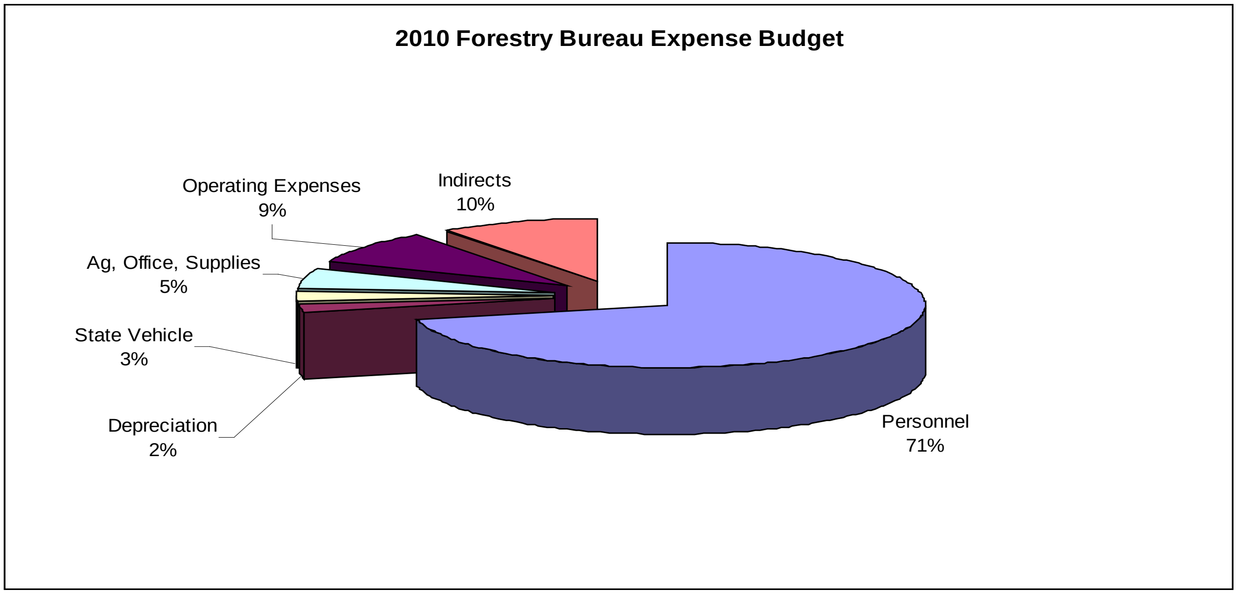
Of the $2,045,015 of general funding for 2010, $988,703 was allocated for work on state forests; an additional $389,632 was generated through crop rentals and timber sales, bringing the total operating budget for state forests to $1,378,335. The remaining $1,056,312 of general fund money was used to support 16 district foresters, their supervisor, four program staff and the Forestry Bureau Chief.

The above figures do not take into consideration positions that are left empty as a result of decreased general funding. When funding is slim, decisions must be made in regard to which services and positions will be maintained and which will be eliminated. One way to mitigate the loss of state funding is to pursue more federal funding opportunities. Many times federal funding defines specific tasks and deliverables that are expected in return for the money that is offered. These tasks may not be related to how the lost general funds were used before, but they at least allow for the retention of personnel. The priority given to certain activities within the forestry bureau is reflected in how the bureau's budget is broken up and where most of its money comes from. For example, when the budget shifts from reliance on general funding toward reliance on federal funding, district foresters must often sacrifice time and resources spent helping private landowners in order to perform forest health and other functions considered important by other agencies offering grants for work to be performed.

Figure 6.18 shows that personnel expenses make up the bulk of the forestry bureau budget at 71%; indirects such as accounting, customer service and computer services make up an additional 10% while the remainder is used for supplies, equipment repairs and other general operating expenses.

[68]<nafoalliance.org/featured/first-ever-study-quantifies-the-economic-impact-of-private-working-forests-in-the-u-s/>. January 23 2010.

Figure 6.18 2010 Forestry Bureau Expense Budget.

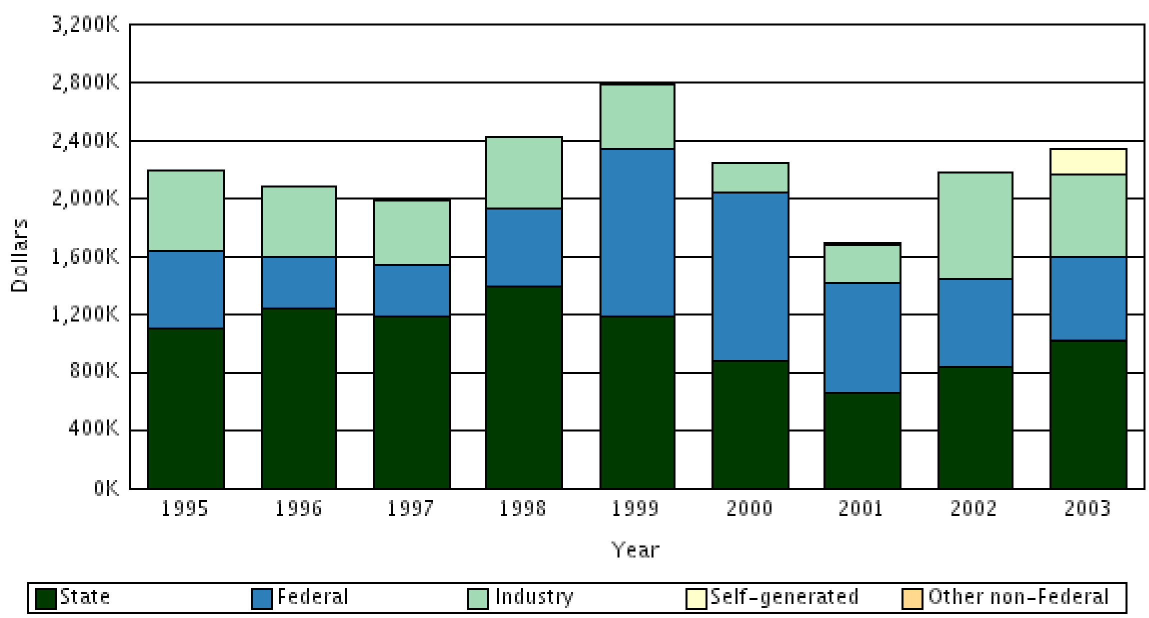


Source: Paul Tauke.

Funding for Forestry Research at Universities

As Figure 6.19 reflects, funding for forestry research at universities has been increasing at the state level, decreasing at the federal level and increasing at the industry level in recent years, which has resulted in very little net change in funding.

Figure 6.19 Funding for Forestry Research at Universities in Iowa.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Maintaining a solid forestry extension program through Iowa State University is integral if important messages and good advice are to be delivered to forest landowners at field days and workshops. An accredited forestry program and knowledgeable extension forester guarantee that terminology and silvicultural practices are consistent across the state during ground-level private forest land practices. Unfortunately, some extension programs have been reduced or eliminated, which has been leading to a reduction in these necessary services.

The creation of a web-based Iowa forestry connection could facilitate better communication between ISU Extension, professional foresters, private forest landowners, public land managers, forestry organizations and other natural resource entities in the state. Keeping these groups informed about educational opportunities, discussion forums, employment opportunities, grant opportunities, on-going research, publications, wood industry information and the "ask a forester" blog could lead to the enhancement of forest activities in the state.

6.6 Forest Certification

Certified Products

Pressure is mounting on retailers of forest products to purchase "green" certified lumber or paper products. Green certified products are those products that can be proven to be grown on property that is managed in a sustainable fashion. If the forest certification movement continues to gain momentum, Iowa's forest owners may need to have their property or forest management practices certified as sustainable by a third party certifier to insure access to some markets for their forest products. However, the expense of certification and lack of additional revenue from having certified forests is prohibiting forest owners from becoming certified. Opportunities and challenges exist in developing a viable and inexpensive means of green certification for small woodland owners in Iowa.

Certified Management

In 2009 Iowa had 1,107 forest landowners representing 93,166 acres of Iowa's forest land who were certified under the American Tree Farm System. A forest landowner certified under this system must have a management plan that follows certain standards and guidelines; these guidelines show landowners how to manage their forest for clean water, wildlife, recreational opportunities and wood products. The number of forest acres being managed reflects the willingness of Iowa forest landowners to improve their forest.

6.7 Highlights of Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits]

Iowa lost more than 51% of its sawmills from 2000 to 2005.

There are currently no pulp mills or cellulosic ethanol plants that use softwoods or small-diameter, low-quality wood in Iowa.

Without a viable wood products industry, forest landowners wouldn't have the economic incentives to perform forest stand improvement activities.

Iowa ranks 49th in the nation for the percentage of land that is available for public recreation.

Due to a lack of funding and lack of understanding of forest management, many recreational areas in forest settings are improperly managed or unmanaged.

The need for public land for recreation has increased as the state's population has become increasingly urban.

Conservation programs cannot compete with agricultural commodity prices without sufficient economic incentives.

Taking land out of agricultural production for the promotion of permanent vegetation like trees is economically unfeasible for most landowners without assistance from state and federal programs.

State land management, native seed source protection, utilization and marketing, and conservation and education are activities that the Iowa DNR Forestry Bureau believes are important but that are not supported by the Forest Service.

In 2010 the DNR Forestry Bureau lost over $550,000 in general fund dollars.

If all of Iowa's forests were properly managed, nearly 20,000 more jobs and $24 million more in annual tax revenue could be generated.

Only 10 to 15% of the Iowa DNR Forestry Bureau budget is available for discretionary spending, which leaves little money for improvements to the state's forest resource.

Only 93,000 acres of Iowa's 2.75 million acres of private forest land is enrolled in the American Tree Farm System.

7.0 Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

Social, legal, economic, and environmental conditions reflect society's values and have a profound effect on forest conservation and sustainable management. These factors create a complex web of influences that can sometimes interact in unexpected ways. For example, some communities, in an effort to slow growth, have enacted zoning ordinances to require larger lot sizes. This has the unintended effect of fragmenting more forest land than if lots were clustered closer together.

The most important question is whether the region's legal, institutional, and social factors, when taken together, tend to support or undermine forest sustainability. A comprehensive planning and monitoring system is critical to answering this question. Some of the important factors to consider include population trends, technology, local, state, national, and international trade, land ownership and local, state, and national laws and regulations.

7.1 Forest Related Planning, Assessment, Policy and Law

State Forest Planning

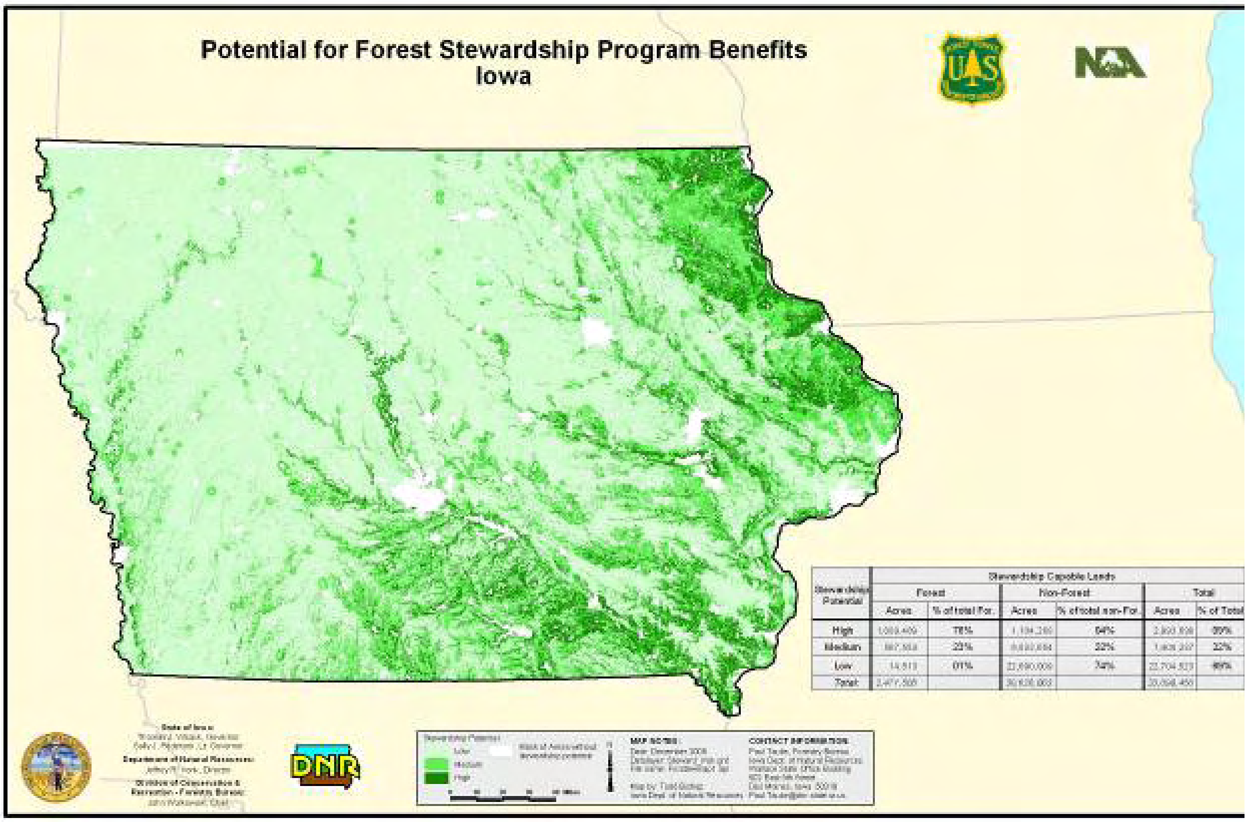
The approximately 35,000 acres of forest land the DNR Forestry Bureau manages have management plans to ensure that they are sustained for future generations and that the mission and core functions for the DNR and Bureau of Forestry are reflected in their management. These plans serve as a record of public input and desired uses and reflect the management intentions for the next twenty years based on current knowledge of land capability, inventory data, sound forestry practices, land stewardship and public demands. These plans are working documents, and are revised as needed to address the challenge of managing a constantly-changing forest resource.

In the planning process, goals and objectives are developed to move the forest resource to a desired future condition. These plans ensure a system of orderly management and development that reflects the current science regarding harvesting, forest stand improvement and reforestation. Management goals and objectives lay a foundation for the implementation of sound forestry management practices for these public forests.

Private Forest Land

Private forest land management is completely voluntary and guidelines are offered through the use of free on-site visits from DNR foresters. Figure 7.1 shows areas of the state where there is potential for private land stewardship, with darker color representing greater potential (details about the criteria that went into the development of this map are provided in the next chapter).

Figure 7.1 Potential for Forest Stewardship Program Benefits.



Source: Kathryne Clark.

Iowa has a voluntary best management practices guide for timber harvesting; there is a technical guide that includes federal standards and DNR Forestry Bureau standards that have to be met for all projects related to trees that receive state or federal cost-share assistance.

7.2 Incentives for Forest Landowners

District foresters provide free consulting services for forest landowners. They can work with landowners to apply for tree planting cost-share assistance at local FSA or NRCS offices to reduce the cost to the landowner for tree planting, forest stand improvement and wildlife habitat improvements. Landowners can receive stewardship plans for their existing timber to help them keep it healthy and productive.

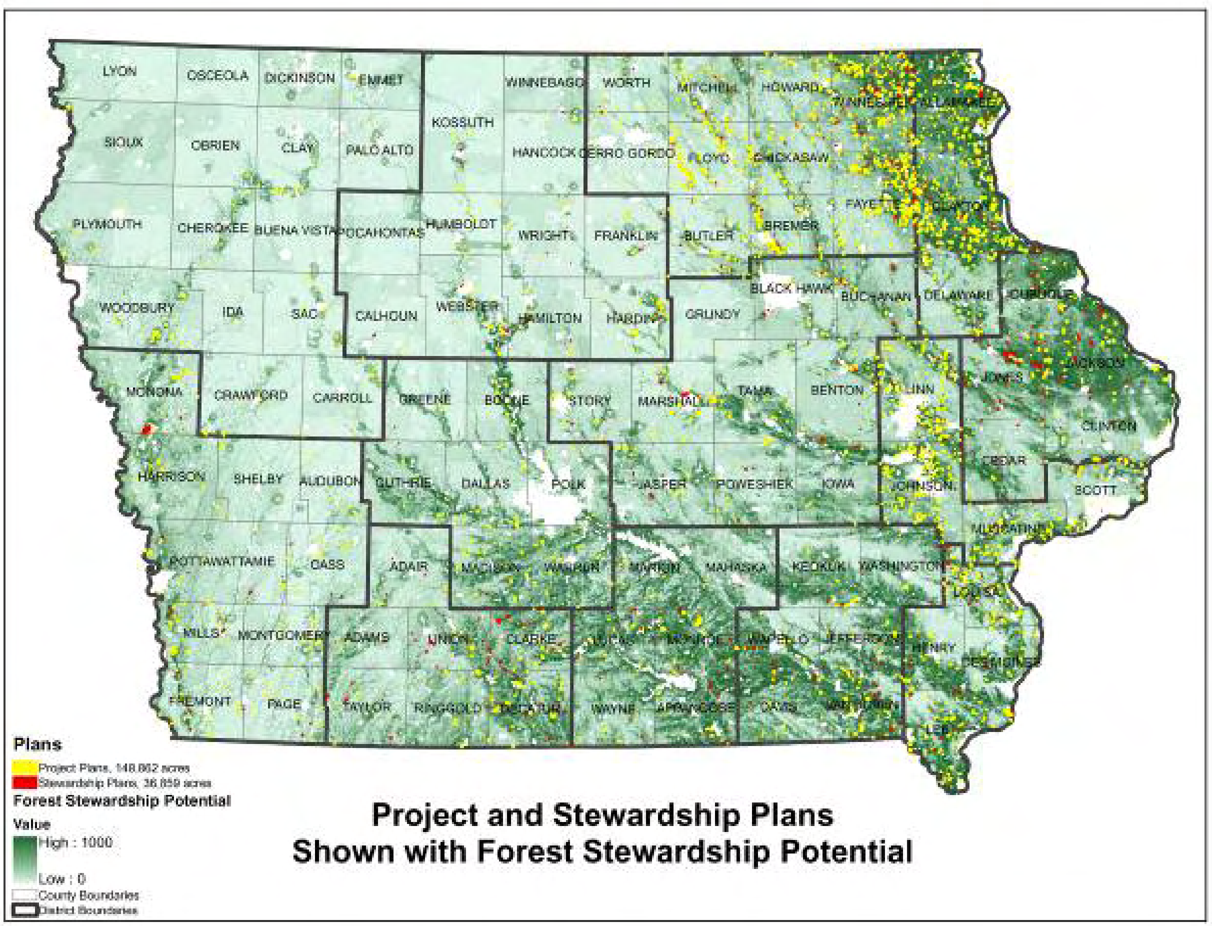
The State Forest Nursery provides low cost seedlings to get people to plant more trees. By selling native conservation seedlings, Iowa forest landowners are able to purchase trees that are adaptable to Iowa's climate at a low cost. Conservation programs that encourage tree planting are at a disadvantage when competing with agriculture, which generates income quickly and consistently; however, lowering the input costs of tree planting is one way to make forest-related activities more economically feasible.

Market-based incentives such as pollution taxes have been an effective way to implement environmental regulations. These incentives are being considered for use in the maintenance and enhancement of ecosystem services by encouraging the production of environmental "goods" rather than controlling environmental "bads". Programs specifically designed to enhance the production of services like carbon sequestration, water and air quality and biodiversity conservation are newer and their impacts are therefore less certain.

7.3 Private Landowner Forest Planning

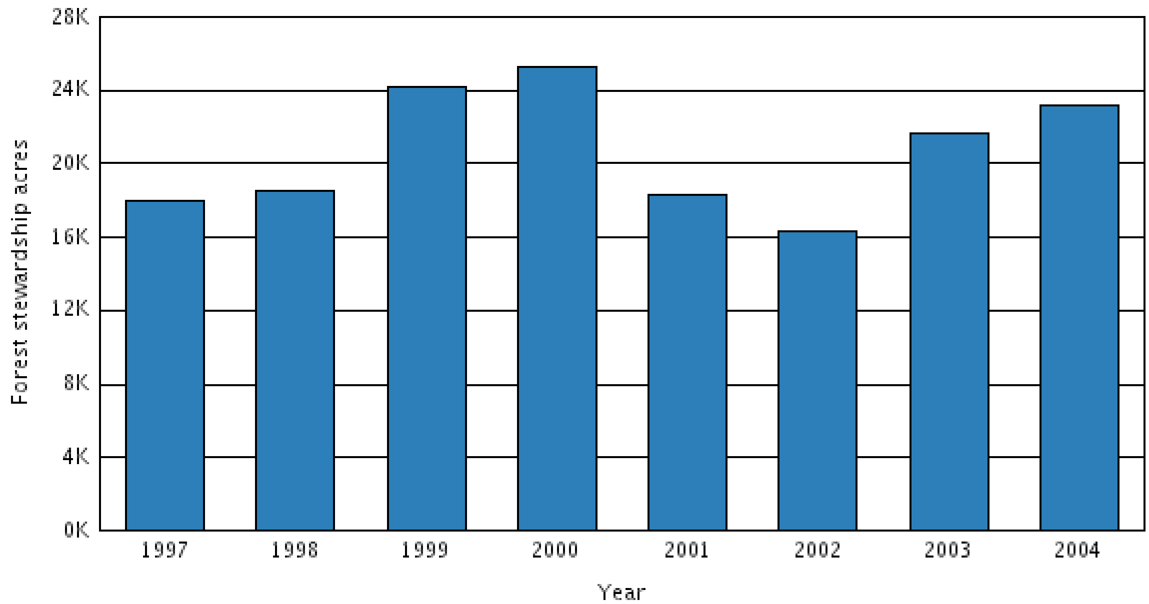
Figure 7.2 shows parts of the state where forest stewardship and project plans have been written for forest landowners 1998-2009, while Figure 7.3 shows the number of acres of forest land for which stewardship plans were written per year from 1997 to 2004. In 2009 DNR foresters wrote stewardship plans for 21,375 acres of forest, or less than 1% of the state's 2.7 million private forest acres. Overall, stewardship plans have been written for over 190,000 acres of forest in the state, which still only accounts for 7% of total forest land. As the number of landowners in the state increases, it becomes more and more difficult for the unchanging number of district foresters to meet the needs of these landowners; furthermore, as private landholdings decrease in size, the management plans that are carried out come to represent smaller and smaller pieces of Iowa's total forest land.

Figure 7.2 Project and Stewardship Plans Shown with Forest Stewardship Potential, 1999-2009.



Source: Kathryne Clark.

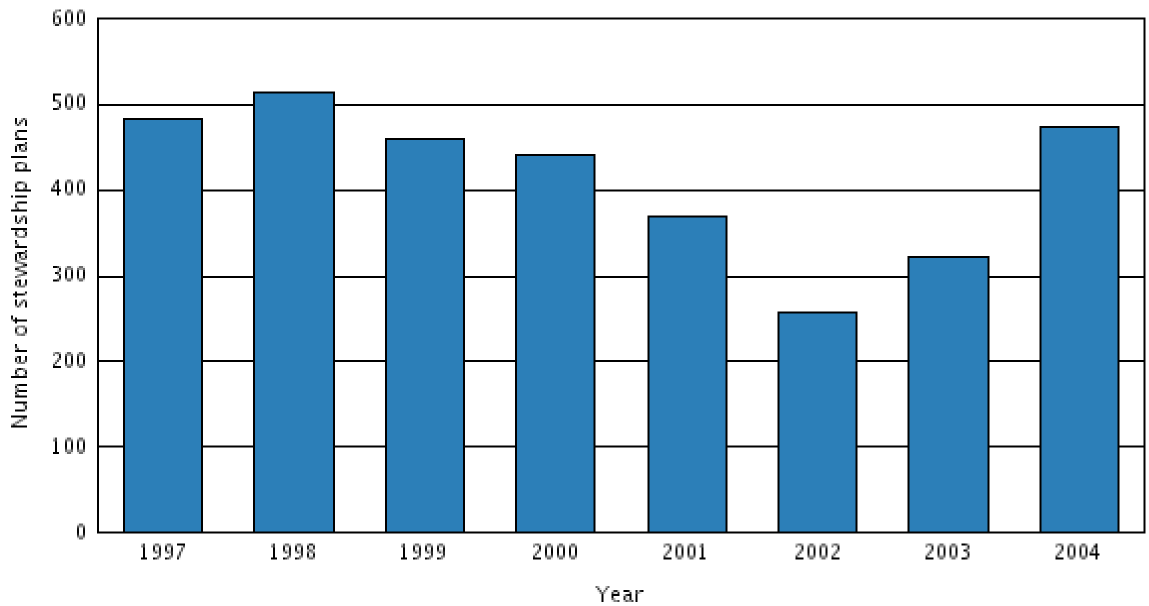
Figure 7.3 Forest Stewardship Acres on Non-industrial Private Forest Land, 1997-2004.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

Figure 7.4 gives the number of forest stewardship plans written per year from 1997 to 2004. A total of 435 stewardship plans were written in 2009, a number that falls within the range shown in this figure. On average, stewardship plans are drawn up for less than 1% of landowners annually and district foresters are able to write only two or three plans apiece per month (It is worth noting that in addition to stewardship plans, district foresters wrote over 700 other plans involving tree planting, forest stand improvement and other forestry-related work in 2009).

Figure 7.4 Number of Stewardship Plans Written for Non-industrial Private Forest Lands, 1997-2004.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

7.4 Forest Laws and Policies

According to the Code of Iowa: *The State Forester has full responsibility and authority to plan and execute all technical phases of the forestry program in Iowa.*

Iowa's regulation of the timber industry is limited; though law requires anyone wishing to purchase timber from a landowner to be bonded and to have an application on file with the DNR Forestry Bureau, there are no requirements for management plans or best management practices during harvests. There is also no additional tax kept by the state to inspect timber harvests, and forest landowners are not required to provide any information about timber sales on their properties. The best the forestry bureau can do at this time is to encourage landowners to work with professional foresters so that their timber is managed as well as possible.

The development of this document is meant to guide the DNR Forestry Bureau to coordinate efforts with stateholders to work on resolving issues facing the forest resource in Iowa.

Forest Reserve[69]

In 1906 the Iowa Legislature passed a private landowner tax incentive known as the Forest and Fruit Tree Reservation Act to "reduce or eliminate property taxes to induce landowners to hold their poorer lands in timber not only as a source of farm income but also for erosion control, watershed protection and game cover". This law allows forest landowners the opportunity to avoid paying property taxes on their forested property as long as it is:

At least 2 contiguous acres in size and generally not less than 66 feet wide or a fruit tree reservation not less than 1 or more than 10 acres in total area.

And that it:

[does] not contain less than 200 growing trees, on a fruit tree reservation at least 40 apple trees per acre and other fruit trees reservations at least 70 trees per acre.

The definition of forest trees includes ash, black cherry, black walnut, butternut, catalpa, honeylocust, Norway and Carolina poplars, mulberry, the oaks, sugar maple, cottonwood, soft maple, osage orange, basswood, black locust, European larch, other coniferous trees and all other forest trees introduced in the state for experimental purposes.

In forest reservations which are artificial groves, willows, boxelders and other poplars shall be included when protecting borders not exceeding two rows in width around a forest reservation or when used as nurse trees not to exceed 100 on each acre.

No cattle, mules, horses, sheep, goats or hogs are permitted on forest reservations.

Not more than 1/5 of the total number of trees in the forest reservation may be removed in any single year unless the trees die of natural causes. When the number of trees falls below 200 trees on each acre, the owner shall within one year restore the number of trees to not less than 200 trees per acre.

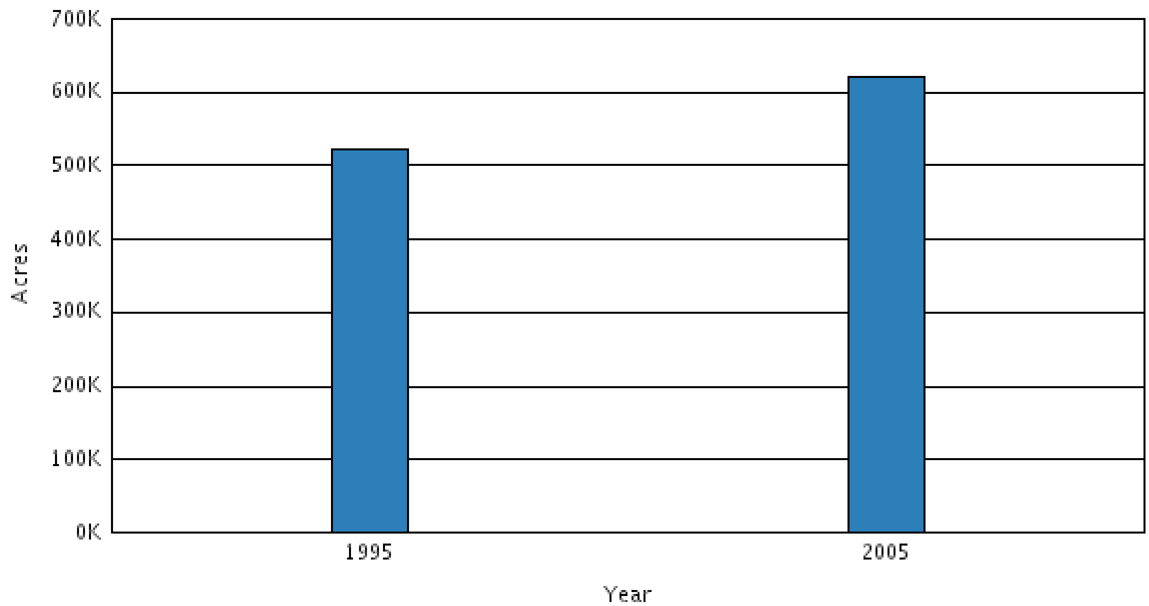
[69]Section 427 of the Iowa Code. <www.iowadnr.gov/forestry/reserve.html.>. April 15 2010.

If any buildings are standing on an area selected as a forest reservation, one acre of that area shall be excluded from the tax exemption. However, the exclusion of that acre shall not affect the area'sz meeting the acreage requirement.

A forest reserve can not be used for leased hunting. (This is based on the presumption that wildlife is a product of the forest and not of the individual trees in the forest. The Iowa administrative rule does not specifically prohibit leased hunting). No forest management plan is required to be enrolled.

Figure 7.5 gives a comparison of the number of acres of forest land enrolled in tax reduction programs in Iowa in 1995 and 2005. There were 659,562 acres of forest enrolled in forest reserve in 2008, which represents an increase of 28% over the 516,017 acres enrolled in 2000. Acres enrolled in forest reserve only represent 22% of Iowa's forest land as of 2008.

Figure 7.5 Forest Land Enrolled in Tax Reduction Programs in Iowa.



Source: U.S. Department of Agriculture, Forest Service - Forest Sustainability Indicators Information System. [Database].

State Forestry Advisory Committees

There are several forest advisory councils, including the Urban Forestry Council, State Stewardship Committee, Forest Health Insect and Disease Management Council, that provide priorities for those programs to the State Forester in specialized areas affecting the forest resource.

Partners with the DNR Forestry Bureau

Organizations that the Forestry Bureau works with to deliver services and programs to conserve and enhance the forest resource include:

- USDA Forest Service
- USDA APHIS
- USDA Natural Resources Conservation Service
- USDA Farm Service Agency
- Iowa Department of Agriculture and Land Stewardship
- Iowa Department of Transportation
- Iowa State University Forestry Extension
- Iowa DNR Wildlife Bureau
- Iowa Prison System
- Alliant Energy
- Mid American Energy
- Black Hills Energy
- Iowa Tree Farm Committee
- Iowa Woodland Owners
- Iowa Nursery and Landscape Association
- Iowa Bankers
- Northeastern Iowa RC&D
- Prairie Rivers RC&D
- Golden Hills RC&D
- Heartland RC&D
- Iowa Wood Industry Association
- Iowa Urban Forestry Council
- Northeastern Iowa Forestry Advisory Committee
- Iowa Arborist Association
- Iowa Association of Municipal Utilities
- Trees Forever
- Iowa Insect and Disease Management Council
- Iowa Wild Turkey Federation
- Pheasants Forever
- Iowa County Conservation Boards
- Iowa Soil and Water Conservation Districts
- Iowa Natural Heritage Foundation

7.5 Highlights of Forest Related Planning, Assessment, Policy and Law

Management plans exist for about 20% of public forest land and less than 10% of private forest land in Iowa.

Forest management plans are not required for enrollment in the Forest Reserve Program.

Best management practices are not required for timber harvesting and no information is collected regarding private forest land timber harvests in Iowa.

Incentives for forestry practices are rarely great enough to persuade landowners to invest in their forests or convert agriculture land to forest land.

8.0 Priority Forest Landscapes

Identifying forest areas that are important to the people of Iowa and that have many attributes that make some areas a higher priority to be working in is a challenge to do using geospatial methods. The first assumption is that the data that is important for deciding which areas are important is available at a scale that is useful. Next, the important issues that can't be displayed geospatially are not included in this evaluation. A final challenge is deciding at what scale the data will be displayed to show where priority forested areas are in the State.

Even though not all forested areas are listed as a priority, that does not mean those forests are not important to the owners of those forests or the wildlife that depend on those areas for food, water or shelter. All forests provide beauty in their own way, stabilize soil, sequester carbon and improve the water quality in the watershed they are located. Some forests provide important corridors for wildlife to move within or shelter for the woodland plants that grow beneath the canopy of the trees.

8.1 Rural Forest Priority Areas

Portions of the state that were excluded from the analysis were urban community areas and open water. Public lands were included.

The way the rural forest priority areas were determined was by looking at 15 different factors for which there was data available. The forest stewardship committee weighted the importance of each factor to allow a GIS specialist to create a composite map that displays where forested areas had the most factors in common.

For each factor the most recent, highest resolution data available was used. Higher resolution data allowed for far more precise areas to be defined within the analysis area.

The 15 factors included in the analysis were developed from issues described earlier in this assessment. The factors are listed with the figure they relate to and were discussed earlier in the assessment.

Weighting applied to the 2009 Forest Priority Map

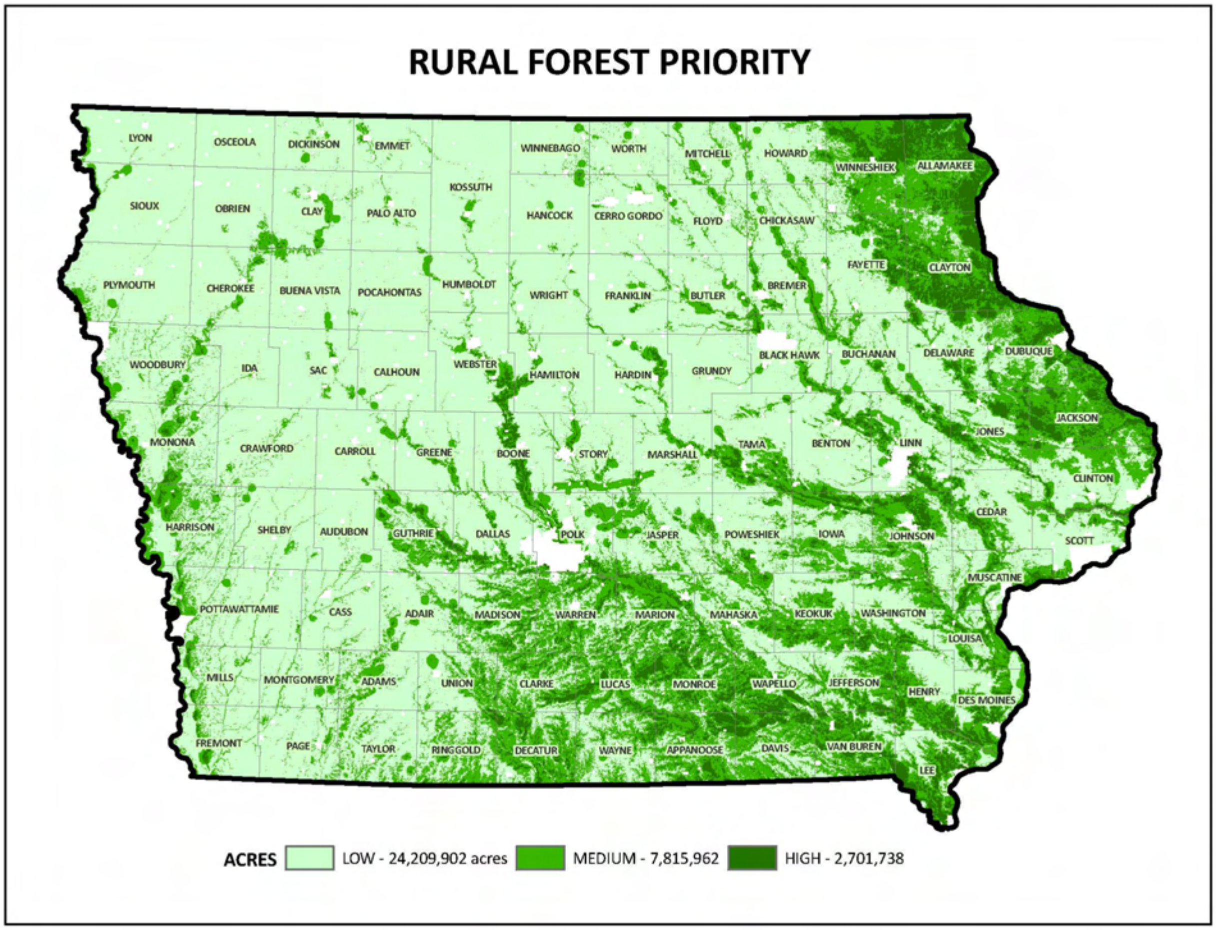
Criterion	Weight (%)	Figure
Forest Soils	18	4.9
Forest Wildlife	18	1.56
Extisting Forest	13	1.3
Forest Patch Size	13	1.42
Promixity to Public Land	13	1.16
Priority Watersheds	7	4.6
Topography (Slope)	4	4.11
Development Risk	3.15	1.25
Riparian Corridor	3	4.2
Pest/Disease (Morality)	2.1	3.15
Forested Wetlands	2	4.1
Oak Regeration	1.4	1.32
Forested Landscapes	1	1.44
Historical Forest	1	1.2
Wildlife Risk	0.35	3.24

When ranking the factors, one was considered the most important and 15 the least important. A mean response value was calculated for each factor which was then subtracted from the highest possible rank (15). The inverse response values generated were then weighted by dividing each by the sum of the inverse response values.

All analysis components were converted to 15 meter pixel ESRI GRIDs for the same spatial extent (used Iowa land cover 2002 clipped to the Iowa border as a spatial reference). The 2009 GIS computation used the final GRID having a low (0-0.14), medium (0.15-0.41) and high rank (0.42-0.98).

Composite Rural Priority Map

Combining all of the 15 maps described above into one overall priority map for determining forest areas of the state with the most issues in common results in the rural priority map.



Source: Kathryne Clark.

This composite map shows there are 2,701,738 acres in Iowa with high potential for growing forest based on 15 attributes for where forest cover would not only thrive, but would be the preferred vegetation cover. Within the high potential growing area there is already 1,889,489 (63.1%) acres of forest growing on those acres. Within the areas forested in the high potential area there are 76,983 (2.8% of the area) acres that have Stewardship Plans written to guide these landowners on how to manage these resources.

There are 7,815,962 acres with medium potential. Within the medium potential growing area there is 34,948 (7.7%) acres that are currently forested. Within the acres that are forested in the medium area there are 50,384 (0.6%) acres that have a Stewardship Plan.

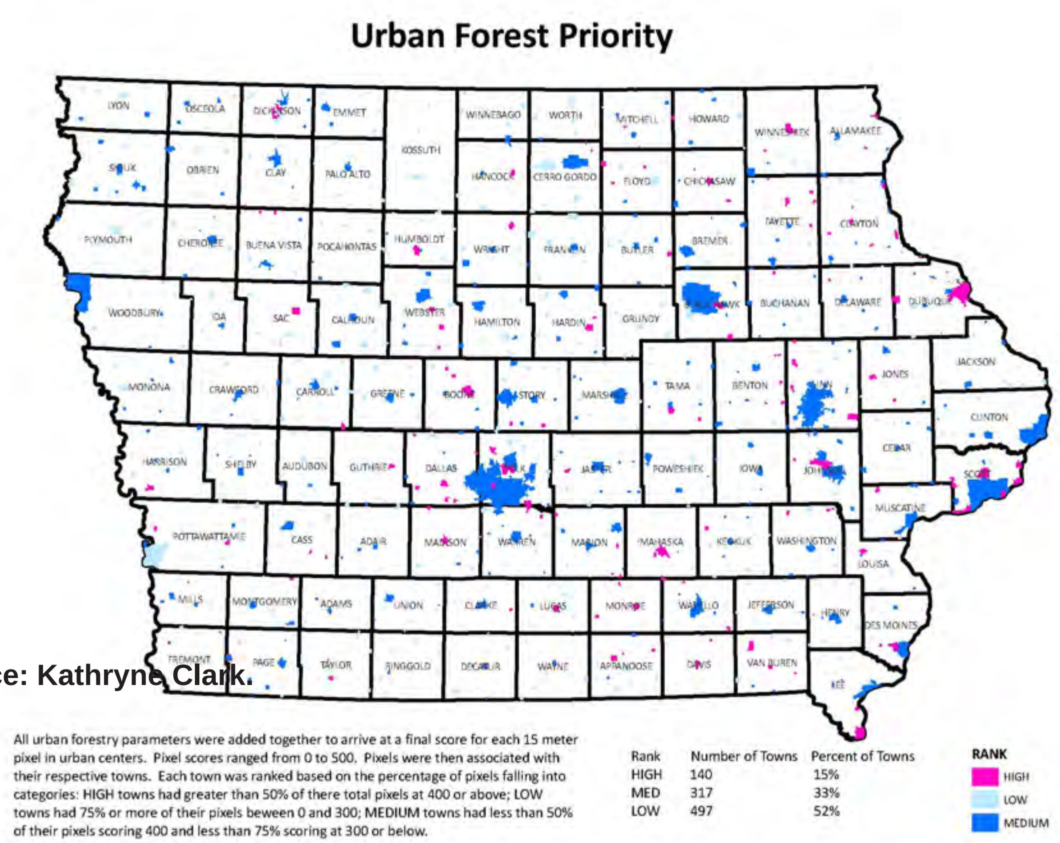
In the low priority area there are 24,209,902 acres that are better suited for other uses but could still grow high quality trees. Within that area there is 7,342 (0.03%) acres that are currently forested. Within the acres that are forested in the poor area there are Stewardship plans written for all of the acres.

8.2 Urban Priority Areas

Prioritizing communities for assistance is a moving target. Community leaders, budgets, threats to the trees and advocates within a community can change from one year to the next making opportunities come and go depending on the situation for that community.

The Urban Priority map uses figures that were developed around urban issues as described in Chapter 1. The map was developed by equally weighting the data from communities participating in Tree City USA (Figure 1.19), urban tree canopy using the Maryland method (Figure 1.26), towns ranked by percent forest canopy (Figure 1.27), community populations (Figure 1.20), surface water sources that communities depend on for drinking water supplies (Figure 1.24) and community growth into existing forest (Figure 1.22).

The communities on the composite map are designated to receive priority assistance for tree inventories, management plans, focused residential tree planting and planning. The goal is to work with community leaders to effectively create policies that improve the condition of the tree resource for the community. They are also areas where limited resources will be focused in an effort to make the largest impact with the limited amount of personnel and money available to service communities. This map does not mean other communities will not receive assistance when requested, rather it means attention will be focused on the issues in the communities in Figure 1.28 and the map will continue to be refined as conditions change. The criteria that went into developing this map emphasize working with communities already existing forest resource, to allow better managemen for the many benefits those trees are already providing those communities. The 140 high ranking communities are listed in Appendix D.



Source: Kathryne Clark.

8.3 Forest Legacy Priority Areas

Detailed descriptions for each of the seven Forest Legacy Priority Areas recommended by the Iowa Forest Stewardship Committee are described in Appendix C. The priority areas are shown in the forest legacy priority map below. The seven legacy areas are distributed across Iowa and cover several natural regions of the state.

Source: Kathryne Clark.

8.4 Multi-State Priority Areas and Issues for Iowa

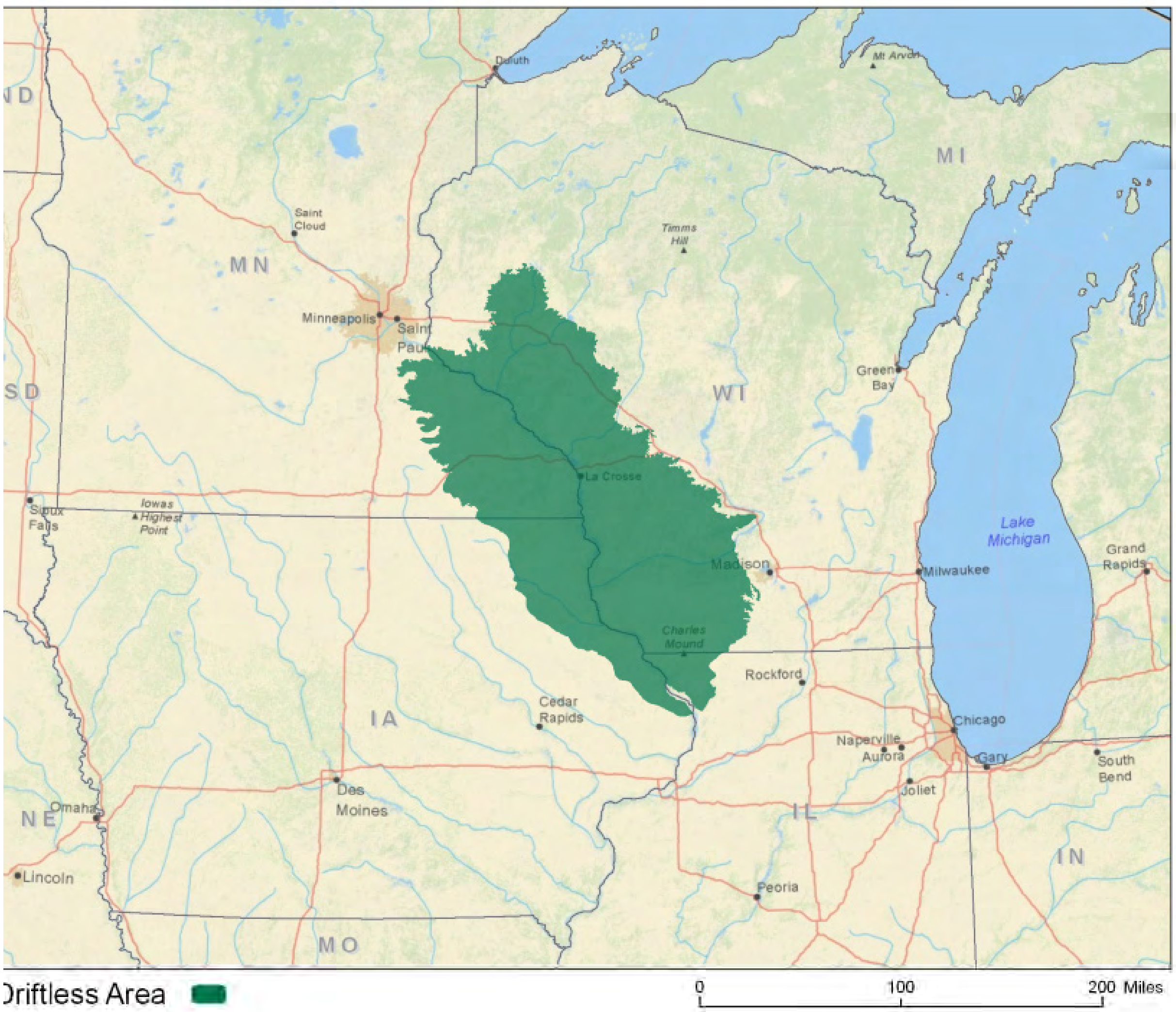
Multi-State Priority Areas

The following areas describe potential conservation areas that Iowa has in common with other states to work on as multi-state projects when policies, stakeholders and funding allow.

The Driftless Area

This is an area that is characterized by a common geologic land form. Steep terrain has allowed much of this area to remain in permanent vegetation.

States: Illinois, Iowa, Minnesota, Wisconsin; see map on next page for boudary.



Issues Associated with the Area

- Cold water, spring fed streams that are sensitive to non-point source pollution due to the karst geology.

- Maintenance of a high value forest resource that attracts tourist to the area each year for a variety of recreational activities.

- Forest fragmentation and parcelization is reducing forest-interior bird habitat.
- Lack of forest management related to limited wood markets.
- Forest invasive plants decreases sunlight to understory plants. As the native plants die, bare soil on steep slopes causes soil erosion

Karst Topography

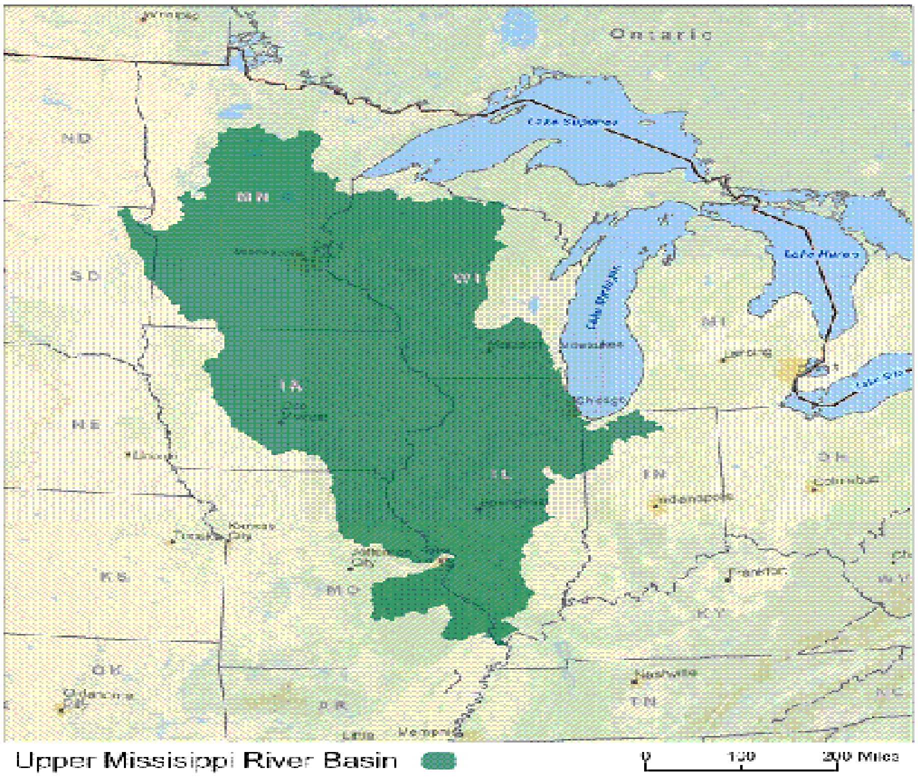
Area with a geology of limestone or other soluble rock that is characterized by caves, sinkholes, and sinking streams.

States: Illinois. Indiana. Iowa. Missouri. Nebraska. South Dakota; see map on next page.

Upper Mississippi Watershed

All of the watersheds that drain into the Mississippi River in the upper Midwest are included as priority areas.

States: Illinois, Indiana, Iowa, Minnesota, Missouri, Wisconsin



Issues Associated with the Area

- Water Pollution--Sediment, nitrogen and phosphorus are the main pollutants in the Upper Mississippi watershed. A significant portion of sediment, nitrogen and phosphorus loads o the Mississippi River comes from human activities: runoff and groundwater from farming, discharges from sewage treatment and industrial wastewater plants, and storm water runoff from city streets. The delivery of high amounts of nitrogen to the Gulf of Mexico causes a hypoxia zone (abnormally low levels of dissolved oxygen in bottom waters) to expand each summer. About 90% of the nitrate load to the Gulf of Mexico comes from nonpoint sources, and over 31% of that load comes from the Upper Mississippi River.

- Loss of Migratory Bird Habitat--The north-to-south orientation of the Upper Mississippi River and its contiguous habitat make it critical to the life cycles of many migratory birds. It is a globally important migratory flyway for 40 percent of all North American waterfowl and 60 percent of all the bird species in North America. The loss of more than 50% of historic floodplain and valley hardwood forests creates a problem for many waterfowl, raptors, songbirds, and shorebirds.

- Forest Loss and Fragmentation--Forests and prairies are the most beneficial land uses in the Upper Mississippi River Basin in terms of protecting watersheds and water quality.

Nearly all of the prairies and about 70 percent of the forest land have been converted to agriculture and urban land uses. The remaining forest land is critical to watershed healthand clean water. The ability of forests to produce abundant clean water declines as they are broken up (fragmented) and eventually lost. Fragmentation is a process where large, contiguous forest landscapes are broken into smaller, more isolated pieces, often surrounded by human-dominated uses. The loss and continued break up of forest land increasingly impairs water flow and quality, forest health and diversity, and other economic and recreational benefits.

Multi-State Priority Issues

The issues described for the remaining of this section describe potential conservation projects that Iowa has in common with other states to work on when policies, stakeholders and funding allow.

Ecosystem Services

Healthy forest ecosystems are ecological life-support systems. Forests provide a full suite of goods and services that are vital to human health and livelihood, natural assets referred to as ecosystem services.

Many of these goods and services are traditionally viewed as free benefits to society, or "public goods" - wildlife habitat and diversity, watershed services, carbon storage, and scenic landscapes, for example. Lacking a formal market, these natural assets are traditionally absent from society's balance sheet; their critical contributions are often overlooked in public, corporate, and individual decision-making.

When forests are undervalued they are increasingly susceptible to development pressures and conversion. Recognizing forest ecosystems as natural assets with economic and social value can help promote conservation and more responsible decision-making.

Note: Text and content taken from: http://www.fs.fed.us/ecosystemservices/

Issues

- As population, income, and consumption levels increase, people put more and more pressure on the natural environment to deliver these benefits. The 2005 Millennium Ecosystem Assessment, prepared by a group of over 1300 international experts, found that 60 percent of ecosystem services assessed globally are either degraded or being used unsustainably. Seventy percent of the regulating and cultural services evaluated in the assessment are in decline. Millennium Ecosystem Assessment scientists predicted that ecosystem degradation could grow significantly worse in the first half of the 21st century, with important consequences to human well-being.

- Climate change, pollution, over-exploitation, and land-use change are some of the drivers of ecosystem loss, as well as resource challenges associated with globalization and urbanization. Land use change is an immediate issue in the United States. The forests of Iowa are experiencing a loss of open space and a decline in forest health and biodiversity, particularly on private lands. Approximately 87% of all forest land in the Iowa, or 3 million acres, is privately owned. Non-industrial interests – families, organizations, and communities that own the land for the aesthetics and uses that forests provide or for income generated from the sale of forest products and services - own 85% of private lands. Recent trends in parcelization and divestiture of private lands in the United States suggest that private landowners are commonly under economic pressures to sell their forest holdings. Rising property values, tax burdens, and global market competition are some of the factors that motivate landowners to sell their lands, often for development uses. The loss of healthy forests directly affects forest landowners, rural communities, and the economy. As private lands are developed, society also loses the life-supporting ecosystem services that forests provide.

Forestation-Reforestation

Healthy diverse forests are essential for providing a broad range of goods and services from forested ecosystems. Maintaining a balance of the many forest-types within the landscape is increasingly difficult due to the many and diverging interests of various forest land owners/managers. Further, many forest-types are becoming increasingly harder to maintain and/or regenerate due to a variety of factors including climate, disease, insect activity, deer herbivory, and invasive plants to name a few.

Issues

- Invasive plants such as garlic mustard, Japanese knotweed and reed canary grass have literally taken over the understory on many locations out-competing the native vegetation, including tree seedling, reducing or eliminating natural regeneration on these sites.

- Extremely high deer populations reduce natural regeneration or shift species composition by favoring some tree species as browse over another. This has contributed to a trend towards increasing amounts of undesirable tree species in some areas and a complete lack of preferred native vegetation regeneration in other areas.

- The hardwood forest type has been severely impacted by the loss of American elm due to Dutch elm disease. Now the Emerald Ash Borer threatens to eliminate ash species, especially black ash that is another important riparian and urban hardwood species.

- Oak regeneration has proven to be extremely difficult to achieve on many sites that have historically been oak dominated systems.

- Historically, large-scale forest disturbance patterns initiated forest regeneration, these include fire, tornadoes/wind. Fire suppression has virtually eliminated large-scale fire as a disturbance agent. Large scale-wind events are present; however their impact on the landscape is often tempered by forest fragmentation and land-use patterns.

- Climate change is forcing people to re-think the notion of species range. As temperatures rise, many tree species may no longer be able to thrive in locations where they existed historically.

- Forest fragmentation has created many smaller blocks of forest and greatly increased the amount of forest "edge" that has existed historically. Edges tend to favor sunloving species where shade tolerant species may have once dominated.

- The lack of forest management is allowing species composition to change, which will affect wildlife habitat and the wood products available to the forest industry.

- Many forest tree nurseries in the region have closed or are producing at greatly reduced capacities. Adequate stocks of planting material may be an issue with reduced capacity.

Invasive Species

Non-native invasive species have the potential to reduce forest diversity and cause huge economic and ecological damage to forests. Insect species such as the Emerald Ash Borer, Gypsy Moth, and Asian Long Horned Beetle have already caused major damage in forests and in urban areas in the Midwest. Non-native disease causing organisms, typically fungi that cause mortality such as those that cause White Pine Blister Rust, Butternut Canker, and Dutch Elm Disease are well documented historically. More recent examples include Hickory Mortality, Beech Bark Disease, and Sudden Oak Death. Dozens of invasive plants species spread and flourish in both urban and forested areas. Resource agencies must have evolving and adaptive responses to detect and reduce the potential for the introduction and spread of new invasive species.

Issues

- Prevention of invasive insects and plants is time consuming and costly. Eradication efforts are very expensive. Doing nothing has far-reaching cost consequences• Invasive species management must be integrated with good land stewardship on millions of acres of privately owned forest.

- Invasive plant populations influence, and are influenced by, environment and co-occur ring plant and animal species. An integrated ecosystem-based approach is therefore es sential but difficult to achieve.

- Quarantines on timber product movement placed on states in infested areas cause eco nomic hardship as well as difficult utilization and marketing challenges.

- The loss of forest diversity reduces the ecological stability of forests.

- Control techniques and methodologies need to be developed, shared and implemented for new invaders.

- The inability to effectively control plants introduced via the horticultural industry allows many problem plants to continue to be bought and sold in the marketplace.

- The ability to identify and detect new invaders is extremely limited due to lack of knowl edge.

- A changing climate may make forests more susceptible to invasive species.

Promoting Sustainable Active Private Forest Management

The Upper Midwest contains some of the highest levels of private forest land ownership in the nation. Unfortunately, the vast majority of these private forestlands are unmanaged, undermanaged, or mismanaged. This represents a huge untapped resource of timber, fiber and associated forest-related employment opportunities. By promoting sustainable active management of these forest lands, the productivity of the regions' forest lands could be enhanced, thereby reducing pressure on existing productive forests and reducing the nations' dependence of outside sources of wood fiber. Active forest management can help to off-set the rising costs of forest ownership, while contributing to the health and resiliency of the regions forests.

Issues

- Most land owners own woodlands for reasons unrelated to forest management. Typically private citizens own forests for hunting, recreation, or other reason unrelated to forest management.

- Landowner turnover rates are increasing due to the aging demographic of current forest owners. This creates opportunities to engage these new landowners who may be more receptive to active forest management.

- Average woodland parcel size is decreasing which leads to increasing the numbers of woodland owners. This creates a capacity issue for those agencies charged with providing landowner assistance.

- Rising land values, and associated property tax rates, are making woodland ownership less appealing to many would-be landowners. Existing landowners may be increasingly tempted to sub-divide large holdings for financial benefit or to reduce their tax burden.

- Many woodland owners are not knowledgeable about forest management and are not aware of programs or cost-share opportunities that might enable them to take an active role in the management of their woodlands.

Sustaining Forest Industry and Markets

The loss of forest products industries and markets constrains opportunities to manage forests and diminishes options for the production and enhancement of an array of ecosystem services

Issues:

- Competition for forest resources among various industrial users of low quality wood is likely to increase as biomass markets (e.g. pellet production) grow.

- New state and federal energy/climate policies will increasingly stimulate demand for forest resources. For instance, proposed federal Renewable Energy Standards are already catalyzing coal fired power plants to co-fire with wood. Large scale fuel switching could cause an enormous drain on resources.

- Requests for resource information (inventory and timber product outputs) will increase as resource use patterns change.

- Which forest products industries and commercial users of wood create the most jobs per volume of wood utilized will become a frequent area for debate.

- Pulp and paper. Though still a very large part of US demand for wood, pulp production has declined for more than 10 years. US still the global leader in wood pulp production, although percentage of total continues to decline. Switch from newsprint to electronic media, declining demand for packaging grade papers as US industries continue to move offshore. Growth in demand and production is focused now in Europe and Asia. Losses in paper output range from -54% for newsprint to -10% for containerboard.[70]

- Acute shortage of loggers as boomers retire and industry fails to recruit new entrants.

- Discussion and information needs regarding forest products production and bioenergy application impacts on carbon lifecycles will increase.

- Housing. Softwood lumber demand associated with homebuilding has been off dramatically. As the economy collapsed and home foreclosure rates accelerated resale values of homes plummeted and new starts turned down as well. Predictions are a return to normal housing starts of 1.5-1.7 million starts by 2012.[71] Homeowner improvements and remodeling are expected to begin a gradual rebound in 2010.[72] Some suggest a trend towards smaller homes with less use of hardwoods for flooring and millwork as homebuyers try to economize on housing costs.

- Hardwood, solid wood products. Recent years outsourcing of furniture, kitchen cabinets, millwork and flooring production to China and other Asian countries has caused many companies to close with a permanent loss of 25-35% of productive capacity nationally. Indexed prices since 2004 show decline in all graded hardwoods with only lumber prices for pallets and railroad ties remaining stable or increasing slightly. 60% of hardwood now used for low priced industrial applications vs. 32% in 1972.[73] Growing capacity/efficiency of remaining mills. Downward pressure on hardwood grade logs probable.[74]

- Green building is experiencing significant interest and is one of the few areas in forest products trending upward. Currently, green building volume as a proportion of the market remains rather low.

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[70] Peter Ince. USDA Forest Products Lab. Forests in Transition. New England Society of American Foresters Winter Meeting.

[71] National Association of Homebuilders. March 24, 2010. Urs Buehlman, Virginia Tech personal communication

[72] Harvard Joint Center for Housing Research. Urs Buehlman, Virginia Tech personal communication

[73] William Luppold. Condition of U.S. Hardwood Markets. Allegheny Society of American Foresters. 11/5/2009

[74] Paul Lyskava. Status and Future of Wood Products Markets. Allegheny Society of American Foresters. 11/5/2009

Urban and Community Forestry

Urban forests are dynamic ecosystems that provide needed environmental services by cleaning air and water helping to control storm water, and conserving energy. They add form, structure, beauty and breathing room to urban design, reduce noise, separate incompatible uses, provide places to recreate, strengthen social cohesion, leverage community revitalization, and add economic value to our communities.

Issues

- Energy consumption. Trees reduce energy demands throughout the year. Communities often only account for the expenses associated with tree maintenance, since the savings are not factored into budgets. This has led to the deterioration of both personnel and money dedicated to maintaining or improving the forest resource in city budgets.

- Air quality. There are many communities in the region that have reduced air quality because of emissions from a variety of sources. More trees are needed to address air quality concerns, improve aesthetics and sequester carbon from the variety of polluting sources found within communities.

- Storm water runoff. Trees slow rainwater, allowing more water to infiltrate the soil, rather than discharging more to a water treatment plant. More economic analysis is needed to compare the costs of preventing storm water runoff to the costs of green infrastructure to give stakeholders, city planners and engineers.

- Green Space. Trees provide natural beauty within a community that enhances the experiences of the people in the area.

- Invasive pests threaten the diversity and longevity of trees susceptible to those pests would otherwise be able to provide to communities.

- Work with partners, other programs and councils to better accomplish common goals related to the urban and community forest resource.

In addition to the areas and issues identified in this section, any issues listed in Chapter 9 that are in common with other states to collaborate are considered multi-state priorities. The strategies that accompany the issues are included in Chapter 9. When opportunities exist to collaborate with other states to resolve an issue using similar strategies, multi-state proposals will be submitted to the Forest Service for funding consideration.

9.0 State Issues and Strategies

This chapter follows the chapter titles from the first seven chapters, to allow for more details about an issue to be referenced. The issues address forest on both public and private land. The short-term and long-term strategies for addressing each issue are listed in bulleted form following each issue. The strategies would be focused but not limited to working within the priority areas developed in Chapter 8. Strategies that address the priority landscape areas and state issues have been provided by stakeholders and DNR foresters.

The resources necessary to address each issue are common across all of the issues and boil down to needing time, money, personnel and sometimes equipment to carryout strategies. Without any one of these items, success will be limited in both scope and persistence. Oftentimes, waiting to address an issue only increases the resources necessary to deal with that issue into the future. With Iowa having already lost half of the forested resource that once existed, opportunities to improve or maintain existing forested resources are fading away.

Federal funding sources will continue to be used to support statewide programs that address issues identified in the first seven chapters and national objectives. Federal and partner financial resources are becoming an increasingly larger portion of the overall Iowa DNR Forestry Bureau budget to deliver forestry programs as described in Figure 6.16 and 6.17.

Information was gathered from a variety of reports, DNR forester experience, and stakeholders. Other natural resource assessments and plans were referenced and incorporated. Coordination with the State Forest Stewardship Committee, State Wildlife Bureau, State Technical Committee, Federal land management agencies, the State Urban and Community Forestry Council, and the Forest Legacy program helped with the development of the strategies to address the issues facing Iowa's forest resource.

Specific DNR Forestry programs are not designated to address each issue; rather a collaborative approach by programs will be used to more effectively implement these strategies. Appropriate evaluation criteria and monitoring results will be applied to strategies and detailed in the grant narrative when applying for funding.

Some strategies provide ways that Iowa's forest resources could become a solution to a variety of environmental problems related to Iowa's natural resources. The strategies developed support National priorities:

1.) conserve and manage forest landscapes for multiple values and uses,
2.) protecting forests from threat,
3.) enhancing public benefits from trees and forests.

Addressing monitoring and revision of the issues will occur as necessary to take into account changes in conditions, values, technologies, and resources through time. Performance measures from the list below will be used to measure outcomes from strategies that are used for the priority issues.

- number of acres of priority forest area harvested
- number of acres of priority forest area FSI completed
- number of forest landowners affected
- number of wood businesses affected
- number of forest management plans written
- number of urban residents assisted
- number of communities inventoried
- number of communities management plans written
- number of residential trees distributed
- number of trees for kids/ teens planted
- number of acres of new forest planted
- number of programs delivered
- number of news releases, articles, radio, TV informational/ educational programs
- number of fire departments assisted
- number of fire fighters trained
- number of insect and disease assists
- number of gypsy moth traps monitored
- number of emerald ash borer traps monitored
- number of acres of oak wilt managed
- number of acres of invasive species managed
- number of acres of forest purchased
- number of acres of conservation easements established for priority forest areas

9.1 Issues Regarding Conservation of Biological Diversity

1. Loss of Forest Land

Strategies

a.) Promote conservation easements and Forest Legacy program easements to sustainably manage biologically diverse forests.

b.) Discuss easements with forest landowners that have large contiguous forests and are identified as a forest priority.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on leaving a forest legacy for future generations.

d.) Produce materials that provide information to forest landowners about why they should manage their forest land.

e.) Public land acquisition efforts enhanced to sustainably manage priority forest areas.

f.) Create an advocacy group to persuade political officials to provide sustainable funding for buying more priority forest land.

g.) Encourage the creation of a Department policy for land acquisition that prioritizes acquiring forested areas that are identified in the State Forest Resource Assessment as a priority.

h.) Encourage and help communities to develop covenants that protect forest resources from development, when land is annexed or new developments are planned.

i.) Increase one-on-one landowner assistance so more forest landowners know about the benefits their forests provide, explaining and developing a forest land ethic.

j.) Encourage through information and education and if necessary, provide incentives for landowners with land in areas that have lost forest to plant trees back in those areas.

k.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that maintains those qualities that make that forest ecosystem desirable.

l.) Support local conservation efforts.

m.) Reduce the number of acres of priority forest grazed by livestock.

n.) Inform forest landowners of priority forests about forest reserve program property tax relief for keeping those areas forested.

o.) Facilitate stakeholder meetings to address loss of forest land by encouraging policies at a local level that protect priority forest areas from land change or offer incentives to manage that property in a sustainable way to protect the qualities of that property.

p.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

2. *Loss of Forest Productivity*

Strategies

a) Encourage through information and education and if necessary, provide Incentives for landowners with forests growing less than full stocking levels to better manage the productivity of those areas by scheduling site visits with a DNR forester.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the benefits improved forest productivity would have for these landowners and to society in general.

c.) Produce materials that provide information to forest landowners about why and how they can manage for a productive forest.

d.) Increase the number of acres of forest stand improvement accomplished within priority forested areas.

e.) Reduce the number of acres of forest grazed by livestock.

f.) Increase hazardous fuels management to improve forest productivity.

g.) Be more aggressive at managing invasive species to prevent productivity losses.

h.) Plant trees in areas of need to improve stocking levels.

i.) Monitor tree plantings to assess the amount of weed control and number of conservation seedlings that are necessary to successfully establish a fully stocked tree planting.

j.) Demonstrate on public lands methods to improve stocking levels.

k.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

3. *Changing Ownership*

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on leaving a legacy for future generations.

b.) Produce materials that provide information to forest landowners about how and why they should manage their forest resource.

c.) Use new technologies to inform and educate landowners, such as webinars, web accessible power points to explain baseline information for forest landowners seeking information.

d.) Promote conservation easements and Forest Legacy program easements to sustainably manage biologically diverse forests and forest priority areas.

e.) Work with county recorders office to create a system of tracking so when priority forest land changes ownership, the new landowners are shipped information about how to appreciate/ manage their forest resources.

f.) Facilitate stakeholder meetings to address loss of forest land caused by changing ownership by encouraging policies at a local level that encourage better management of priority forest resources.

g.) Provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that maintains those qualities that make that forest ecosystem desirable.

h.) Public land acquisition efforts enhanced in priority forest regions.

i.) Inform forest landowners of priority forests about forest reserve program property tax relief for keeping those areas forested.

j.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

4. Lack of Forest Ecosystem Diversity

Strategies

a.) Promote the use of prescribed fire in native landscapes and oak-hickory forest types to selectively favor fire adapted vascular plants and trees.

b.) Increase hazardous fuels management to improve natural systems functionality.

c.) Use forest stand improvement activities to select crop trees that maintain a diverse canopy.

d.) Increase one-on-one landowner assistance so more forest landowners know about how to manage for forest ecosystem diversity, explaining and developing a forest land ethic.

e.) Be more aggressive at managing invasive species to encourage forest ecosystem diversity.

f.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits of having diversity within the forest ecosystem.

g.) Produce materials that inform forest landowners about how and why they should manage for forest ecosystem diversity.

h.) Reduce the number of acres of forest grazed by livestock.

i.) Plant more diversity in forests, including species on the edge of their range to accommodate changing climate conditions.

j.) Research, demonstrate and promote how to plant woodland wildflowers and shrubs in areas where they have been lost due to past land uses.

k.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that maintains those qualities that make that forest ecosystem diverse.

5. *Lack of Well Managed Private or Public Forest Land*

Strategies

a.) Establish case studies on public and private lands to show how a well managed forest can be profitable for the landowner and provide all the ecosystem services simultaneously.

b.) Provide technical forestry assistance and develop forest stewardship plans on public and private lands.

c.) Initiate contact in priority forest areas to encourage forest management plans, offering one-on-one forestry assistance.

d.) Use recognition programs and local media to reward model landowners who are leaders in conservation to inspire and motivate others to plant trees and be better stewards of heir forest resources.

e.) Increase the number of acres forest landowners with management plans.

f.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from better managing the forest.

g.) Increase the amount of before and after harvest management activities to improve the establishment of natural regeneration.

h.) Increase the number of acres of forest stand improvement accomplished.

i.) Increase hazardous fuels management to improve natural systems functionality.

j.) Be more aggressive at managing invasive species in forested areas.

k.) Provide aid and support to fire suppression and protection agencies.

l.) Reduce the number of acres of forest grazed by livestock.

m.) Seek sustainable funding for all public lands to get forest stand improvement work done in a timely manner.

n.) Utilize advanced technology to document more information about the condition of the forest resource while on site.

o.) Seek sustainable funding to purchase and maintain forest management equipment to accomplish the necessary forest management on public lands.

p.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that maintains those qualities that make that forest ecosystem desirable.

q.) Produce materials that inform forest landowners about how and why they should manage their forest.

r.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

6. *Insufficient Availability of Professional Forestry Technical Assistance*

Strategies

a.) Seek sustainable funding for more professional foresters to service priority forest areas.

b.) Encourage through information and education a viable private consulting sector.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by managing forest areas and the lost opportunities caused by doing nothing.

d.) Produce materials that inform forest landowners about who, how and where they can receive professional forestry technical assistance.

e.) Focus technical forestry assistance within priority forest areas.

7. *Lack of Awareness the Values Trees provide People*

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by managing forest areas and the lost opportunities caused by doing nothing.

b.) Produce materials to inform forest landowners about all of the benefits trees provide to society.

c.) Targeted outreach to forest landowners within priority areas to provide information about how to manage and appreciate their forest resource.

d.) Participate in public events to raise awareness and provide information about the values trees provide to everyone.

e.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

8. Lack of Community Forest Inventory Data on both Private and Public areas

Strategies

a.) Education, outreach and advocacy through Community Stewardship Field Days, mass media about the benefits of managing trees and the risks and costs associated with doing nothing.

b.) Inventory priority communities along with those seeking assistance.

c.) Develop management plans to address the needs of a communities forest resource.

9. Based on the Small Amount of Community Forest Inventory Data Iowa does have, the Data shows a Lack of Diversity in Communities

Strategies

a.) Education, outreach and advocacy through Community Stewardship Field Days, fact sheets, mass media about the benefits of growing a diverse mix of trees within a community.

b.) Produce materials to inform homeowners about how and why they can increase the diversity of the forest resource in their community.

c.) Use urban tree canopy assessment tools to help communities.

d.) Increase tree canopy in new communities with excessive impervious material.

e.) Facilitate stakeholder meetings to address the lack of diversity and consequences there of, by encouraging policies at a local level that promote additional urban forestry management planning for communities.

f.) Facilitate creating policies with stakeholders for communities that dedicate funding for tree maintenance and replacement as a part of their management plan.

g.) Facilitate stakeholder meetings to address the lack of funding allocated within a community and consequences there of, by encouraging policies at a local level that provide dedicated funds for managing the trees in that community.

h.) Establishing a tree-care industry licensing credential for arborists and tree service companies

i.) Building and maintaining a healthy and energetic base of volunteers to lead community tree groups and activities.

j.) Promote the benefits trees provide to homeowners and businesses (energy efficiency, improved air quality, improved water infiltration, stabilize soils, reduce storm water runoff, improved aesthetics, increased property values, noise reduction) to encourage tree planting in Iowa communities, especially when new developments occur where no trees exist.

k.) Promote tree planting as a part of every community plan.

l.) Partner with utility companies and NGO's to inform city planners, developers, and community leaders about the benefits trees provide to community homeowners and businesses.

m.) Increase hazardous fuels management.

n.) Be more aggressive at managing invasive species in urban areas.

o.) Provide aid and support to fire suppression and protection agencies.

10. Lack of Management within the Urban Community Forest Resource

Strategies

a.) Education, outreach and advocacy through Community Stewardship Field Days, news articles, mass media about the benefits of managing trees and the risks and costs associated with doing nothing.

b.) Develop management plans to address the needs of a communities tree and forest resource.

c.) Produce materials to inform community homeowners about how, why and where they can get assistance to manage their trees.

d.) Facilitate stakeholder meetings to establish a tree-care industry licensing credential for arborists and tree service companies to service community and homeowner management needs using appropriate arborcultural techniques.

e.) Partner with utility companies and NGO's to inform city planners, developers, and community leaders about the benefits community management plans have for community homeowners and businesses.

f.) Promote planting a diversity of trees as a part of every community plan.

g) Increase hazardous fuels management.

h.) Be more aggressive at managing invasive species in urban areas.

i.) Provide aid and support to fire suppression and protection agencies.

j.) Building and maintaining a healthy and energetic base of volunteers to help communities with managing their forest and tree resource.

11. *Lack of Funding for Urban Forestry Programs*

Strategies

a.) Education, outreach and advocacy through Community Stewardship Field Days, news articles and other mass media outlets- key on the long-term benefits forestry programs provide to communities and the cost to communities of not keeping up with tree planting and tree maintenance programs.

b.) Facilitate stakeholder meetings to address the lack of funding allocated within a community for tree maintenance and replacement as a part of their management plan.

c.) Show how services related to urban forestry activities are improving Iowa's community forest resources and discontinue activities that are not funded.

d.) Provide incentives for communities with excessive impervious area to plant more trees there.

e.) Compete for grants to allow work to continue on services related to urban forestry programs that serve the mission of the DNR.

f.) Partner with utility companies and NGO's to inform city planners, developers, and community leaders about the benefits trees provide to community homeowners and businesses.

g.) Increase hazardous fuels management.

h.) Be more aggressive at managing invasive species in urban areas.

i.) Provide aid and support to fire suppression and protection agencies.

j.) Building and maintaining a healthy and energetic base of volunteers to help communities accomplish needed management of the forest and tree resource.

12. *Lack of Locally Adapted Landscape Nursery Stock*

Strategies

a.) Improve the quality and consistency of retail nursery stock with special emphasis on the residential tree distribution programs.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by planting locally adapted landscape nursery stock and issues to be faced by using nursery stock supplied by sources from outside of Iowa.

c.) Produce materials to inform forest landowners about how, why and where they can buy locally adapted landscape nursery stock.

d.) Create partnership between private nurseries and the State Forest Nursery to grow native liner stock for their landscape trees.

e.) Work with nurseries and organizations in the state to offer better native grown nursery stock to communities in order to increase the diversity.

f.) Make native conservation seedlings and landscape nursery stock available to public agencies to demonstrate growing on public lands.

13. Decline of Oak-hickory Forest Types

Strategies

a.) Target forest areas with oak-hickory canopy as places to engage landowners and public entities about methods to ensure a continuing oak-hickory forest.

b.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests that are oak-hickory types, to manage those forests in a way that these areas remain oak-hickory.

c.) Utilize more prescribed fire to favor fire tolerant tree species like oaks and hickory.

d.) Encourage tree planting plans to have a large component of oak species.

e.) Promoting awareness of forest resource issues.

f.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by managing oak-hickory forest areas and the lost opportunities caused by having less oak-hickory forest.

g.) Intensify even-aged management in oak-hickory forest types.

h.) Increase the amount of before and after harvest management activities to take advantage of existing seed source on site to establish adequate regeneration of desirable species.

i.) Increase the number of acres of forest stand improvement accomplished.

j.) Stewardship plans to document current stand conditions and provide prescriptions to establish more mast producing trees.

k.) Increase hazardous fuels management to improve natural systems functionality.

l.) Become more aggressive at managing invasive species in oak-hickory forest types.

m.) Provide aid and support to fire suppression and protection agencies.

n.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests that are oak-hickory types, to plant more oak and hickory trees in areas that have lost forest.

o.) Produce materials to inform forest landowners about how and why they can reduce the decline of oak-hickory forest on their property.

p.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

14. Forest Fragmentation

Strategies

a.) Facilitate stakeholder meetings to address fragmentation by encouraging policies at a local level that prevent dividing forested property into smaller units or offer incentives to manage that property in a sustainable way to protect the qualities of that property.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from larger contiguous areas of forest and the lost opportunities caused by fragmentation.

c.) Produce materials to inform forest landowners about how and why they can reduce fragmentation of the forest resource on their property.

d.) Engage landowners in these areas by scheduling site visits with a DNR forester to offer solutions to reduce fragmentation.

e.) Encourage tree planting to re-connect forested areas.

f.) Reduce the number of acres of forest grazed by livestock.

g.) Host public meetings with forest landowners showing them on a landscape scale where fragmentation could be eliminated.

h.) Encourage through information and education and if necessary, provide incentives to forest landowners that reduce the amount of fragmentation their forest resource has.

i.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that prevents fragmentation.

j.) Public land acquisition efforts enhanced to protect the most valuable remaining forests from being fragmented into smaller units.

k.) Inform forest landowners of priority forests about the forest reserve program property tax relief for keeping those areas forested.

l.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

15. Forest Parcelization

Strategies

a.) Facilitate stakeholder meetings to address parcelization by encouraging policies at a local level that prevent dividing forested property into smaller units or offer incentives to manage that property in a sustainable way to protect the qualities of that property.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by keeping forested areas intact and the lost opportunities caused by parcelization.

c.) Produce materials to inform forest landowners about how and why they can reduce parcelization of the forest resource on their property.

d.) Engage landowners in these areas by scheduling site visits with a DNR forester to offer solutions to reduce parcelization.

e.) Promote conservation easements and Forest Legacy program easements to sustainably manage biologically diverse forests and forest priority areas from parcelization.

f.) Develop forest management options for forests less than 20 acres in size.

g.) Provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that prevents parcelization.

h.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that prevents parcelization.

i.) Public land acquisition efforts enhanced to prevent the most valuable remaining forests from being parcelized.

j.) Inform forest landowners of priority forests about the forest reserve program property tax relief for maintaining those areas as forests.

k.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

16. Consistency and Transparency in the Development of Landowner Incentive Programs

Strategies

a.) Better communication between agencies to better promote and simplify landowner conservation incentive programs.

b.) Promote the long-term benefits trees provide in conservation programs as a rate of return from taxpayer investment in that conservation practice.

c.) Require re-payment of all economic incentives, if the conservation practices are removed, even if ownership changes.

17. *Lack of Forest Habitat for Species of Greatest Conservation Need*

Strategies

a.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that benefits specific habitat preferences for species of greatest conservation need (SGCN).

b.) Work with Federal and State partners to improve conservation programs that fund conservation practices that improve forest habitat for SGCN.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by managing forest areas for SGCN and the lost opportunities caused by allowing populations of SGCN to decline.

d.) Produce materials to inform forest landowners about how, why and where to manage for SGCN.

e.) Reduce the number of acres of forest grazed by livestock.

f.) Inventory which wildlife species are benefiting from forestry practices.

g.) Provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that benefit SGCN.

h.) Public land acquisition efforts enhanced to protect the most valuable remaining forests that are providing habitat for SGCN.

18. *Changing Landowner Demographics*

Strategies

a.) Encourage through information and education and if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by managing forest areas and the lost opportunities caused by doing nothing.

c.) Produce materials to inform forest landowners about how important the forest resource is for all of society.

d.) Explore using new technologies to inform landowners, such as webinars, web accessible power points to explain baseline information for forest landowners seeking information.

e.) Inform forest landowners of priority forests about forest reserve program property tax relief for maintaining those areas as forests.

f.) Create markets or develop incentives that pay landowners with priority forests to manage those ecosystems in a sustainable manner that continues to provide the ecosystem services the trees and forests on their land provide.

19. Economic Viability of Private and Public Sector Nurseries

Strategies

a.) Create partnerships that benefit both private and public sector nurseries.

b.) Promote reforestation and tree planting; key on planting trees as a way of getting and staying in touch with their property and leaving a legacy for future generations.

c.) Encourage through information and education and if necessary, provide incentives for landowners with land in areas that have lost forest to plant trees back in those areas.

d.) Promote tree planting conservation programs with native seedlings to all landowners that have suitable areas for growing trees through partners and organizations.

e.) Study and improve the quality of nursery conservation seedlings to improve transplanting survival rates and increase customer satisfaction.

f.) Produce only the profitable varieties of trees and shrubs needed.

g.) Seek alternative funding sources to support nurseries growing a diversity of native seedlings that would be desirable for growing in conservation plantings but are not profitable to grow.

h.) Evaluate customer needs, satisfaction and develop a marketing strategy that promotes native seed source plant material as being the absolute best source of planting stock for conservation related tree plantings.

i.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by planting native conservation seedlings and the problems with planting non-native conservation seedlings.

j.) Produce materials to inform forest landowners about how, why and where to obtain native conservation seedlings.

20. Maintaining a Supply of Native Low Cost Conservation Seedlings

Strategies

a) Establish seed orchards using native trees with desirable genetics to supply seed for growing conservation seedlings.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by having access to low-cost native conservation seedlings and the lost opportunities caused by more expensive seedlings.

c.) Seek alternative funding sources that support nurseries growing native conservation seedlings.

21. Maintain a Population of Native Tree Species on Public Land that are Threatened

Strategies

a.) Encourage through information and education and, if necessary, provide incentives to private and public landowners to maintain forest stands that have trees or forest associated plant species threatened with extinction.

b.) Establish seed orchards using native trees to preserve Iowa genetics.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received by managing native trees and the repercussions of losing native genetics.

d.) Produce materials to inform forest landowners about how, why and where to manage for forest associated plants or trees threatened with extinction.

e.) Promote the benefits of native seedlings for use in any private lands project that is federal, state, county or private (i.e. National Turkey Federation) cost-shared and/or any landowner that contacts the state (forester or private lands biologist) for assistance.

f.) Develop and maintain a database to record locations of trees that are rare.

g.) Propagate rare species to increase their populations.

h.) Write stewardship plans that perpetuate the presence of rare species and perform forest stand improvement around mature populations to promote healthy trees, increase seed production and increase germination on site.

22. Loss of Early Successional Forest Habitat

Strategies

a.) Harvest over-mature or poorly stocked stands of timber to encourage regeneration of desirable tree species.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the benefits received by managing forest areas for early successional forest habitat and the lost benefits caused by not having this forest habitat.

c.) Produce materials to inform forest landowners about how, why and where to manage for early successional forest habitat.

d.) Increase hazardous fuels management to improve natural systems functionality.

e.) Be more aggressive at managing invasive species, so adequate regeneration of desirable forest habitat can be achieved.

f.) Provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that promotes early successional forest habitat at some point in time in the management of that property.

g.) Encourage tree planting where landowners are willing to convert land-use.

9.2 Issues Related to Productive Capacity

1. Decline in the Number of Loggers, Timber Buyers, Sawmills and Secondary Wood Processors

Strategies

a.) Develop policies that offer price support structure similar to agricultural food crops to stabilize timber markets.

b.) Develop markets for small diameter trees and low quality hardwoods in sufficient number that most priority forests have access.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from using locally grown trees for products and the lost benefits caused by not having a wood products industry available for forest landowners.

d.) Produce materials to inform forest landowners about who they can sell their timber to.

e.) Encourage through information and education and, if necessary, provide incentives to forest landowners to better manage stocking levels to help meet the species and volume demands of area sawmills and secondary wood processors.

f.) Invest in technology to allow ethanol plants or other industries to incorporate hardwood or small diameter, low quality wood into the production of fuel stock.

g.) Reduce the number of acres of forest grazed by livestock.

h.) Engage local business leaders to develop a better business environment for wood related businesses applicable to their area.

2. Lack of Understanding about the Economic Importance of the Forest Resource

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from forests and the lost benefits caused by not having a managed forest resource.

b.) Produce materials to inform homeowners and forest landowners about how the economic importance benefits all citizens.

c.) Better describe the variety of businesses in Iowa that rely on trees for making wood products and the economic impact those trees and businesses have on Iowa's economy.

d.) Increase one-on-one landowner assistance so more forest landowners know about the benefits their forests provide, explaining and developing a forest land ethic.

e.) Better describe the number of people in Iowa that rely on wood products for income.

f.) Reduce the number of acres of forest grazed by livestock.

g.) Increase hazardous fuels management.

h.) Become more aggressive at managing invasive species in forested areas.

3. Lack of Awareness about the Benefits Forests Provide

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from forests and the lost benefits caused by not having managed forest resource.

b.) Produce materials to inform homeowners and forest landowners about the benefits rural forests provide to all of society.

c.) Create economic incentives to people who own high quality forest ecosystems to manage those forests in a sustainable manner that maintains those qualities that make that forest ecosystem desirable.

d.) Reduce the number of acres of forest grazed by livestock.

e.) Increase hazardous fuels management to improve natural systems functionality.

f.) Increase awareness of invasive species in rural forests.

g.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

h.) Incorporate forestry curriculum into educational materials developed for schools.

4. Development of Woody Biomass Markets

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from forests producing woody biomass and the lost benefits caused by not having these markets available.

b.) Determine the benefits and problems of harvesting forest systems for woody biomass.

c.) Utilize wood residue from timber management for biomass to create new businesses.

d.) Determine where these markets would be feasible.

9.3 Issues Affecting Forest Ecosystem Health and Vitality

1. Forest Health

Strategies

a.) Promote forest diversity and sustainability.

b.) Promote silvicultural techniques that help trees resist forest health threats.

c.) Determine effective monitoring, control and regulatory needs for pests that affect Iowa's forest resource.

d.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from forests and the lost benefits caused by not having a healthy forest resource.

e.) Produce materials to inform homeowners and forest landowners about EAB.

f.) Increase hazardous fuels management to improve natural systems functionality.

g.) Become more aggressive at managing invasive species in forested areas.

2. Impact of EAB on Urban Trees and Rural Forests

Strategies

a.) Stakeholders working together on a readiness plan to develop a plan of action.

b.) Inventory trees in communities to help with preparation of a management plan.

c.) Survey and monitor ash trees for symptoms of EAB.

d.) Facilitate stakeholder meetings to address the impact EAB will have on the urban and forest resource by encouraging policies at a local level that prepare communities and forest landowners for EAB.

e.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from ash trees and the lost benefits caused by not having ash trees.

f.) Produce appropriate materials to inform homeowners and forest landowners about EAB.

g.) Promote diversity and alternatives for replacing ash.

h.) Increase hazardous fuels management to improve natural systems functionality.

i.) Become more aggressive at managing invasive species in urban areas.

3. Ozone Monitoring

Strategies

a.) Survey, monitor and document findings.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from forests and the damaging affects of increased ozone in the atmosphere on forests.

4. Invasive Species

Strategies

a.) Survey, record and create a database where invasive species are located.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from native plants and the lost benefits caused by increasing populations of invasive species.

c.) Produce materials to inform forest landowners about how and why they should prevent invasive species from becoming established in their forest.

d.) Stakeholders working together on a readiness plan to develop a plan of action.

e.) Use more prescribed fire to manage invasive plants at the appropriate time.

f.) Use mechanical or chemical control options where fire is not an option.

g.) Develop management plans for treatment options by species.

h.) Increase hazardous fuels management to improve natural systems functionality.

i.) Become more aggressive at managing invasive species in forested areas.

j.) Encourage through information and education, if necessary, provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that prevents establishment of invasive species.

5. Forest Regeneration Challenges where Localized Heavy Deer Populations Exist

Strategies

a.) Increase hunting permits where there is not enough habitat to support the local deer population.

b.) Use tree shelters, fencing or another deer exclusion method in areas where desirable tree species are unable to become established due to deer populations in the area.

c.) Provide financial assistance to forest landowners where heavy deer populations are preventing the establishment of adequate forest regeneration.

d.) Survey, monitor, study the effects of heavy deer populations on regeneration and tree planting establishment.

e.) Evaluate the timber quality of trees grown where heavy deer population conditions exist and compare to timber quality where populations are not at detrimental levels.

f.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the lost benefits caused by having too many deer inhabiting an area and solutions for addressing heavy deer populations.

g.) Produce materials to inform forest landowners about why and how they can reduce deer populations on their property.

h.) Create a stakeholder group that looks at the forest resource capacity before making recommendations for deer population levels for that area.

i.) Develop policies that allow private forest landowners more hunting options to control depredation of their trees.

j.) Become more engaged with the decision makers of deer populations so consideration of the capacity of the forest resource to support deer populations in an area is a primary consideration.

6. Lack of Fire Personnel

Strategies

a.) Provide fire personnel with training and skills development opportunities, specifically in wildland fire incident command, suppression and tactics.

b.) Assist VFD's with wildland fire related equipment needs.

c.) Provide prescribed fire training.

d.) Provide better compensation to fire personnel to attract more interest in these types of jobs.

7. Building Homes in the WUI

Strategies

a) Increase hazardous fuels management to improve natural systems functionality.

b.) Become more aggressive at managing invasive species in the wildland-urban interface.

c.) Develop CWPP's and encourage use of Firewise tactics.

d.) Provide aid and support to fire suppression and protection agencies.

e.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on risks associated with building within WUI and provide alternative solutions for people seeking these types of living areas.

f.) Produce materials to inform forest landowners about how to prevent or reduce their homes exposure to fire.

8. Better Oak Management within Fire Dependent Ecosystems

Strategies

a.) Increase the number of acres of prescribed fire in oak-hickory forests.

b.) Increase prescribed fire training for forest landowners.

c.) Train more people to use prescribed fire.

d.) Survey, monitor, and study the effects of fire on oak regeneration and effects on other species populations

.

e.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from forests managed with fire and the lost benefits caused by not using fire as a management tool.

f.) Produce materials to inform forest landowners about how, why and where they should manage oak using fire.

g.) Increase hazardous fuels management to improve natural systems functionality.

h.) Be more aggressive at managing invasive species within fire dependent ecosystems.

9. Lack of Prescribed Fire Knowledge

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on benefits received from prescribed fire training and the risk of not being trained or using prescribed fire as a management tool when managing a forest resource.

b.) Produce materials to inform forest landowners about why and how they can use prescribed fire to manage their forest resource.

c.) Deliver prescribed fire training.

d.) Make FEPP available to fire departments.

e.) Facilitate more partnering with volunteer fire departments and counties to assist each other when doing safe fire practices and prescribed burns in their counties or regions.

f.) Provide aid and support to fire suppression, protection and natural resource management agencies.

9.4 Issues Affecting Conservation and Maintenance of Soil and Water Resources

1. Availability of Cost-share Programs for Forestry Practices

Strategies

a.) Provide incentives to forest landowners with priority forests to manage those ecosystems in a sustainable manner that promote good forest conservation practices.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide for water and soil resources and the increased costs society pays in other ways for not sustainably managing these resources.

c.) Produce materials to inform forest landowners about what cost-share programs are available to help with forestry related activities.

d.) Make suitable native conservation seedlings available at a low cost, to keep tree planting from being a cost prohibitive activity.

e.) Encourage conservation cost-share programs to include forestry practices that allow all willing landowners to participate in tree planting and forest management activities.

f.) Reduce the number of acres of forest grazed by livestock by providing cost-share to encourage protecting forest areas from grazing.

g.) Provide cost-share programs that allow management of forest systems with fire.

h.) Provide cost-share programs that allow management of invasive species in forested areas.

i.) Inform forest landowners of priority forests about forest reserve program property tax relief for maintaining those forested areas.

2. The Importance of Forest Cover for Maintaining/ Improving Water Quality is Not Recognized in Iowa

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide for water resources and the lost benefits of not taking care of water quality.

b.) Produce materials to inform forest landowners about how and why they can improve water quality using trees.

c.) Facilitate stakeholder meetings to address how trees improve water quality by encouraging policies at a local level that better manage water resources.

d.) Monitoring efforts to show the difference forest cover has on water quality and aquatic life compared to areas that do not have forest cover adjacent to them.

e.) Provide adequate landowner incentives to encourage better forest conservation along rivers, lakes and wetlands.

f.) Promote the establishment of more riparian buffers and bottomland forests adjacent to rivers, lakes and wetlands.

g.) Restore flood plain forests to mitigate flooding problems in communities downstream.

h.) Reduce the number of acres of forest grazed by livestock that have a water source within them.

i.) Increase hazardous fuels management to improve natural systems functionality .

j.) Be more aggressive at managing invasive species that are found along water sources.

k.) Provide aid and support to fire suppression, protection and natural resource management agencies.

l.) Public land acquisition efforts enhanced to protect the most valuable remaining forests along important lakes and rivers.

m.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

n.) Increase forest cover in watersheds that supply surface drinking water to communities.

o.) Increase forest cover in watersheds that have impaired waterways according to standards associated with the Clean Water Act.

3. Community Storm Water Runoff

Strategies

a.) Identify communities causing the most pollution from their storm water.

b.) Work with planners/ developers to use natural systems to filter storm water before it is discharged into natural areas, rivers and lakes.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits green infrastructure provides for water resources and the hidden costs paid in other ways for not using natural systems as solutions.

d.) Produce materials to inform community leaders about how, where and why communities can utilize trees within a green infrastructure to manage their storm water runoff.

e.) Provide incentives to priority communities to use green infrastructure to manage storm water runoff.

4. Soil Erosion

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide for soil resources and the hidden costs for correcting soil erosion later.

b.) Produce materials to inform forest landowners about how, where and why they can reduce soil erosion on their property.

c.) Encourage through information, education and if necessary provide incentives to landowners that follow best management practices when performing forestry silvicultural practices.

d.) Work with partners to shape conservation program so policies are in place that encourage planting native conservation seedlings as long-term solutions for maintaining soil on highly erodible ground.

e.) Show the economic benefits of using taxpayer money to establish trees for conservation practices and their long-term economic payback compared to other types of land uses (reimbursing for flooding when farms, businesses or homes are flooded, grass being easily reverted to agriculture).

f.) Reduce the number of acres of highly erodible land grazed by livestock.

g.) Reduce the number of acres of highly erodible land cultivated for row crops.

h.) Increase hazardous fuels management to improve natural systems functionality.

i.) Become more aggressive at managing invasive species where soil erosion is a concern.

j.) Provide aid and support to fire suppression, protection and natural resource management agencies to improve natural systems functionality.

k.) Provide incentives to forest landowners with highly erodible soils to establish trees to stabilize those soils.

l.) Public land acquisition efforts enhanced to acquire the most valuable remaining forests that are growing on highly erodible land.

m.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

5. Deriving Annual Income from Property

Strategies

a.) Provide incentives to forest landowners for growing trees that are providing ecosystem services

b.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

c.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide and the lost benefits of not sustainably managing these resources.

d.) Produce materials to inform forest landowners about how they can responsibly derive income from the forest resource on their property.

e.) Partner with Iowa Department of Economic Development to provide assistance to rural forest landowners to develop products/ markets from Iowa trees and forests.

f.) Inform forest landowners of priority forests about forest reserve program property tax relief for maintaining those forested areas.

g.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

9.5 Issues of Forest Contribution to Global Carbon Cycles

1. Iowa Produces more Carbon than it Sequesters

Strategies

a.) Improve stocking levels of existing forests.

b.) Improve markets for wood-based products.

c.) Promote tree planting as a part of every community and stewardship plan.

d.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide for the environment and the lost benefits of not improving Iowa's forest resources.

e.) Produce materials that inform forest landowners about how they can sequester more carbon by using trees.

f.) Provide incentives to landowners that sequester carbon by using trees.

g.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

9.6 Issues of Forest Enhancement of Long-Term Multiple Socioeconomic Benefits to Meet the Needs of Society

1. Lack of Financial Return for Forest Stand Improvement Activities

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide and the lost benefits of not managing these resources.

b.) Produce materials to inform forest landowners about how and why they should perform forest stand improvement.

c.) Improve markets that can utilize the smaller diameter products that are being removed in forest stand improvement activities.

d.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

e.) Increase one-on-one landowner assistance so more forest landowners know about the benefits their forests provide, explaining and developing a forest land ethic.

2. Lack of Public Forest Land

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide to various user groups and the lost opportunities to these user groups of not managing or having enough forest resources.

b.) Produce materials that inform forest landowners about what the DNR Forestry Bureau is doing with public forest land and what they can learn from the management activities occurring on these lands.

c.) Facilitate stakeholder meetings to address the lack of public forest land by encouraging policies at a local level that provide sustainable funding for buying more priority forest land.

3. Lack of Funding for Forest Management on Public Land

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide to various user groups and the lost benefits to these user groups of not managing the forest resource.

b.) Facilitate stakeholder meetings to address the lack of management on public forest land by encouraging policies at a local level that provide sustainable funding for managing more priority forest land.

c.) Decrease high cost activities like trail maintenance by decreasing the number of trails.

d.) Change policies to allow public forest land to be eligible for forestry conservation cost-share programs.

e.) Establish demonstration areas showing beneficial forest management.

f.) Increase hazardous fuels management to improve natural systems functionality.

g.) Become more aggressive at managing invasive species.

h.) Provide aid and support to fire suppression/protection and natural resource management agencies.

i.) Construct and maintain necessary infrastructure to accomplish forest management.

4. Lack of Applied Research for Silvicultural Methods within Iowa

Strategies

a.) Dedicated personnel to follow research projects through that look at different silvicultural methods for managing the forest resource.

b.) Research and develop how to manage for declining tree species populations to improve their ability to regenerate naturally.

c.) Research and develop management options for invasive species.

d.) Research the viability of developing specialty forest markets.

5. Lack of Funding for Forestry Programs

Strategies

a.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forestry programs provide to various user groups and the lost opportunities to these user groups when those programs are no longer available.

b.) Facilitate stakeholder meetings to address the lack of management of forest land in Iowa by encouraging policies that provide sustainable funding for Forestry programs.

c.) Show how services related to forestry activities are improving Iowa's forest resources and discontinue activities that are not funded.

d.) Compete for grants to allow work to continue on services that serve the mission of the DNR.

e.) Re-assign employee work duties based on grants awarded.

6. Declining Involvement with Universities

Strategies

a.) Collaborate on mutually beneficial programs in areas that are common.

b.) Use new technologies to inform and exchange information, such as webinars, web accessible power points to communicate.

c.) Include field studies and analysis with projects to secure better information that can be learned from and built upon in the future.

7. Lack of Forestry Education in Schools

Strategies

a.) Increase the presence of trees on school property that also serve as outdoor classrooms.

b.) Facilitate workshops and produce educational materials working with teachers to develop curriculum about forestry that meet national science standards.

c.) Improve communication between the DNR and schools about services available.

d.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide to society and the lost benefits to society of not managing forest resources

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e.) Produce materials to inform teachers and students about how and why the forest resource is important to society.

f.) Obtain representation on the Iowa Conservation Education Coalition council and other relevant councils to offer input on forestry curriculum.

8. Lack of Stewardship Plans Written in Relation to the Amount of Forest

Strategies

a.) Increase the number of foresters available to work with forest landowners on developing stewardship plans.

b.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide and the lost benefits of not managing these resources.

c.) Produce materials to inform forest landowners about the services offered by the Forestry Bureau.

d.) Prioritize stewardship plans to be written within priority forest areas.

e.) Develop incentives that encourage forest landowners to use their stewardship plans.

f.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

9.7 Issues of Forest Related Planning, Assessment, Policy and Law

1. Lack of Policies or Laws to Encourage Better Management of Forest land

Strategies

a.) Work with stakeholders to create policies that require forest landowners to have and follow a forest stewardship plan to be eligible for forest reserve.

b.) Work with stakeholders to create policies that encourage best management practices to be followed for all timber harvesting.

c.) Work with stakeholders to explore policies that would encourage forest stewardship plans for timber sales.

d.) Work with stakeholders to explore policies that would encourage forest stewardship plans for all forests.

e.) Work with stakeholders to develop local ordinances to sustainably manage forest areas.

f.) Education, outreach and advocacy through Forestry Field Days, news articles and other mass media outlets- key on the long-term benefits forests provide and the lost benefits of not managing these resources.

g.) Work with county offices to create a system of tracking forest land ownership so the new landowners are shipped information about forest benefits and how to sustainably manage their forest.

h.) Work with conservation agencies to more closely monitor compliance of forestry practices that are cost-shared to ensure success.

i.) Work with other public agencies that own forest land to develop strategies and policies that ensure sustainable management of the forest resource is accomplished on all public forest land.

j.) Utilize the Iowa Forest Resource Assessment and Strategies document in conjunction with the Wildlife Action Plan to prioritize forest land acquisition.

k.) Provide sustainable funding for public agencies that is dedicated to sustainably care for the forest resource.

l.) Work with stakeholders to encourage policy that increase forest cover within watersheds and rivers that are drinking sources for communities to encourage land use in those watersheds that will improve the water quality and reduce costs of water treatment.

m.) Create markets or develop incentives that pay landowners for the ecosystem services provided by their trees and forests.

2. Continuing Education for Foresters, Loggers and Consultants

Strategies

a.) Provide training and educational opportunities specifically for foresters, loggers and consultants.

b.) Improve the exchange of information among foresters within Iowa.

c.) Maintain a database of current forestry information that is available for people to keep up-to date on knowledge.

d.) Produce materials that provide continuing education opportunities.

e.) Use new technologies to inform and educate, such as webinars, You-tube, web accessible power points to explain information.

3. Improve Communication among Forestry Stakeholders

Strategies

a.) Use new technologies to inform and educate, such as webinars, You-tube, web accessible power points to communicate.

b.) Host field days to share information between stakeholders.

c.) Creation of a web-based Iowa forestry connection to offer education, classifieds, discussion forums, employment opportunities, research, project updates, grant opportunities, publications, wood industry info, ask a forester blog, etc.

d.) Development of online feedback on DNR Forestry webpage (for general questions and feedback on field days)

e.) Find common issues among stakeholders to get their constituents to embrace forestry issues.

f.) Maintain a database of current forestry information that is available for people to keep up-to-date on.

4. Green Certification

Strategies

a.) Develop economic incentive for participation.

b.) Train field staff to be able to certify forests.

c.) Explore green certification of public and private forest land.

5. Assist Communities with Forest Resource Management to Minimize the Effects on Trees Caused by Natural Disaster

Strategies

a.) Work with communities and stakeholders to develop a designated fund for assisting communities that manage their tree and forest resources.

b.) Develop natural resource disaster plans of recovery.

c.) Assist communities to develop urban management plans, maintenance plans, and budgets to prepare their trees to be better able to withstand natural disasters.

d.) Encourage tree planting to replace lost resources.

e.) Produce materials to inform communities about how to manage their trees after a natural disaster.

Conclusion

Iowans enjoy many attributes of their trees or forests. This enjoyment is shown by the increasing number of acres of forest cover over the past two decades across the state, an increasing housing market on acreages (land with trees or grass), and by the number of people visiting local conservation areas for recreation as they turn to local options for vacationing. This document has shown a variety of example of how forests down to a single tree provide multiple benefits wherever they are planted. They help purify the air by absorbing pollutants and producing oxygen. They provide the wood that is used in the construction and furnishing of almost every home. They can provide firewood as a heating source for a home or a campfire. Shade trees increase property values for homeowners which increases the tax base in communities. Trees improve visual curbside appeal for homes and business districts, cool those areas by providing shade to buildings and other surfaces that absorb heat. It has been estimated that trees can save an average household up to $250 annually in energy costs. Trees provide habitat for birds and other wildlife within urban or rural areas. Trees armor streambanks by holding soil in place and slowing water flowing over the soil causing pollutants and sediment to be deposited before reaching a stream. Where forested watersheds remain, water treatment costs for those citizens are lower.

Demands on forest resources have varied in the past and will continue to change in the future based on societies needs. A growing population, changing land-use decisions with changing forest ownership, invasive species and other influences make long-term planning a challenge for forests in Iowa that are 87% privately owned.

Above: Photo by Iowa Dept. of Natural Resources.

Improving air, soil and water quality is dependent on the land-use decisions of the approximately 150,000 private forest landowners across the state. If markets could be developed for ecosystem services, forestry as a land use would become more competitive when compared to other land uses. Ideas of leasing forest land for hunting, carbon sequestration, improving water quality to reduce the need for water treatment plants downstream, urban trees removing pollution are all ecosystem services that are valued in the billions of dollars per year.[75]

Having information about the condition of Iowa's forest resource both past and present, allows for review about how these resources are changing. This data driven document provides insight about the condition of Iowa's forest resources. Strategies developed for the issues related to Iowa's forest resource were given in Chapter 9. Chapter 9 lays the groundwork for stakeholders to use as a reference for addressing the issues that are most relevant to their constituents.

This assessment of Iowa's forest resource is meant to serve as a working document that will continue to evolve and change in tune with the attitudes stakeholders and partners perceive the important forest issues and areas to be throughout the state. It is the intent of this document to provide initial direction about where to begin resolving some of the issues affecting Iowa's forest resource.

[75]Interim Update of the 2000 RPA Assessment. p41.

Appendix A Ranking of Forest Acreage by County.

County	Total Land Class	Accessible Forest	Non Forest	Noncensus Water	Census Water	% of County in Forest
Allamakee	420,318	176,675	233,599	4,189	5,856	42.03%
Clayton	518,960	142,133	361,626	9,305	5,897	27.39%
Jackson	415,252	108,807	298,068	0	8,378	26.20%
Decatur	338,921	92,369	238,547	2,594	5,410	27.25%
Lee	340,189	84,507	238,096	0	17,587	24.84%
Van Buren	311,995	76,275	227,547	0	8,173	24.75%
Des Moines	284,172	72,632	203,970	0	7,570	25.56%
Monrow	286,085	71,498	204,812	9,774	0	24.99%
Wapello	274,560	69,717	199,925	0	4,918	25.39%
Appanoose	335,796	69,697	254,233	0	11,866	20.76%
Tama	468,893	66,541	400,623	1,729	0	14.19%
Winnesiek	447,955	65,761	381,217	977	0	14.68%
Lucas	293,526	64,828	227,780	918	0	22.09%
Madison	356,602	59,943	296,659	0	0	16.81%
Dubuque	377,991	55,988	131,625	0	8,378	14.81%
Linn	473,081	51,669	419,875	1,538	0	10.92%
Guthrie	374,977	49,124	325,275	577	0	13.10%
Mahaska	346,406	47,479	298,927	0	0	13.71%
Davis	315,882	47,060	267,419	1,403	0	14.90%
Harrison	444,875	45,085	399,790	0	0	10.13%
Warren	392,471	44,124	347,120	1,226	0	11.24%
Johnson	409,742	43,668	366,074	0	0	10.66%
Clarke	281,516	43,327	238,189	0	0	15.39%
Henry	286,788	42,676	244,112	0	0	14.88%
Jefferson	285,954	41,971	243,984	0	0	14.68%
Iowa	358,207	40,667	314,879	2,661	0	11.35%
Monona	443,093	40,179	402,915	0	0	9.07%
Marion	360,654	39,918	320,736	0	0	11.07%
Mills	290,307	37,345	245,758	1,254	5,950	12.86%
Potawattamie	609,724	36,133	573,591	0	0	5.93%
Washington	377,357	35,988	338,262	3,007	0	9.54%
Muscatine	286,992	35,640	251,174	177	0	12.42%
Polk	374,879	34,899	339,980	0	0	9.32%
Wayne	329,450	33,287	290,229	5,933	0	10.10%
Story	358,862	30,886	327,977	0	0	8.61%
Webster	455,452	30,704	424,748	0	0	6.74%
Woodbury	573,768	30,330	541,394	556	1,487	5.29%
Fremont	324,244	29,945	288,349	0	5,950	9.24%
Keokik	356,216	29,853	323,073	3,281	0	8.38%
Dallas	347,909	29,700	340,555	0	4,655	7.92%
Benton	432,287	29,496	402,424	366	0	6.82%
Black Hawk	369,588	29,018	338,108	2,462	0	7.85%

County	Total Land Class	Accessible Forest	Non Forest	Noncensus Water	Census Water	% of County in Forest
Page	344,765	28,137	314,273	2,355	0	8.16%
Ringgold	337,690	28,041	309,649	0	0	6.92%
Boone	375,949	26,757	345,866	0	3,306	7.12%
Powershiek	398,928	25,968	364,781	8,179	0	6.51%
Greene	365,961	25,318	340,643	0	0	6.92%
Howard	314,655	25,147	289,508	0	0	7.99%
Union	280,319	24,847	255,472	0	0	8.86%
Clinton	454,775	24,789	414,004	5,897	10,086	5.45%
Floyd	317,384	24,588	289,053	3,774	0	7.74%
Louisa	250,641	24,295	202,418	1,637	22,291	9,69%
Scott	299,318	24,249	264,563	5,897	4,611	8.10%
Delaware	369,308	24,029	345,279	0	0	6.51%
Plymouth	545,431	22,718	522,713	0	0	4.17%
Bremer	293,814	21,742	272,072	0	0	7.40%
Fayette	465,809	21,263	444,547	0	0	4.56%
Jasper	459,701	19,680	440,022	0	0	4.28%
Hardin	369,736	19,640	350,095	0	0	5.31%
Marshall	370,063	18,867	350,576	621	0	5.10%
Taylor	331,297	18,813	303,534	5,950	0	5.68%
Adair	377,046	18,278	357,513	1,254	0	4.85%
Jones	374,789	17,608	357,182	0	0	4.70%
Montgomery	284,683	17,388	267,295	0	0	6.11%
Crawford	446,909	17,050	429,859	0	0	3.83%
Cedar	363,382	14,786	345,509	3,568	0	4.06%
Mitchell	294,664	14,451	280,214	0	0	4.90%
Butler	365,573	13,032	352,541	0	0	3.56%
Buchanan	378,624	9,612	367,228	1,784	0	2.54%
Cherokee	373,972	8,924	365,048	0	0	2.39%
Clay	375,669	7,787	362,787	0	5,095	2.07%
Chickasaw	307,467	7,136	297,383	2,948	0	2.32%
Grundy	307,076	6,816	300,260	0	0	2.22%
Humboldt	276,036	6,734	269,302	0	0	2.44%
Franklin	384,937	6,562	378,376	0	0	1.70%
Cass	363,712	6,505	357,207	0	0	1.79%
Hamilton	374,490	6,404	364,366	3,721	0	1.71%
Cerro Gordo	361,995	6,071	355,924	0	0	1.68%
Osceola	263,622	5,841	257,781	0	0	2.22%

County	Total Land Class	Accessible Forest	Non Forest	Noncensus Water	Census Water	% of County in Forest
Kossuth	620,451	5,573	614,742	136	0	0.90%
Palo Alto	359,721	5,017	354,704	0	0	1.39%
Sac	373,970	4,938	368,255	777	0	1.32%
Pocahontas	374,757	4,374	364,433	5,950	0	1.17%
Emmet	260,074	4,058	250,921	0	5,095	1.56%
Adams	266,801	3,763	263,038	0	0	1.41%
Ida	279,633	3,218	276,415	0	0	1.15%
Wright	379,844	3,035	374,827	1,982	0	0.80%
Lyon	382,544	2,766	379,778	0	0	0.72%
Shelby	375,611	2,581	373,030	0	0	0.69%
Buena Vista	373,894	2,509	365,436	0	5,950	0.67%
Dickinson	265,099	1,684	257,466	0	5,950	0.64%
Total County	**35,998,727**	**2,993,267**	**32,724,688**	**116,316**	**164,456**	**8.31%**

Appendix B Population and Forest Acreage Changes since Statehood.

Year	Population	Percentage Change	Acres of Forest	Percentage Change
1840	43,000			
1850	192,000	+346	6,471,000	
1860	675,000	+251		
1870	1,194,000	+74		
1880	1,625,000	+36		
1890	1,912,000	+18		
1900	2,232,000	+17		
1910	2,225,000	-.5	2,500,000	-61%
1920	2,404,000	+8	2,000,000	-20%
1930	2,471,000	+3	2,500,000	+25%
1940	2,538,000	+3	2,500,000	---------
1950	2,621,000	+3	2,500,000	---------
1960	2,758,000	+5	2,500,000	---------
1970	2,824,000	+2	1,500,000	-67%
1980	2,914,000	+3		
1990	2,777,000	-5	2,054,000	+37
2000	2,926,000	+5		
2008	3,002,555	+3	3,032,000	+48

Appendix C Forest Legacy.

The Iowa Forest Legacy Assessment of Need (AON) remains unchanged from the approved version on March 7, 2002 by the U.S. Secretary of Agriculture at that time. The information provided in here is from that document.

The individual descriptions for each forest legacy area have specific information about the given Forest Legacy Area, including:

- General Description
- Description of Boundaries of the Forest Legacy Area
- State/Federal Managed Lands with the Forest Legacy Area
- Description of the Important Values within the Forest Legacy Area
- Current and Potential Conversion Pressures
- Goals and Objectives for the Specific Forest Legacy Area

The Iowa Department of Natural Resources, Forests & Prairies Division and the Forest Legacy Subcommittee recommended the following forested areas in Iowa to be designated Forest Legacy Areas.

1. ***Loess Hills***
2. ***Upper Des Moines River Valley***
3. ***Mississippi River Blufflands***
4. ***Iowa/ Cedar River Valleys***
5. ***Driftless Area***
6. ***State-protected waterways***
7. ***Southern Iowa Drift Plain***

1. Loess Hills

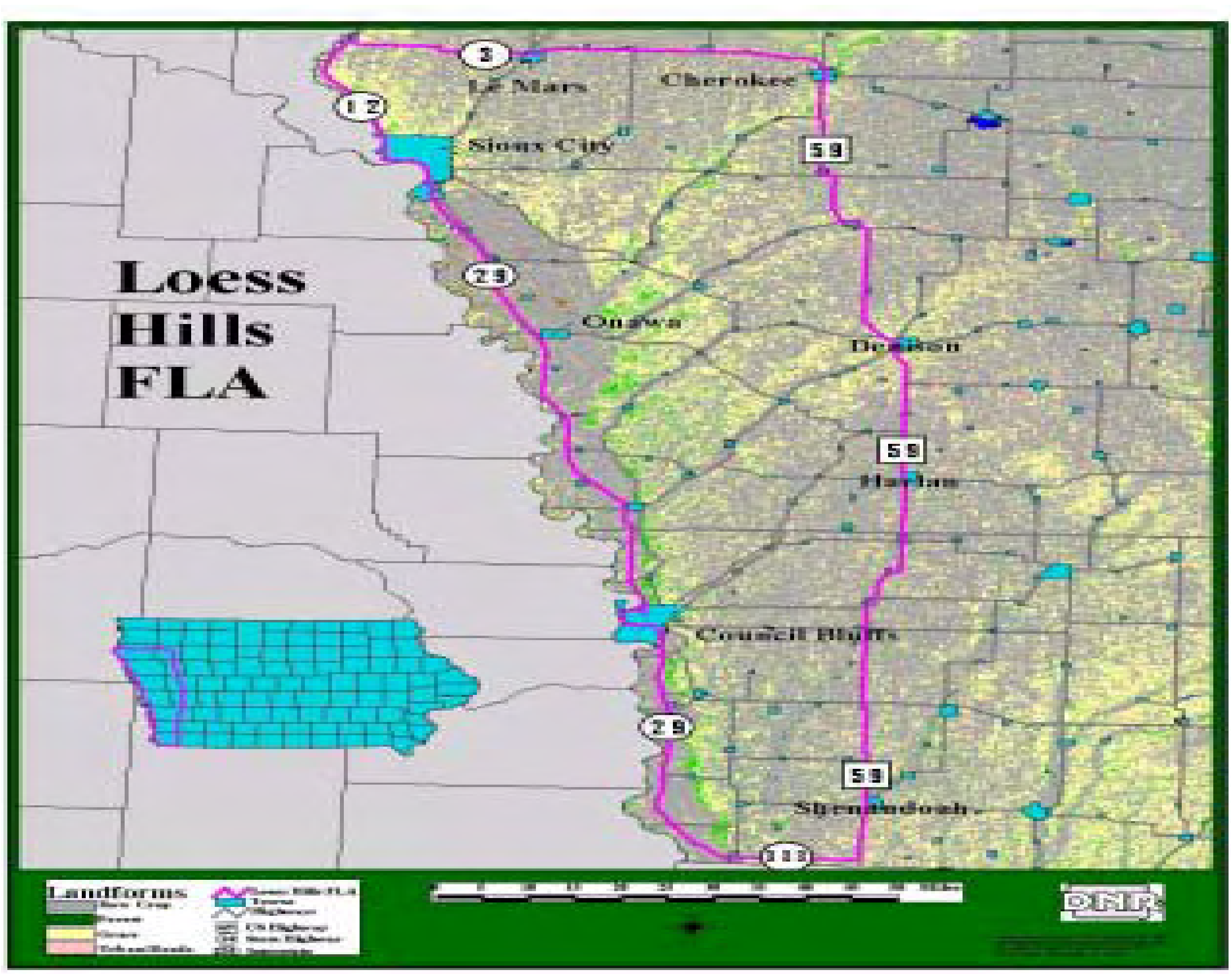
General Description

The Loess Hills Region is the most unique natural area remaining in Iowa today. The area was formed thousands of years ago by finely ground material washed out of melting glaciers that was deposited by prevailing westerly winds and deposited in a band of hills which resemble huge snowdrifts along the Missouri River floodplain. While loess, which is the major soil composition of the Loess Hills area, is fairly common in the world, it rarely reaches the depth and relief of the western Iowa loess. The rugged nature of these hills has prevented their conversion to cropland and has protected them from overgrazing by livestock. Some hills today appear as the first native Americans and pioneers first saw them, the former considering the land looking over the broad Missouri to be sacred ground.

Description of Boundaries of Forest Legacy Area

The Loess Hills Forest Legacy Area follows the unique geological formation of the Loess Hills stretching from Plymouth County near the Nebraska/South Dakota border in the north to Fremont County near the Nebraska/Missouri Border in the south. Specifically, the northern boundary of the Loess Hills Forest Legacy Area will start at the City of Akron at the intersection of State Highway 3 and 12, then east along Highway 3 to the City of Cherokee, south along U.S. Highway 59, west on State Highway 333, north on Interstate 29, north on State Highway 12 to the City of Akron.

Loess Hills FLA Area



State/Federal Managed Lands within the Forest Legacy Area

State and Federal managed lands within the Loess Hills Forest Legacy Area include: the Loess Hills State Forest (10,000 acres), Stone State Park (1,069 acres), Preparation Canyon State Park (344 acres) and Waubonsie State Park (390 acres).

Description of the Important Environmental Values

Private ownership dominates the forests of the Loess Hills Forest Legacy area. A national scenic byway was established the length of the Loess Hills offering overlooks and vistas of this unique geological formation. The forests are composed of oak-hickory woodlands, rare oak savannas, bottomland hardwoods and redcedar sucessional areas. These forests are contiguous offering unique and critical habitat for native plant and wildlife species, including several threatened and endangered species. These forests are beginning to offer increase public recreational opportunities for hunting, fishing, hiking and camping. These forests protect the fragile loess soils from erosion and limiting sedimentation in city drinking water supplies.

Current and Potential Conversion Pressures

This forest legacy area is threatened from continued fragmentation into residential hobby farms (urban/rural interface). Interstate 29 interchanges invite residential and commercial development, and provide high-speed transportation corridors for commuters. Native American and Riverboat casinos located at Onawa, Sioux City and Council Bluffs, Iowa employ a large number of people and increase development pressure on the area. The continued mining of fill for the development of urbanization is a serious concern threatening the Loess Hills in the ever growing metro areas of Omaha-Council Bluffs and Sioux City.

Goals and Objectives for the Loess Hills Forest Legacy Area

Goal: To reduce fragmentation and reduce the threats of mining for fill of private forests bordering or near federal, state county government or permanently protected forest holdings.

Objectives - to use conservation easements, purchase of other development rights fee acquisition and forest stewardship planning on private lands to:

- reduce forest fragmentation thereby maintaining contiguous forest resources,
- protect boundaries and natural resource management opportunities on federal, state, county government or permanently protected forests,
- protect unique and critical habitat for native plant and wildlife species,
- protect fragile loess soils from erosion.

2. Upper Des Moines River Valley

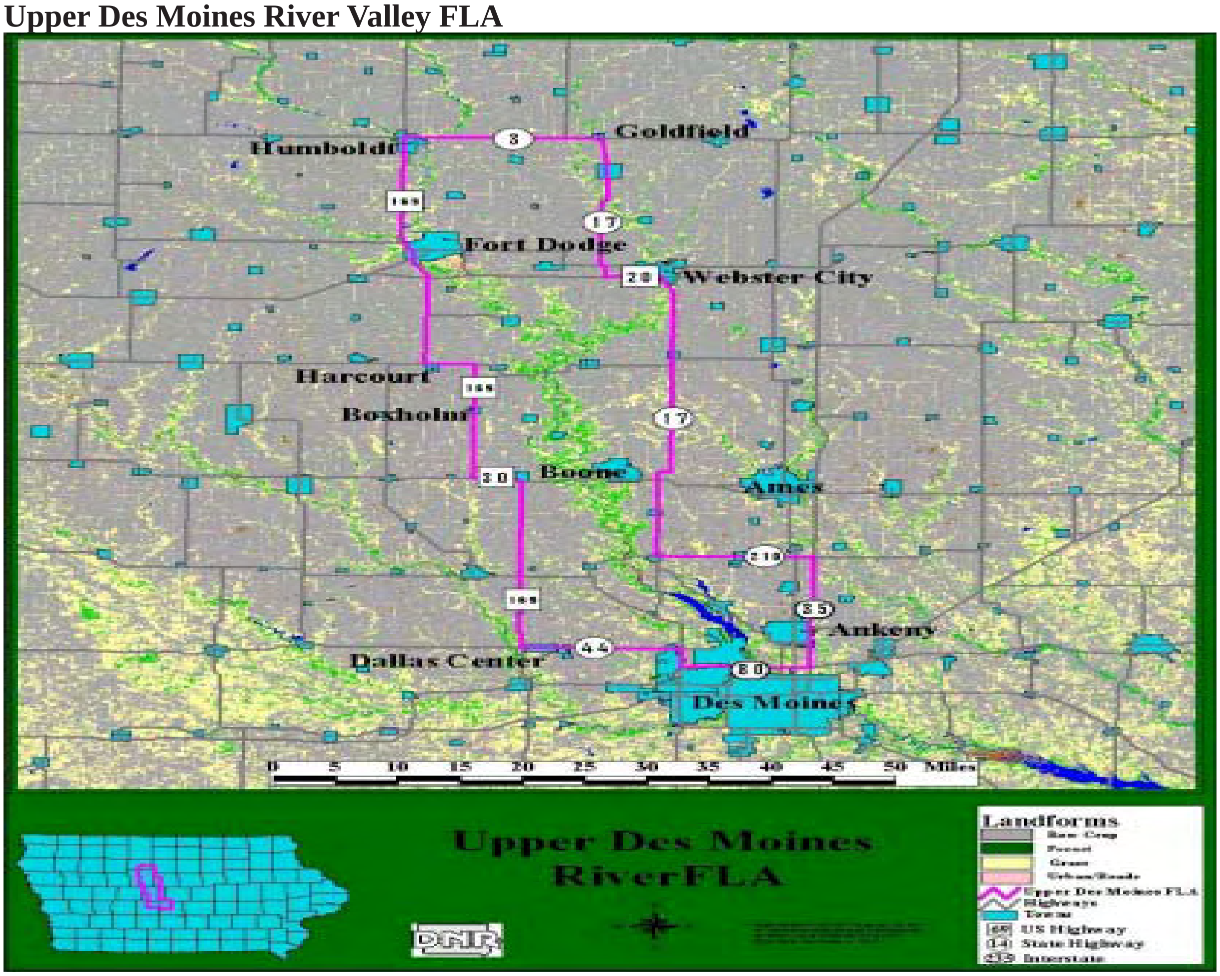
General Description

Deep valleys and wooded, moist habitats characterize the landscape along one of Iowa's major rivers. The Upper Des Moines River Valley provides a pathway for the migration of numerous animals and migratory birds every spring and fall. This area provides a habitat to Iowa's rare and threatened plant and animal species and many of its remaining wild species. Nesting hawks, and many other birds and squirrels, nestle into the fragmented floodplain forests and endangered communities that spring up along this specialized niche. One of these specialized niches, Woodsman Hollow, is a literal botanical treasure trophy located adjacent to the Upper Des Moines River, and is home to a large population of unusual ferns.

Description of Boundaries of the Forest Legacy Area

The Upper Des Moines River Valley is forested from Humboldt County in North Central Iowa to the Saylorville Lake Dam in Polk County just north of the City of Des Moines, Iowa.
Private ownership dominates the Forest Legacy area's forestland. Specifically, the Upper Des Moines River Valley Forest Legacy Area northern boundary is at the intersection of State Highway 3 and U.S. Highway 169 at the City of Humboldt, east along State Highway 3 to the City of Goldfield, south along State Highway 17 to the City of Madrid, east along State Highway 210 to Interstate 35 south, south along Interstate 35, west along Interstates 80/35 to State Highway 141 north, west along State Highway 44, north along U.S. Highway 169 to the City of Humboldt.

Upper Des Moines River Valley FLA



State/Federal Managed Lands within the Upper Des Moines River Valley Forest Legacy Area

State and Federal managed lands within the Upper Des Moines River Valley Forest Legacy Area includes: Dolliver Memorial State Park (600 acres), Ledges State Park (1,200 acres), Big Creek State Park (3,550 acres), Brushy Creek State Recreation Area (6,500 acres) and Jester County Park (300 acres). There are several large natural park areas owned and managed by the City of Fort Dodge, Iowa in this area as well.

Description of Important Environmental Values

The forests in the Des Moines River Valley exist primarily on upland slopes and floodplain areas too steep for agriculture. The forests are dominated by oak-hickory, maple-basswood and silver maple-green ash-cottonwood. The Upper Des Moines River Valley forests protect major U.S. Army Corps of Engineer recreational/flood control lakes at Saylorville and Red Rock Reservoirs. State and County parks within this Legacy Area are some of the most heavily utilized recreational areas in the state due to their proximity to the Des Moines-Ames metro areas. These forests offer scenic overlooks and vistas containing unique cultural and geological resources. The forests are contiguous and offer critical fish and wildlife habitat, along opportunities for continuation of traditional forest management activities. Sawmill and wood producing operations in Boone, Des Moines, Redfield and Webster City depend upon the working forests in the Legacy Area for their raw materials.

Current and Potential Conversion Pressures

The Des Moines metro area is expanding into this Forest Legacy Area. Hobby farms and larger house lots fragment the resource, with choice house lots being located near federal (Corps of Engineers) and State (DNR) ownership limiting natural resource management efforts. All indications are that this trend will continue, forcing forestland values to increase, spurring additional development pressures on forest landowners.

Goals and Objectives for the Upper Des Moines Forest Legacy Area

Goal: To reduce fragmentation of private forests bordering or near federal, state, county government or permanently protected forest holdings.

Objectives – to use conservation easement, purchase of development rights, fee acquisition and forest stewardship planning on private lands to:

- reduce forest fragmentation thereby maintaining contiguous forest resources
- protect boundaries and natural resource management opportunities on federal, state, county or permanently protect forests
- protect scenic overlooks and vistas
- protect unique cultural and geological resources
- protect critical fish and wildlife habitat
- provide opportunities for continued traditional forest management activities that provides raw materials for the forest products industry
- protect riparian forest watershed values

3. Mississippi River Blufflands

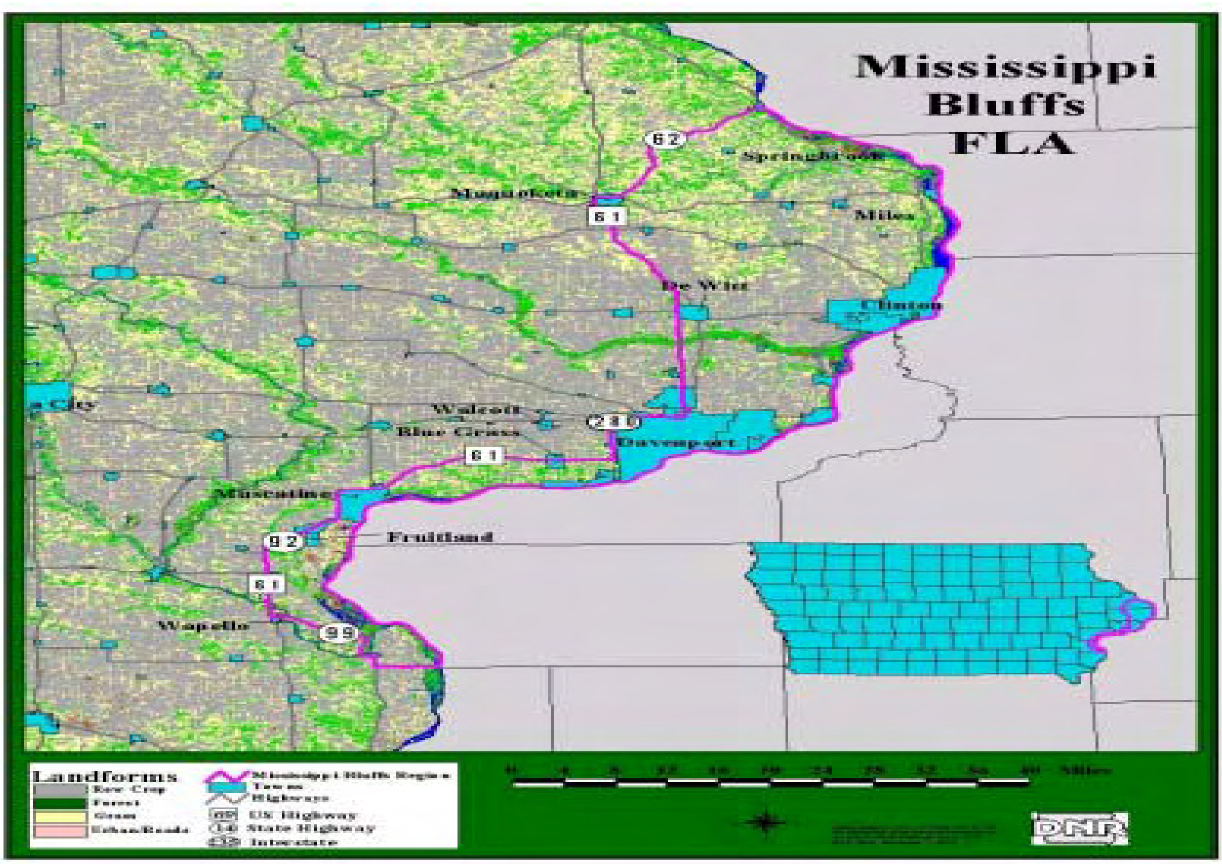
General Descriptions

In scattered spots along the Mississippi River Valley remnants of native forest both on steep bluffs and level floodplains/islands can still be seen. Though much of this land has been stripped for agricultural use and drainage, many bluffland and floodplain forests still thrive along this great river. These undisturbed, bluffland and riparian communities are some of Iowa's most endangered community types from real estate development and fragmentation. Serving as transportation for goods and supplies, as well as people, for hundreds of years, the Mississippi River Blufflands Forest Legacy Area is dotted by numerous settlements. Some of the oldest cities in Iowa are located along the great river, including the Cities of Bellevue, Bettendorf, Clinton, Davenport and Muscatine.

Description of Boundaries of Forest Legacy Area

The Forests of the Mississippi River Bluffslands extend along Iowa's eastern border with Illinois. The Mississippi River Blufflands Forest Legacy Area stretches from Jackson County in the north to Louisa County in the south. The forests within the Mississippi River Blufflands Forest Legacy Area are primarily owned by private landowners. Specifically, the northern boundary of the Mississippi River Blufflands Forest Legacy Area starts at the City of Bellevue, Iowa south along the banks of the Mississippi River to Lake Odessa State Wildlife State Wildlife Area and the City of Tooleboro. Then the area goes west along State Highway 99 (the Great River Road), northeast along U.S. Highway 61 and State Highway 92, north along Interstate 280, east along Interstate 80, north along U.S. Highway 61 to the City of Maquoketa, northwest along State Highway 62 to the City of Bellevue.

Mississippi River Blufflands Area



State/Federal Managed Lands Within the Mississippi River Blufflands Forest Legacy Area
State and Federal managed lands within the Mississippi River Blufflands Forest Legacy Area includes: several forested Islands managed by the U.S. Army Corps of Engineers involving the Upper Mississippi River National Wildlife Refuge and the Mark Twain National Wildlife Refuge. Other important public ownership in the Forest Legacy Area are Bellevue State Park (707 acres), and Wildcat Den State Park (423 acres).

Description of the Important Environmental Values
The forests of the Mississippi River Blufflands Forest Legacy Area are a combination of high quality blufflands - upland forest of oak-hickory and sugar maple-basswood and floodplain – riparian forests and islands of silver maple-cottonwood. The upland forests are on extreme steep slopes and along with the floodplain forests are a critical for protecting drink water supplies, recreational opportunities and flood control. This Forest Legacy Area possesses important nesting sites for the red-shouldered hawk and the bald eagle. This is a critical corridor for migratory birds. These bluffland riparian areas also serve as buffer between the river and the upland agricultural community, protecting and cleaning the waters running into the Mississippi River drainage. The Forests of this Forest Legacy area offer opportunities for the continuation of traditional forest management activities involving the high quality hardwood resources that influences economic opportunities for sawmills in the communities of Mount Pleasant, and Fort Madison, Iowa to the west and south of this area. They also hold unique cultural and geological resources.

Current and Potential Conversion Pressures
The Blufflands area is one of the last areas in Iowa, where large parcels of contiguous forestland remain. Many of these large parcels of private forests border public forest holdings. The senior citizen demographics of forest ownership in this region indicate a great potential for landowner turnover in the next 10 years. In recent years the area has been experiencing increasing forestland values as second homes and recreational parcels for absentee landowners. Private forestland owners along with the Iowa Natural Heritage Foundation have commented on increased subdivisions of these last remaining large parcels of valuable forestlands being more common. With the close proximity to Chicago, Minneapolis-St. Paul, Rochester, MN and Madison, WI, absentee landowner trends are predicted to continue, and with affordable prices for smaller parcels, forest fragmentation will undoubtedly occur.

Goals and Objectives For the Mississippi River Blufflands Forest Legacy Area

Goal: To reduce fragmentation and protect water quality values of private forests that border or are near federal, state, county or permanently protected forests.

Objectives – to use conservation easements, purchase of other development rights, fee acquisition and forest stewardship planning to:

- reduce forest fragmentation and maintain contiguous forest resources
- protect boundaries and natural resource management opportunities on federal, state, county or permanently protected forests
- reduce soil erosion and protect water quality
- provide critical fish and wildlife habitat
- provide outdoor recreation opportunities
- provide opportunities to continue traditional forest management that provides resources for economic development of rural communities
- protect unique archeological, cultural and geological resource

4. Iowa/ Cedar River Valleys

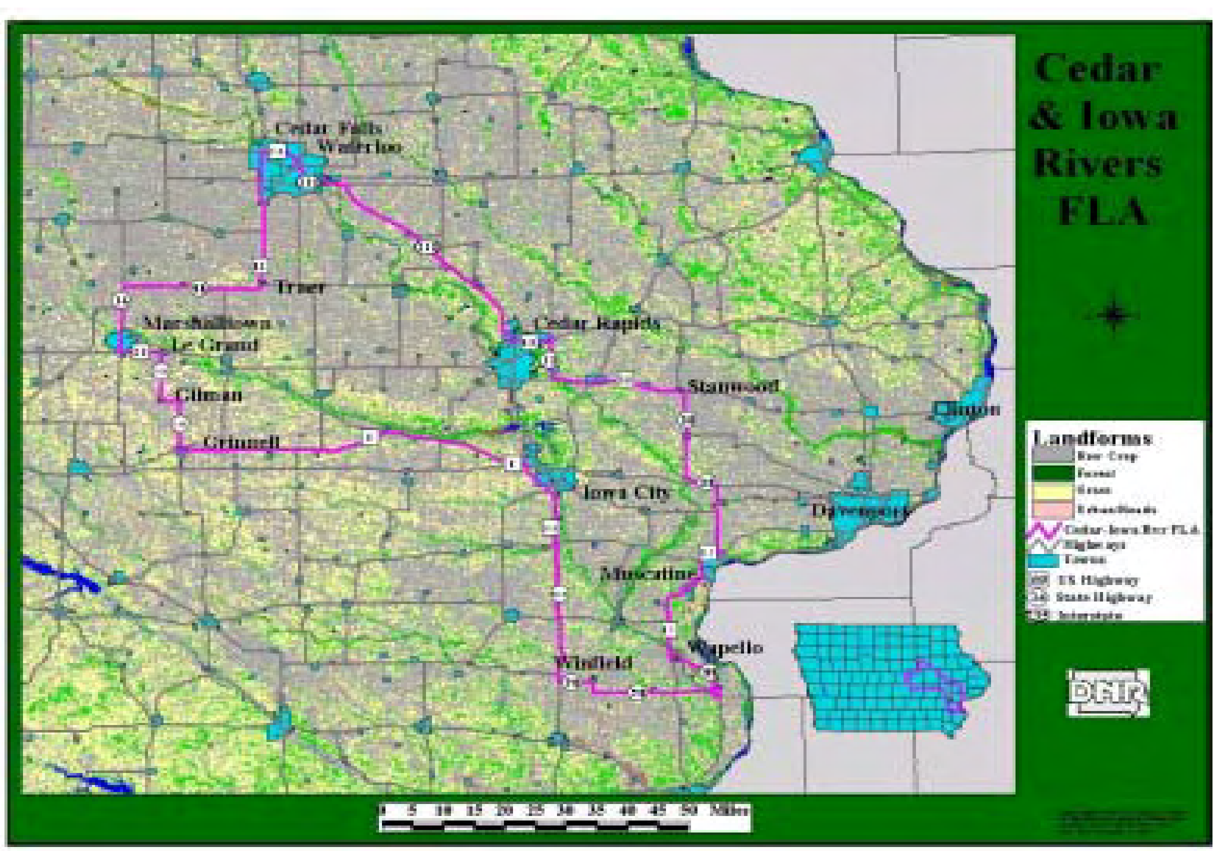
General Description

The Cedar and Iowa Rivers run from heavily agricultural areas of north central Iowa through the Cities of Waterloo/Cedar Falls, Cedar Rapids and Iowa City to their final destination at the Mississippi River. The forests within this Forest Legacy Area exist on steep slopes or floodplain areas. The forests along these steep slopes are upland species of oak-hickory, while the floodplain forests are silver maple-green ash-cottonwood.

Description of Boundaries of Forest Legacy Area

The Cedar/Iowa River Valley Forest Legacy Area extends from North Central Iowa, joining together at Columbus Junction, Iowa then emptying into the Mississippi River at Lake Odessa State Wildlife Area. Specifically, this Legacy area starts at the intersection of State Highway 57 and U.S. Highway 218 in the City of Cedar Falls. It runs south along Interstate 380, east along State Highway 65, then south on State Highway 13. It then goes east along U.S. Highway 30, south along State Highway 38, east along Interstate 80. It then goes south along State Highway 38/U.S. 6, southwest along U.S. Highway 61. It heads east along State Highway 99 and west along Louisa County Highway H22. It then heads west along State Highway 78, north along U.S. Highway 218, west On Interstate 80, west on U.S. Highway 6 to the City of Grinnell. Then the Forest Legacy Area goes north on State Highway 146, west on U.S. Highway 30 to the City of Marshalltown. It runs north on State Highway 14, east on State Highway 96, north on U.S. Highway 63, north on State Highway 58 to the City of Cedar Falls, Iowa. Private ownership dominates the Cedar/Iowa River Forest Legacy area.

Iowa/ Cedar River Valleys Area



State/Federal Managed Areas within the Cedar/Iowa River Valley Forest Legacy Area

Managed Federal and State Forest areas within the Cedar/Iowa River Valleys Forest Legacy Area includes: George Wyth State Park (1,200 acres), Pleasant Creek State Park (1,927 acres), Palisades-Kepler State Park (840 acres), and Lake Odessa Wildlife Area (5,000 acres). Along the Iowa River, the Corps of Engineers controls a large flood control/recreational lake at Coralville Reservoir. This Forest Legacy area contains the drinking water supply watersheds for the Cities of Waterloo-Cedar Falls, and Cedar Rapids-Iowa City. In addition, the historic Amana Colonies Forests, the largest private forest ownership in Iowa (7,000+ acres) are located within this Forest Legacy area.

Description of the Important Environmental Values

The private forests within the Cedar/Iowa River Valleys Forest Legacy Area help to provide drinking water supplies for the cities of Cedar Falls, Waterloo, Cedar Rapids, Iowa City and many other smaller communities. The forests of the Cedar and Iowa Rivers provide recreational opportunities along with critical fish and wildlife habitat. These forests have long been important for the timber industry in Iowa, as markets for silver maple and high quality oak help sawmills in Belle Plaine, Edgewood, Vinton and Wyoming, Iowa.

Current and Potential Conversion Pressures

Currently, urban sprawl is parceling forestland around the metro areas of Cedar Falls/Waterloo and Cedar Rapids/Iowa City, impacting contiguous forest wildlife habitat and traditional forest management opportunities. Continued parcelization is expected to continue as farming becomes less attractive financially and land subdivision increases. Forested parcels especially near public holdings are highly sought by developers. This continued forest fragmentation would impact the riparian values of the forests within this Legacy Area. The Forests of the Cedar/Iowa River Valley Forest Legacy Area have in the last decade taken severe impacts from storms and flooding. During 1998, over 10,000 acres of private forests within the Iowa River Valley were either broken or blown over by a 100-mph straight wind/tornado.

Goals and Objectives for the Iowa/ Cedar River Valley Forest Legacy Area

Goal: To reduce forest fragmentation and water quality values of private forests that border or are near federal, state, county or permanently protected forests.

Objectives – to use conservation easements, purchase of other development rights, fee acquisition and forest stewardship planning to:

- maintain contiguous forest resources
- maintain and expand riparian forests
- protect boundaries and natural resource management opportunities on federal, state, county or permanently protected forests
- provide critical fish and wildlife habitat
- provide critical fish and wildlife habitat
- provide opportunities for outdoor recreation
- provide opportunities to continue traditional and sustainable forest management that benefits the economy of rural communities

5. Driftless Area

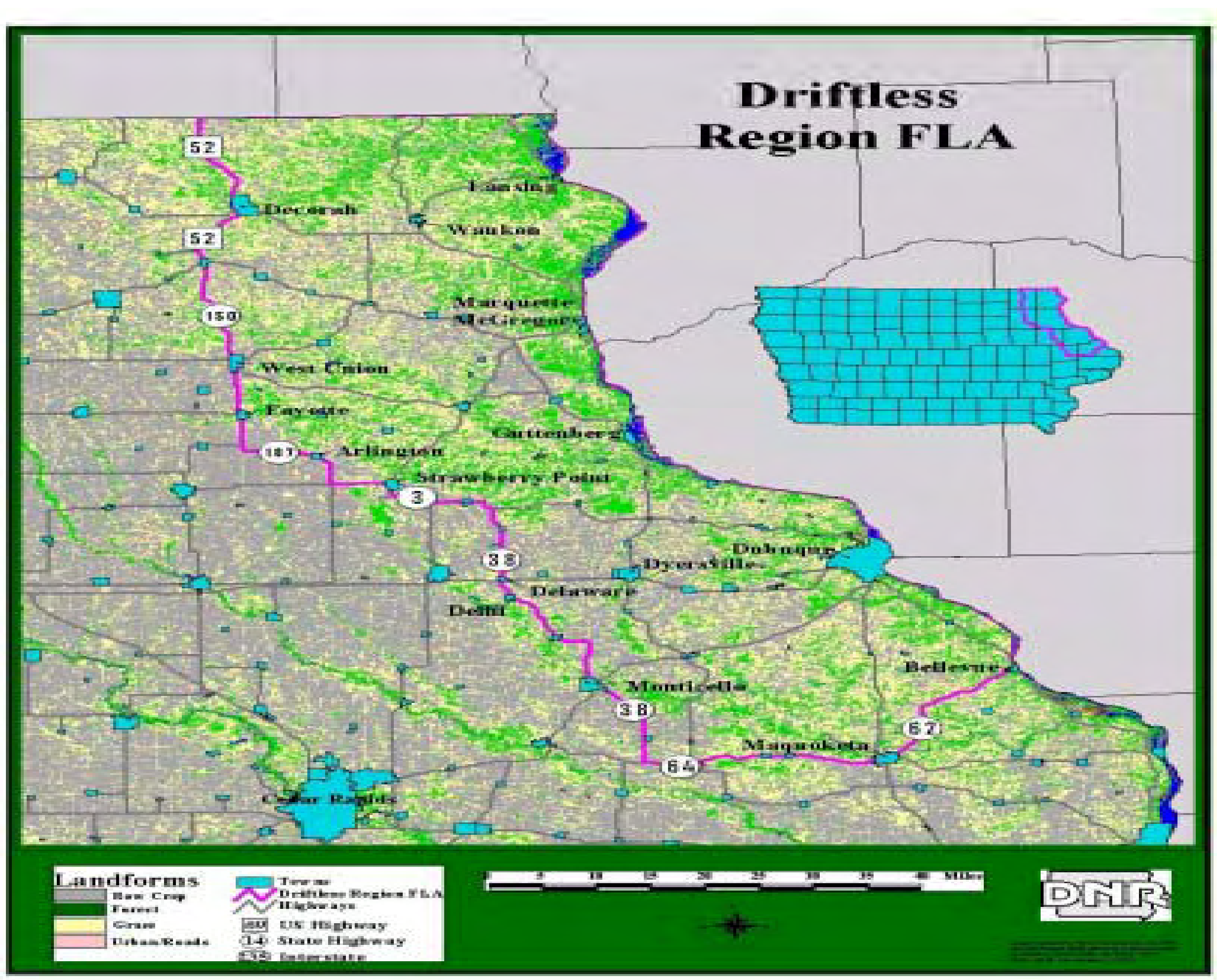
General Description

Located in extreme northeast Iowa counties of Allamakee, Clayton, Dubuque, Fayette, Jackson and Winneshiek, the Driftless Forest Legacy Area contains some of the last remaining large parcels of forestland in Iowa. The Driftless Forest Legacy Area given its name because of its lack of glacial deposits or “drift,” the topography is Iowa’s most rugged and scenic, and is also home to a considerable portion of Iowa’s remaining forestland.

Description of Boundaries of Driftless Forest Legacy Area

The Driftless Area exists in extreme Northeast Iowa counties of Allamakee, Clayton, Dubuque, Fayette, Jackson and Winneshiek, bordering the states of Illinois, Minnesota and Wisconsin. Specifically, the Driftless Forest Legacy Area starts at the Minnesota state border at U.S. Highway 52, south along Highway 52 through the City of Decorah, then south to State Highway 150. It then runs south on State Highway 150, then east/south along State Highway 187, and east along U.S. Highway 20. It then runs south along State Highway 38, east along State Highway 64 to the City of Maquoketa. It then runs northeast along State Highway 62 to the Mississippi River, then north along the Mississippi River to the Iowa/Minnesota state border near the City of New Albin, then west along the state boundary to U.S. Highway 52.

Driftless Area



State/Federal Managed Lands within the Driftless Forest Legacy Area

State and Federal managed lands within the Driftless Forest Legacy Area includes: Yellow River State Forest (9,000 acres), Pikes Peak State Park (970 acres), Volga River State Recreation Area (5,500 acres), Maquoketa Caves State Park (300 acres), Bixby State Park (184 acres), Backbone State Park (2,000 acres) and Effigy Mounds National Monument (3,000 acres). The Forest Legacy Area also includes valuable county and city park areas, such as the City Parks of Dubuque, Iowa. The Driftless Forest Legacy Area contains the protected waterway areas of the Upper Iowa River and its watershed.

Description of the Important Environmental Values

Because of the extremely dissected nature of the land, this area is also home to many microhabitats. Along the cool, north-facing slopes are ice caves, through which cold airflows, that create a boreal habitat capable of sustaining golden saxifrage, monkshood and bunchberry plants. The practically extinct small land snail, a holdover from the Ice Age, makes its home in this region. The land snail is currently found nowhere else in the world, and two lichens, lungwort and umbillicaria, grow nowhere else in the state of Iowa. The Driftless Area is also home to some of Iowa's best trout streams. The Upper Iowa River Watershed includes Iowa's only tie to prehistoric times, with native populations of balsam fir and white pine. This heavily forested river watershed contains unique areas, threatened and endangered plants, and possesses the highest quality fisheries in the state. The forests of the Driftless area exist on extremely steep slopes (>28%) and consist of high quality hardwoods of Oak-Hickory and Sugar Maple-Basswood. The forests provide scenic overlooks and vistas, providing countless opportunities for public recreation on public and private lands. Traditional forest management activities occur throughout the area due to the high quality of the trees, providing income to forest landowners and helping to employ sawmills in Dubuque, Elkader, and Guttenberg, Iowa.

Current and Potential Conversion Pressures

In partnership with the Iowa Natural Heritage Foundation, the IDNR has determined that private forestlands in the Driftless Forest Legacy Area are some of the largest remaining forested parcels in the state. These private forests border many key public and permanently protected forest areas. Landowner demographics so an aging ownership with few heirs with interests in continuing farming. Development pressures for these scenic forests are increasing through the area; subdivision advertisements and higher forestland offers have been seen at land auctions. County records show increased absentee and out of state land ownership, as second and recreational homes are increasing throughout the area. This trend in demand for second homes/recreational lands is expected to continue given the close proximity of the Driftless Forest Legacy Area to the Metropolitan areas of Chicago (3 hours away) and Minneapolis-St. Paul (2 hours away). The Driftless Forest Legacy Area is suffering from increased problems of non-native invasive plants such as buckthorn and garlic mustard. The area is at the leading front of the Gypsy moth now established in the Madison, Wisconsin area.

Goals and Objectives of the Driftless Forest Legacy Area

Goal: To reduce forest fragmentation of private forests bordering or near federal, state, county or permanently protected forest holdings.

Objectives – to use conservation easements, purchase of other development rights, fee acquisitio

- Protect boundaries and natural resource management opportunities on federal, state, county or permanently protected forests
- Protect unique archeological, cultural and geological resources
- Protect unique the habitats of flora and fauna resources
- Provide opportunities for outdoor recreation
- Protect scenic vistas and overlooks
- Protect opportunities for sustainable traditional forest management on private lands to benefit economies of rural communities
- Reduce soil erosion to protect water quality.

6. State Protected Waterways

General Description

In the late 1970's the then Iowa Conservation Commission (today the Iowa DNR) spent considerable effort and time in developing a State Protected Water Areas program. State Designated Protected water Areas contain a high quality condition landscape that is unique in the state. Areas designated for Protected Waters are Middle Fork of the Raccoon River, the Boone River the Wapsipinicon River and Little Sioux River. Each of these Protected Water Areas contains critical forest cover that is threatened from surrounding land use conversion from commercial and expanded agricultural interests.

Description of Boundaries of State Protected Waterways Forest Legacy Area

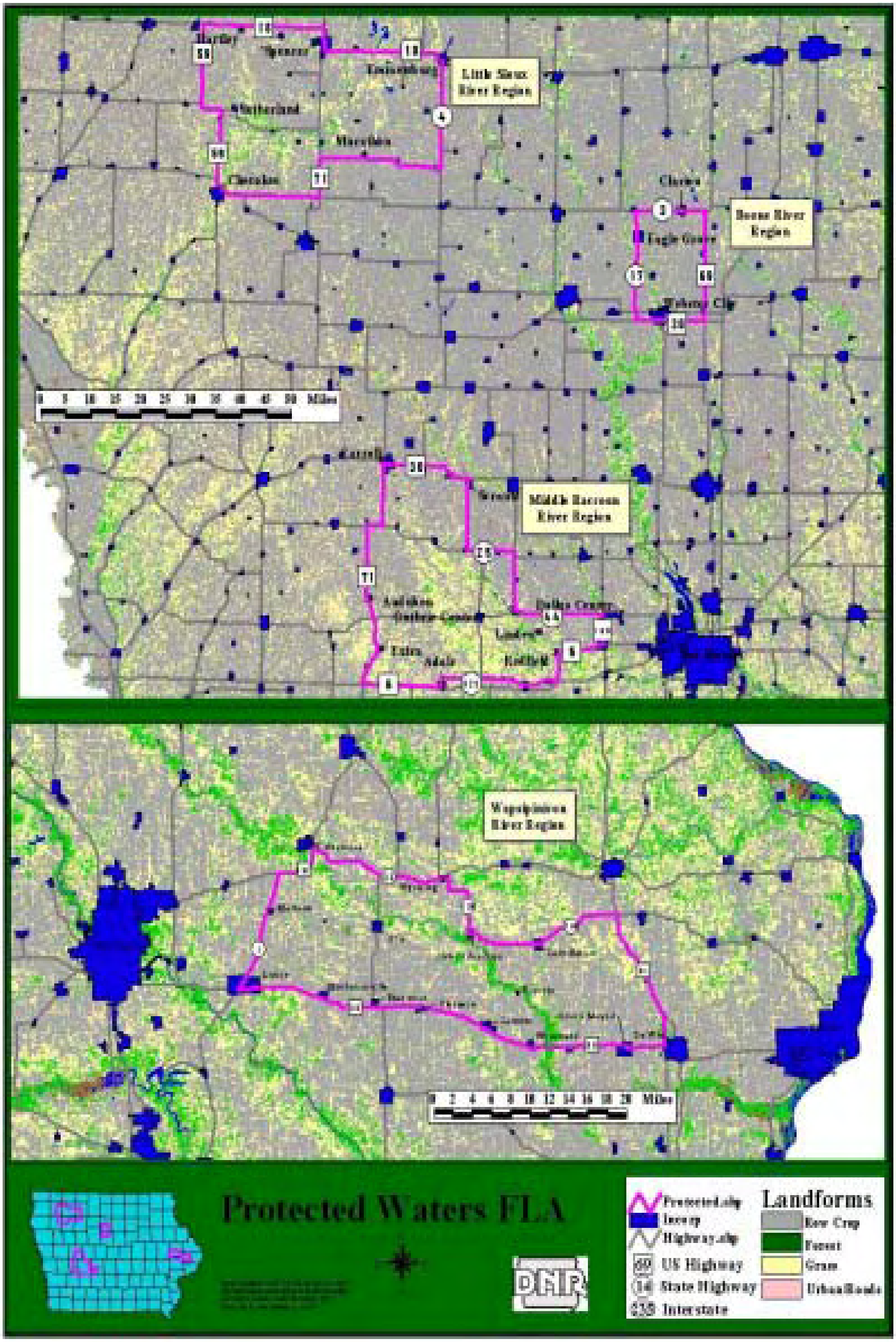
The Middle Fork of the Raccoon River flows from the west central to central Iowa joining the Raccoon River just west of the City of Des Moines. The Forest Legacy Area starts at the intersection of U.S. Highway 71 and U.S. Highway 30 in the City of Carroll, Iowa. It continues east along Highway 30 to the City of Scranton, heading south along State Highway 25. It then continues east along State Highway 141, heading south along State Highway 4. Then it heads east along State Highway 44 to the City of Dallas Center. It then heads south along U.S. Highway 169 to U.S. Highway 6 in the City of Adel. It continues along State Highway 6 to Interstate 80 West. It then goes west along Instate 80, then west on State Highway 925 to the City of Adair. It then west along U.S. Highway 6, then heads north on U.S. Highway 71to the City of Carroll.

The Boone River flows through a heavy agricultural area of North Central Iowa. The Forest Legacy Area of the Boone River Valley would start at intersection of State Highway 17 and State Highway 3. It runs east along State Highway 3, then heads south along U.S. Highway 69. It then runs west along U.S. Highway 20, then heads north along State Highway 17.

The Wapsipinicon River protected waterway area located in east central Iowa of this Forest Legacy Area begins at Intersection of U.S. Highway 61 and U.S. Highway 30 just west of the City of DeWitt, Iowa. It runs west along U.S. Highway 30 to the Cities of Mount Vernon/Lisbon. It then runs north along State Highway 1, then east along U.S. Highway 151 to the City of Anamosa. It then runs east along State Highway 38, then runs south/east along State Highway 136. It then turns south on U.S. Highway 61to the intersection of U.S. Highway 30.

The Little Sioux River protected waterway area is located in extreme northwest Iowa. The Forest Legacy Area begins intersection of U.S. Highways 71 and 18 at the City of Spencer, Iowa. It heads east along Highway 18 to the City of Emmetsburg, heading south along State Highway 4. It then turns west on State Highway 10, heading south along U.S. Highway 71. It then turns west along State Highway 3 to the City of Cherokee, heading north on U.S. Highway 59 to the intersection with U.S. Highway 18 north of the City of Primghar. It then heads east along U.S. Highway 18 to the Intersection of U.S. Highway 71 in the City of Spencer, Iowa.

State Protected Waterways Areas



Description of the Important Environmental Values

The Middle Fork of the Raccoon River and the Boone River forests exists as upland hardwood forests on steep slopes and floodplain forests in a highly agricultural area of North and West Central Iowa. They provide critical fish and wildlife habitat in this limited forested area, helping to provide drinking water for several communities in their areas. They both contain rare and unique oak savanna remnants. The Wapsipinicon State Protected Waterway possesses steep slopes covered with upland and floodplain hardwood trees. The forestlands in the Wapsipinicon River State Protected Waterway provide drinking water supplies for all the communities in their watershed and are critical fish and wildlife habitat areas. Several unique and rare cultural and geologic features are found in the Limestone Bluffs of Wapsipinicon River valley The Middle Raccoon River Protected Waters area is the source of drinking water for the Des Moines metro area (400,000 residents). The forests along the Middle Raccoon River are critical riparian habitat and a source of raw materials for the sawmill at Redfield, Iowa. The Little Sioux River forests are Bur oak savanna remnants along with bottomland hardwoods in the floodplains, with redcedar covered steep slopes. The Little Sioux River's forests is the only wooded habitat in the region. This state protected waterway supplies drinking water supplies for the City of Spencer, Iowa (25,000 residents).

State/Federal Managed Lands within the State Protected Waterways Forest Legacy Area

State and Federal managed lands within the Middle Raccoon State Protected Water portion of this Forest Legacy Area includes Springbrook State Recreation and Educational Center (920 acres) and Lake Panorama private recreation area. The Boone State Protected Water portion of this Forest Legacy Area includes no major state or federal managed lands. The Wapsipinicon State Protected Water portion of this Forest Legacy Area includes Wapsipinicon State Park (390 acres). The Little Sioux Protected Water portion of this Forest Legacy Area includes Wanata State Park (160 acres).

Current and Potential Conversion Pressures

The forests within this Forest Legacy Area are critical for water quality for both drinking water supplies and outdoor recreation. They have all been under constant pressure to conversion from agricultural clearing for crops and for unrestricted livestock grazing for beef and dairy production. The forests of the Wapsipinicon and the Middle Raccoon State Protected Water portions now facing residential and commercial land development due to their proximity to the metro areas of Cedar Rapids and Des Moines respectfully. Interest in land development is especially keen around areas that border county and state parks areas.

Goals and Objectives of the State Protected Waterways Forest Legacy Area

Goal: To reduce fragmentation of private forests bordering or near federal, state, county or permanently protected forests.

Objectives – to use conservation easements, purchase of other development rights, fee acquisition and forest stewardship planning to:

- Maintain contiguous forest resources
- Protect and expand riparian forests
- Protect unique archeological, cultural and geologic resources
- Provide critical fish and wildlife habitat
- Provide opportunities for sustainable traditional forest management that will benefit the economies of rural communities
- Reduce soil erosion to protect drinking water supplies.

7. Southern Iowa Drift Plain

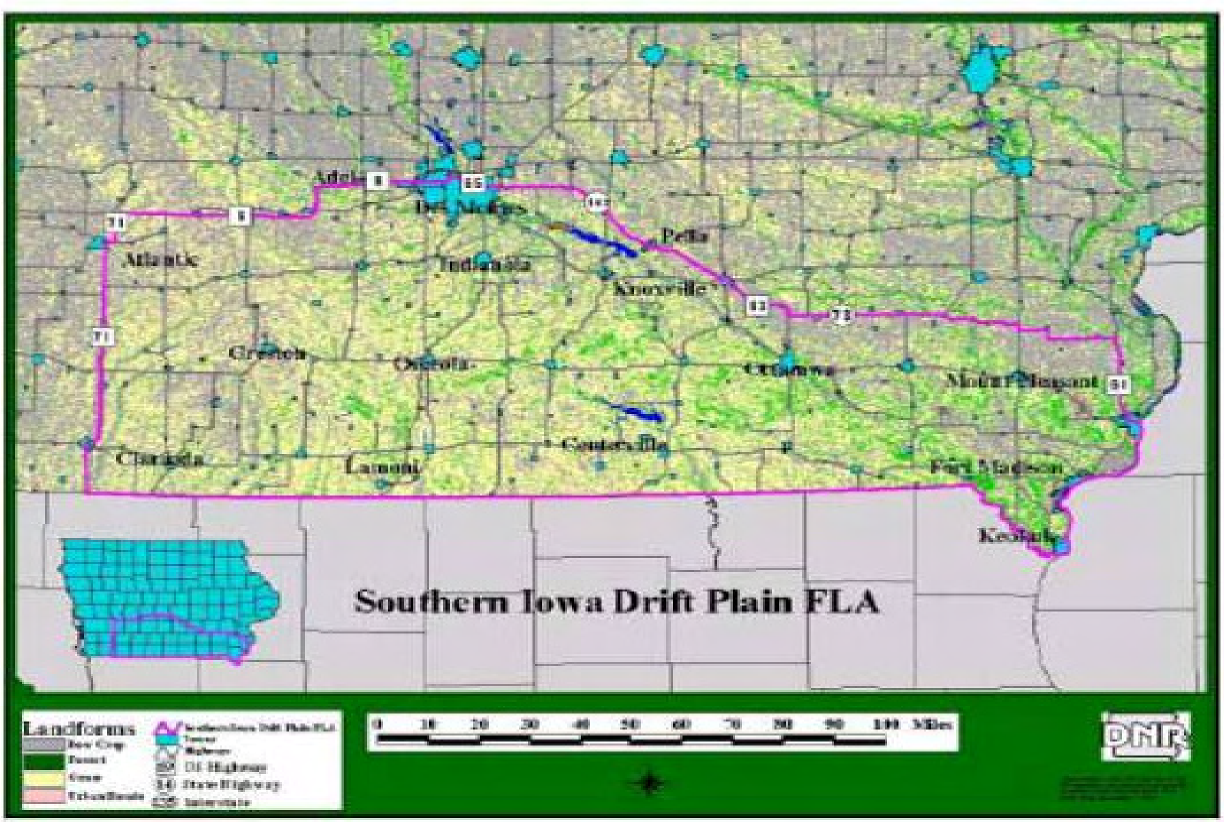
General Description

Southern Iowa forests are a unique resource that resembles the forests of the Ozarks of Missouri and Arkansas. Hardwood forests occupy steep and highly erodible slopes. These forests have been abused by past agricultural and livestock overuse. These forests offer opportunities for agroforestry development of non-traditional forest products, from nuts to mushrooms. Absentee land ownership is increasing and fragmentation has been noted in the area.

Description of Boundaries of Southern Iowa Drift Plain Forest Legacy Area

The Southern Iowa Drift Plain extends from southwestern Iowa northeast to the Des Moines metro area, south east along the Des Moines River to the Mississippi River to the Missouri State border. areas bordering the Mississippi River with its southern boundary being Missouri. It covers a large expense of the southern 1/3 of Iowa, and is an area in transition from marginal cropland to large animal feeding operations. The southwest corner of this Forest Legacy Area begins at the City of Braddyville at the Intersection of U.S. Highway 71 and the border with the State of Missouri. It runs north along Highway 71 to U.S. Highway 6, heading through the City of Des Moines. At U.S. Highway 69 it runs south to State Highway 163 to the City of Oskaloosa. At the City of Oskaloosa, it turns south along U.S. Highway 63, then east along State Highway 78 to the Community of Olds. Then it runs south along U.S. Highway 61 (also known as the Great River Road) bordering the Mississippi River to the City of Keokuk, Iowa. At the City of Keokuk, the Legacy Area turns west along the state border with Missouri.

Map of Southern Iowa Drift Plain



State/Federal Managed Lands within the Southern Iowa Drift Plain Forest Legacy Area

Although this Forest Legacy Area forest ownership is largely controlled by private landowners, but does contain several important state forested public areas. These include: as Stephens State Forest (12,000 acres), Lake Ahquabi State Park (770 acres), Lake Darling State Park (1,387 acres), Lake of Three Fires State Park (1,155 acres), Nine Eagles State Park (1,119 acres), Lake Icaria County Recreation Area (1,945 acres), Green Valley State Recreation Area (990 acres), Bobwhite State Park (398 acres), Redhaw State Park (649 acres), Honey Creek State Recreation Area (828 acres), Lake Wapello State Park (1,150 acres), Sharon Bluffs State Park (144 acres), Geode State Park (1,641 acres) and the Rathbun Lake State Wildlife Area. Rathbun Lake is a major drinking water source for all of south central Iowa and north central Missouri.

Description of Important Environmental Values

The forests of the Southern Iowa Drift Plain are upland forests similar to Ozark forests of Southern Missouri. They exist on steep slopes (>14%). These forests had been heavily grazed when cow-calf operations were economic until the 1980's farm crisis and the shift now towards feedlot operations. Forestland grazing still continues in the area, with estimates that 59% of the forests are grazed. The area forests provide abundant areas for game and non-game wildlife; it was here that the first successful restoration of wild turkey and white tailed deer was started. Golden and bald eagle migration along the Des Moines River makes heavy use of the forested areas. The forests provide significant areas for outdoor recreation for residents and visitors to the area; the forests are critical to a growing tourism trade. Water quality is a major issue within this Forest Legacy Area, from sedimentation and excessive nutrient issues. Forests and their protection can play an important roll in protecting water quality, especially as it relates to the Des Moines River and Rathbun Lake. The forests within this Forest Legacy Area offer opportunities for expansion of traditional and non-traditional forest products. Resource Conservation and Development Areas in Burlington, Centerville, Fairfield and Runnells, Iowa are expanding rural development through forestry efforts in finding markets for traditional and non-traditional forest products.

Current and Potential Conversion Pressures

Pressures continue to convert forested areas into agricultural crop ground or livestock grazing, as the region is economically depressed. There is a general lack of awareness of the values of forestland to water quality enhancement, though efforts to restore riparian areas is increasing. The close proximity to the Des Moines metro area is increasing opportunities for large parcels to be subdivided into residential and hobby farm locations. Interest for private hunting preserves in southern Iowa according to recent state and Iowa Natural Heritage Foundation land purchases has significantly increased land values, increasing subdivision and forest fragmentation in the area. This trend is expected to continue, with increased absentee land ownership pushing forestland values even higher. Opportunities for increased forest stewardship efforts especially for improved wildlife habitat exist with many of these absentee landowners.

Goals and Objectives for the Southern Iowa Drift Plain Forest Legacy Area

Goal: To reduce forest fragmentation of private forests bordering or near federal, state, county or permanently protected forests.

Objectives – to use conservation easements, purchase of other development rights, fee acquisition and forest stewardship planning to:

- Maintain contiguous forest resources
- Protect boundaries and natural resource management oportunities on federal, state, county, and permanently protected forest
- Enhance and expand riparian forest areas
- Protect unique archeological, cultural and geologic resources
- Provide critical fish and wildlife habitat
- Provide opportunities for sustainable traditional and nontraditional forest products to assist the ecconomies of rural communities
- Reduce soil erosion to protect drinking water supplies.

Those items common to each of the Forest Legacy Areas are the government entities that may be assigned management responsibilities and the Means for Protection, addressed below:

Identification of governmental entity that may be assigned management responsibility

The Forest Legacy Program in Iowa will be implemented through a State Grant Option, by which the State of Iowa will hold title to all conservation easements or deeds for acquired tracts of forestland entered into the Forest Legacy Program in Iowa. The Iowa Department of Natural Resources (IDNR), Division of Forests and Prairies is the lead agency for this program, with consultation through the Iowa Forest Stewardship Committee.

The State of Iowa, IDNR Division of Forests and Prairies will hold title to all acquisitions made through the Forest Legacy Program in Iowa, in coordination with the IDNR's Land Acquisition Bureau. The IDNR Division of Forests and Prairies may elect to delegate management and administration of individual tracts of land within the Forest Legacy Program to another agency within the IDNR, or to other organizations or government entity, including land trust or other conservation groups.

Means for Protection of Forest Legacy Area Tracts

- Acquisition of tracts of forestland will primarily be accomplished through conservation easements, as the preferred method. However, were the situation is warranted, acquisition of full-fee may be utilized as an appropriate method of acquisition.

- Acquire development rights on all tracts. Those rights include, but are not limited to the right to construct buildings and other improvements, remove forest cover for non-forest uses and control utility right-of-way locations.

- Timber rights retained by the landowner shall follow guidelines set forth in the Forest Stewardship Plan approved by the Iowa State Forester or his designee, and include the use of Forestry Best Management Practices (BMPs), applicable laws and regulations and with the following provisions:

    - All timber harvesting for a tract or tracts shall be in consultation with a professional forester and all logging conducted by state Bonded Timber Buyers. Departures from sustained forest management are permitted only in limited response to outbreaks of forest insects and disease and salvage in the event of fire or natural disasters.

    - Timber harvesting or cutting is according to Iowa's Forestry Best Management practices and within the guidelines of the individual Forest Stewardship Plan.

- Forest Stewardship plans shall be reviewed and updated as needed at least once every ten years.

- Consider acquisition of public access rights on each tract (not required). Determine on a case by case basis the need for public access vs. the potential threat for land conversion. The Iowa Forest Stewardship Committee will make final recommendations concerning public access provisions for any said tract to the State Forester. The Iowa State Forester will make final decisions prior to the start of negotiations.

- Restrict development of mineral or oil and gas rights to allow no more than 10 percent of the surface occupancy of the Forest Legacy tact, with total area of all non-forest uses not exceeding 10 percent of the total tract area. Upon landowner completion of operations, the land shall be reclaimed as much as practical to its original contour and reforested.

- No disposal of waste or hazardous material will be allowed on properties in the Forest Legacy program in Iowa.

- Prohibit the use of signs and billboards on all properties, except to state the name and address of the property owner and/or provide Forest Legacy or other forestland incentive/ recognition programs, such as Tree Farm, etc.

- Existing dams or water impoundments or similar structures may be allowed to remain and be maintained.The Forest Stewardship Committee who will make recommendations to the State Forester for his final approval/denial will review exceptions or new impoundments on a case by case basis.

- Any revisions to the easement regarding existing structures may be made only upon approval by the government holding title to the easement.

- New or expansion of industrial, commercial or residential activities, except traditional forest uses will be reviewed on a case by case basis by the Iowa Forest Stewardship Committee. The Forest Stewardship Committee will then make recommendations to the State Forester for his final determination.
- A parcel must have a Forest Stewardship plan completed by a professional forester and approved by the State Forester or his designee before entering the Forest Legacy Program. This Forest Stewardship plan must be current and updated at least every 10 years or as needed.

- Each conservation easement will contain appropriate clauses to address the goals and objectives of the individual Forest Legacy area. Such clauses may include, but are not limited to the following:

    - Scenic Resources – where local, state or nationally designated scenic routes, bike trails, hiking trails or area would be impacted, design timber harvests and timber stand improvement work to minimize aesthetic impacts.

    - Public Recreation – where appropriate acquire public recreation access easements for public recreation such as hiking, hunting and fishing.

- Riparian Areas – where appropriate, limit impacts to riparian zones during traditional forest uses by following Iowa Forestry Best Management Practices, develop species control measures in aquatic communities to minimize negative impacts of invasive species. These measures should be addressed in the Forest Stewardship plan.

- Unique, Rare, Threatened or Endangered Species – where identified unique, rare, threatened or endangered species of animals or plants exist on the Forest Legacy tract, the Forest Stewardship plan must address their protection and appropriate management.

- Archeological, Cultural or Geologic Features – if a tract contains known archeological, cultural or geologic features, the Forest Stewardship plan must address their protection.

- Borders existing public or permanently protected forests – where the tract borders existing public or permanently protected forests, the Forest Stewardship plan will address the use of appropriate buffer zones during traditional forest use.

- Unique or Isolated Tree Species/Stand Conditions – if a tract contains known unique or isolated tree species/stand conditions such as old growth or savannas, the Forest Stewardship plan will address appropriate management efforts.

- Invasive Species – limit the terrestrial plant and animal stocking activities (particularly exotic species) to minimize negative impacts on native ecosystems. Such stocking and invasive species control and management efforts should be addressed in the Forest Stewardship plan.

Iowa Forest Legacy Landowner Application Package WILL CONTAIN:

- Forest Legacy Program Application-Information Sheet

- Landowner Inspection Consent Agreement

- Forest Legacy Program Application Form (# of pages)
- Application Submission Checklist

- Map of Designated Forest Legacy Areas

- Iowa Forest Legacy Program Evaluation Criteria and Description

Application and Ranking of Requests

Landowners will be expected to complete an application with the assistance of the local DNR Forester or other knowledgeable professionals to insure that the information is complete and correct. Applications will be reviewed by the Iowa DNR Division of Forests and Prairies and go to the Forest Stewardship Committee for review and prioritization.

Points will be awarded to the applications for the number of criteria met. Actual point amounts for each criterion will be determined by the Forest Stewardship Committee and approved by the Iowa State Forester.

Site visits and inspections of the actual property will be necessary for properties being considered, an inspection consent agreement will be completed at the time of application.

Applicants will be notified of how their application was scored once the Forest Stewardship Committee and the State Forester have completed their assessment and recommendations.

IOWA's ASSESSMENT OF NEED-PUBLIC INVOLVEMENT
Public Participation Process and Draft timetable:

The public participation process for Iowa's Forest Legacy Program Assessment of Need (AON) took place initially during the fall of 1999 when the Iowa Forest Stewardship Council was introduced to the concept of the Forest Legacy Program. The council voted to pursue development of the Assessment of Need by the Iowa DNR Division of Forests and Prairies.

The next phase involved discussion with interested organizations, stewardship committee members and landowners over the state of Iowa at organization meetings and through informal/formal networks of forestry and private landowner organizations. A Forest Legacy Sub Committee was established in August of 2000 to help in the development and review of the initial draft AON. This sub committee determined the proposed Forest Legacy Areas. The second draft was developed in May 2001 being brought in front of the entire Forest Stewardship Committee for comment and approval on May 8, 2001. Comments were received on the second draft, and are included in this AON from Forest Stewardship Committee members. The entire stewardship committee voted to support the 7 proposed Forest Legacy Areas.

Additions and revisions proposed by the Stewardship Committee were addressed in the Third Draft of the AON that was released for public comment on August 14, 2001. During the Iowa Natural Resources Commission public meeting of August 2001, State Forester Mike Brandrup gave an informational review of the Draft AON, and asked for any comments to be made by September 10, 2001. The Draft AON and news release was placed on the Department of Natural Resources-Division of Forests and Prairies web site www.state.ia.us/forestry on August 14, 2001. A general state wide news release was put out by the Department of Natural Resources on that same day letting people know about the AON, and that a public hearing was set for September 10, 2001 at the State Forest Nursery in Ames. The public hearing was held on September 10th with 7 participants. Additional public comments were received and addressed through a question and answer period.

Additional email and telephone conversations concerning the AON were received and addressed right up to the final preparation of the AON on November 30th.

A letter to the Chair of each County Supervisor where a Forest Legacy Area is proposed was mailed on November 29, 2001. In addition, letters to members of Iowa's delegation to the House of Representatives and Senate were mailed on November 29, 2001. The final AON was completed and sent to the U.S. Department of Agriculture Secretary for her approval on December 3, 2001.

Following is the timetable for production of this Forest Legacy Assessment of Need (AON) for the State of Iowa:

November 1999 -- State Forest Stewardship Committee is introduced to Forest Legacy concept and votes to pursue Assessment of Need development.

March 2000 -- State of Iowa applies to federal matching funds to develop AON

May 2000 -- Research on other states' Forest Legacy Plan begins; an AON outline is constructed; list of organizations and people to talk with about the program is developed and implemented.

June 2000 -- Preparation of the AON Draft document begins following discussions with members of the forest stewardship committee and state foresters; focus of Forest Legacy Plan and possible Forest Legacy Areas are identified as information is gathered for the AON. Funding for preparation of the AON is received by IDNR from USDA Forest Service-State/Private Forestry.

August 2000 -- AON drafted and sent to a Forest Legacy subcommittee for review and comment; a meeting is held with the subcommittee where comments are received, the AON is sent back to the DNR for further development and revisions.

May 2001 -- The second draft of the Forest Legacy Plan is developed and presented for comment to the State Forest Stewardship committee. Comments are received from State Stewardship Committee members (enclosed).

July 2001 – A third draft is developed and sent out to the Forest Legacy subcommittee for further review.

August 2001 – Efforts to receive additional public through open meetings is held with the Iowa Woodland Owners Association, Iowa Tree Farm Committee, Northeast Iowa Forest Advisory Committee and the Southeast Forest Advisory Committee. The document is put on the DNR's web page and news releases requesting public input are sent out statewide for a 21-day review and comment period. Letters sent to the Chair of County Supervisors where FLA will occur.

September 2001 -- Public hearing was held on September 10th from 6:30-8 pm at the State Forest Nursery in Ames. A formal presentation was given to the audience and comments were taken and addressed during the meeting. Additional comments were received and addressed via email and phone calls. Governor Vilsack approves the plan and designates the Iowa DNR Division of Forests and Prairies as the lead agency in program implementation (see attached letter).
October 2001 – The Iowa Natural Heritage Foundation Executive Director support the AON, and helps to coordinate a partnership meeting with the DNR to begin identification of potential legacy tracts around Yellow River State Forest. November 2001 -- Revisions are then made to draft AON; additions and corrections are made to the final AON; lists of involved parties is added, as well as names of organizations involved in the implementation of the plan. The Final AON sent to U.S. Secretary of Agriculture for approval follows.

THOMAS J. VILSACK
GOVERNOR

OFFICE OF THE GOVERNOR
STATE CAPITOL
DES MOINES, IOWA 50319
515 281-5211
FAX 515-281-6611

SALLY J. PEDERSON
LT. GOVERNOR

September 21, 1999

Mr. Mike Dombeck
Chief, USDA Forest Service
201 14th Street, SW at Independence Ave., SW
Washington, DC 20024

Dear Chief Dombeck:

I am writing to designate the Forest and Prairies Division of the Iowa Department of Natural Resources as the state's lead agency for USDA's Forest Legacy Program as authorized under Section 1217 of Title XII of the Food, Agriculture, Conservation and Trade Act of 1990.

Please send all information and pertinent materials to: Michael E. Brandrup, State Forester, Iowa Department of Natural Resources, Wallace State Office Building, Des Moines, Iowa 50319-0034.

The Forest Legacy Program and the federal, state, local and private partnerships that it will promote will compliment other programs within the state. The program will better enable us to protect and manage our valuable forest resources today and in the future.

Sincerely,

Thomas J. Vilsack
Governor

Cc: Paul Johnson, Director of the Iowa Department of Natural Resources

USDA

United States Department of Agriculture

Office of the Secretary
Washington, D.C. 20250

APR - 7 2002

The Honorable Thomas J. Vilsack
Governor
State of Iowa
Des Moines, Iowa 50319-0001

Dear Governor Vilsack:

I am pleased to inform you that your request for participation in the Forest Legacy Program (FLP) has been approved pursuant to our authority under Section 7 of the Cooperative Forestry Assistance Act of 1978 (16 USC 2103c), as amended.

Seven candidate Forest Legacy Area(s) (FLA) meeting eligibility criteria to achieve these goals and having public support were proposed. They are described and mapped in the Iowa AON. All seven areas are hereby instituted as approved FLA's.

We appreciate the work of the employees of the Iowa Department of Natural Resources, under the leadership of Director Jeffrey R. Vonk, who has worked diligently to bring Iowa into the FLP.

Thank you again for your efforts to join the FLP. Please do not hesitate to contact Under Secretary for Natural Resources and Environment Mark Rey if you have any questions.

Sincerely,

Ann M. Veneman
Secretary

An Equal Opportunity Employer

Community
Adel
Albia
Anamosa
Atkins
Beacon
Bedford
Belmond
Bloomfield
Bonaparte
Boone
Buffalo
Carlisle
Center Point
Chariton
Charles City
Chelsea
Chillicothe
Clermont
Coalville
Colfax
Columbus Junction
Coon Rapids
Coralville
Crescent
Cumberland
Dawson
Dayton
De Soto
Decorah
Dounds
Dubuque
Dundee
Dyersville
Earlham
Eddyville
Eldon
Eldora
Eldridge
Elgin
Elk Run Heights

Community
Elkader
Elkport
Evensdale
Floris
Floyd
Fraser
Fredericksburg
Fredonia
Fredonia
Garber
Garner
Granger
Grant
Guttenberg
Hamilton
Hampton
Hartford
Harvey
Hazleton
Humboldt
Huxley
Keokuk
Keosauqua
Kirkville
La Porte City
Lambs Grove
Lansing
Le Claire
Leando
Lehigh
Leighton
Linn Grove
Lisbon
Lovilia
Marysville
Massena
Maxwell
McGregor
Melrose
Middletown
Missouri Valley
Mitchell

Community
Montrose
Mount Vernon
Mystic
New Hampton
Newhall
Nora Springs
North Buena Vista
Oakland
Oakland Acres
Okoboji
Olin
Oskaloosa
Oxford
Palo
Panora
Panorama Park
Peterson
Pilot Mound
Plymouth
Polk City
Princeton
Rathbun
RedField
Riceville
Riverdale
Rock Falls
Rockford
Sac City
Sageville
Saylorville
Shellsburg
Sioux Rapids
Spillville
St. Lucas
Steamboat Rock
Swan
Tama
Thurman
Tiffin
Unionville
University Heights
University Park

Community
Urbana
Van Meter
Volga
Wadena
Wahpeton
Walcott
Walker
Waterville
Wellman
West Burlington
West Liberty
West Okoboji
West Union
What Cheer
Windsor Heights
Winterset
Woodburn

Appendix E Forest Type Acres & Percentages in 1990, 2003, 2008.

Forest Type	2008 Total	2008 Percentage	2003 Total	2003 Percentage	1990 Total	1990 Percentage
Nonstocked	81,367	2.7%	73,343	2.8%	2,700	0.1%
Aspen	9,407	0.3%	12,035	0.5%	7,304	0.4%
Cottonwood	102,379	3.4%	83,825	3.1%	22,741	1.1%
Eastern Redcedar	21,650	0.7%	32,018	1.2%	24,472	1.2%
Eastern Redcedar/ Hardwood	61,427	2.0%	34,299	1.3%	26,305	1.3%
White Oak	135,483	4.5%	155,155	5.8%	89,430	4.4%
Mixed Uplands Hardwoods	485,596	16.0%	370,415	13.9%	105,116	5.1%
Black Ash/ American Elm/Red Maple	27,998	0.9%	21,867	0.8%	497,427	24.2%
Sugar Maple/ Yellow Birch	24,590	0.8%	25,343	1.0%	509,018	24.8%
White Oak/ Red Oak/ Hickory	778,491	25.7%	779,197	29.2%	763,949	37.2%
Other Pine/ Hardwood	3,400	0.1%	4,045	0.2%		0.0%
Northern Red Oak	37,280	1.2%	50,773	1.9%		0.0%
Blur Oak	201,223	6.6%	143,595	5.4%		0.0%
Black Walnut	111,926	3.7%	59,662	2.2%		0.0%
Black Locust	32,037	1.1%	18,087	0.7%		0.0%
Cherry/ White Ash/ Yellow Poplar	61,934	2.0%	12,838	0.5%		0.0%
Elm/Ash/ Black Locust	247,998	8.2%	194,011	7.3%		0.0%
River Birch/ Sycamore	39,967	1.3%	40,530	1.5%		0.0%
Willow	25,923	0.9%	15,932	0,6%		0.0%

Forest Type	**2008 Total**	**2008 Percentage**	**2003 Total**	**2003 Percentage**	**1990 Total**	**1990 Percentage**
Sycamore/ Pecan/ American Elm	6,560	0.2%	6,454	0.2%		0.0%
Hackberry/ Elm/Green Ash	281,423	9.3%	289,507	10.9%		0.0%
Silver Maple/ American Elm	177,773	5.9%	155,848	5.8%		0.0%
Cottonwood/ Willow	15,529	0.5%	26,768	1.0%		0.0%
Black Cherry	1,416	0.0%	0	0.0%		0.0%
Hard Maple/ Basswood	35,266	1.2%	34,233	1.3%		0.0%
Other Hardwoods	13,519	0.4%	14,673	0.6%		0.0%
Other Exotic Hardwoods	11,045	0.4%	5,906	0.2%		0.0%
Totals	**3,032,807**		**2,665,150**		**2,054,795**	

Appendix F Forest Wildlife Species of Greatest Conservation Need.

Source of the information from this Appendix comes from Iowa's Wildlife Action Plan.

Iowa Abundance: A=abundant, **C**=common, **CL**=common locally, **U**=uncommon, **UL**=uncommon locally, **R**=rare, **SC**=special concern, **Th**=threatened, **En**=Endangered, **X**=extirpated, **E**=extinct

Iowa/National Status: B=breeding, **N**=non-breeding
SX/NX=presumed extirpated, **SH/NH=**possibly extirpated, **S1/N1=**critically imperiled, **S2/N2=**imperiled, **S3/N3**=vulnerable, S**4/N4=**apparently secure, **S5/N5=**secure, **SNR/NNR=**unranked, **SU/NU=**unrankable, **SNA/NNA=**not applicable

Table 1. Wildlife of greatest conservation need found in forest habitat (>60% canopy of tree species with crowns interlocking).

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Birds				
Red Eagle	*Haliaeetus leucocephalus*	Endangered R	S3B, S3N	N4B, N4N
Red-Shouldered Hawk	*Buteo lineatus*	Endangered U	S2B	N5B, N5N
Broad-Winged Hawk	*Buteo platypterus*	R	S3B	N5B
Peregrine Falcon	*Falco peregrinus*	U	S4B	N5
Ruffed Grouse	*Bonasa umbellus*	U	S4B	N5
American Woodcock	*Scolopax minor*	C	S4B, S5N	N5B, N5N
Black-Billed Cuckoo	*Coccyzus erythropthalmus*	C	S3B	N5B
Yellow-Billed Cuckoo	*Coccyzus americanus*	C	S3B	N5B
Whip-Poor-Will	*Caprimulgus vociferous*	CL	S5B	N5B
Acadian Flycatcher	*Empidonax virescens*	R	S3b, S3N	N5B
Brown Creeper	*Certhia americana*	R	S2B, S3N	N5B

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Veery	*Catharus fuscescens*	R	S2B, S3N	N5B
Wood Thrush	*Hylocichla mustelina*	U	S4B, S4N	N5B
Blue-Winged Warbler	*Vermivora primus*	U in E, R in W	S3b, S4N	N5B
Golden-winged Warber	*Vermivora chrysoptera*	U	S1B	N4B
Canada Warbler				
Cerulean Warber	*Dendroica cerulean*	R	S2b, S3N	N4B
Prothonotary Warbler	*Protonotaria citrea*	R	S3B, S3N	N5B
Worm-eating Warber	*Helmitheros vermivorus*	R	S2B, S2N	N5B
Black & White Warber	*Mniotilta varia*	R	S5N	N5B, N4N
Hooded warbler	*Wilsonia citrine*	R	S1B, S2N	N5B
Louisiana Waterthrush	*Seiurus motacilla*	R	S3B, S4N	N5B
Kentucky Warbler	*Oporornis formosus*	R	S1B, S3N	N5B
Mammals				
Hayden's shrew	*Sorex haydeni*	CL	S4-Apparently Secure	N4
Short-tailed Shrew	*Blarina hylophaga*	CL	S4	?
Evening bat	*Nycticeius humeralis*	CL	S3 Threatened	N5
Northern Myotis	*Myotis septentrionalis*	CL	S4-Apparently Secure	N4
Red Squirrel	*Tamiasciurus Hudsonicus*	CL	S3	N5
Red-Backed Vole	*Clethrionomys gapperi*	R	Endangered	N5
Woodland Vole	*Mictotus pinetorum*	R	S3	N5

Common Name	**Scientific Name**	**Iowa Abundance**	**Iowa Status**	**National Status**
Spotted Skunk	*Spilogale putorius*	R	Endangered	N5
Bobcat	*Lynx rufus*	U	S3	N5
Reptiles & Amphibians				
Timber Rattlesnake	*Crotalus horridus*		S3	N5
Copperhead	*Agristrodon contortix*		S1	N5
Butterflies				
Pipevine Swallowtail	*Battus philenor*	SC	S?	N5
Columbine Dustywing	*Erynnis lucilius*	SC	S3	N4
Hickory Hairstreak	*Satyrium caryaevorum*	SC	S3	N4
Land Snails				
Iowa Pleistocene Snail	*Discus macclintocki*	R		N1
Fagid Ambershell	*Catinella gelida*	R		N1
Minnesota Pleistocene snail	*Novasuccinea N. SP. Minnesota A.*	R		N.N.R
Iowa Pleistocene Succinea	*Novasuccinea N. SP. Minnesota B.*	r		N.R.R
Briarton Pleistocene snail	*Vertigo brierensis*	R		N1
Hubricht's vertigo	*Vertigo hubrichti*	R		N3
Iowa Pleistocene Vertigo	*Vertigo iowaensis*	R		n3
Bluff Vertigo	*Vertigo occulta*	R		N2

Table 2. **Wildlife of greatest conservation need found in wet forest habitat (Temporarily or seasonally flooded forest or woodland).**

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Birds				
Yellow-Crowned Night-Heron	*Nyctanassa violacea*	R	S3B, S3N	N5B, N5N
Osprey	*Pandion haliaetus*	R	SXC, S3N	N5B, N4N
Bald Eagle	*Haliaeetus leucocephalus*	Endangered R	S3B, S3N	N4B, N4N
Red-shouldered Hawk	*Buteo lineatus*	Endangered U	S2B	N5B, N5N
Peregrine Falcon	*Falco peregrinus*	Endangered R	S1B	N4B, N4N
American Woodcock	*Scolopax minor*	C	S4B, S5N	N5B, N5N
Black-billed Cuckoo	*Coccyzus erythropthalmus*	C	S3B	N5B
Long Eared Owl	*Asio otus*	Th	S2B, S3N	N5B, N5N
Red-headed Woodpecker	*Melanerpes erythrocephalus*	C	S5B	N5B, N5N
Brown Creeper	*Certhia americana*	R	S3B	N5
Acadian	*Empidonax*	R	S3B, S3N	N5B
Flycatcher	*Virescens*			
Veery	*Catharus fuscescens*	R	S2B, S3N	N5B
Wood Thrush	*Hylocichla mustelina*	U	S4B, S4N	N5B
Cerulean Warbler	*Dendroica cerulean*	R	S2B, S3N	N4B
Prothonotary Warbler	*Protonotaria citrea*	R	S3B, S3N	N5B
Louisiana Waterthrush	*Seiurus motacilla*	R	S3B, S4N	N5B

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Kentucky Warbler	*Oporornis formosus*	R	S1B, S3N	N5B
Rusty blackbird	*Euphagus carolinus*	R	S3N	N5B, N5N
Mammals				
Hayden's shrew	*Sorex haydeni*	CL	S4 Apparently Secure	N4
Least shrew	*Cryptotis parva*	R	S3 Threatened	N5
Evening bat	*Nycticeius humeralis*	CL	S3 Threatened	N5
Reptiles & Anphibians				
Blue-spotted Salamander	*Ambystoma laterale*		S1	N5
Central Newt	*Notophthalmus viridescens*		S2	N5
Smallmouth Salamander	*Ambystoma texanum*		S3	N5
Crawfish frog	*Rana areolata*		S1	N4
Wood turtle	*Clemmys insculpta*		S1	N4
Yellowbelly Water Snake	*Nerodia erythrogaster flavigaster*		S1	N5
Copperbelly Water Snake	*Nerodia erythrogaster neglecta*		S1	N5

Table 3. Wildlife of greatest conservation need found in forest habitat (Open stands of tree species with 25-60% canopy cover).

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Birds				
Bald eagle	*Haliaeetus leucocephalus*	Endangered R	S3B, S3N	N4B, N4N
Red-shouldered Hawk	*Buteo lineatus*	Endangered U	S2B	N5B, N5N
Swainson's Hawk	*Buteo swainsoni*	R	S3B, S3N	N5B
Ruffed grouse	*Bonasa umbellus*	U	S4B	N5
American Woodcock	*Scolopax minor*	C	S4B, S5N	N5B, N5N
Black-billed Cuckoo	*Coccyzus erythropthalmus*	C	S3B	N5B
Yellow-billed Cuckoo	*Coccyzus americanus*	C	S3B	N5B
Long-eared owl				
Whip-poor-will	*Caprimulgus vociferous*	CL	S5B	N5B
Red-headed Woodpecker	*Melanerpes erythrocephalus*	C	S5B	N5B, N5N
Least flycatcher	*Empidonax minimus*	R	S1B, S4N	N5B
Bewick's wren	*Thryomanes bewickii*	R	S2B, S2N	N5B
Northern Mockingbird	*Mimus polyglottos*	R	S3B	N5
White-eyed Vireo	*Vireo griseus*	R	S2B, S3N	N5B, N5N
Blue-winged Warbler	*Vireo pinus*	R-W/U-E	S3B, S4N	N5B
Golden-winged Warber	*Vermivora chrysoptera*	U	S1B	N4B
Yellow-breasted chat	*Icteria virens*	R	S3B, S3N	N5B
Eastern towhee	*Pipilo erythro-phthalmus*	CL	S4B, S4N	N5
Mammals				

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Hayden's shrew	*Sorex haydeni*	CL	S4-Apparently Secure	N4
Short-tailed Shrew	*Blarina hylophaga*	CL	S4	?
Least shrew	*Cryptotis parva*	R	S3 Threatened	N5
Bobcat	*Lynx rufus*	U	S3	N5
Reptiles & Amphibians				
Timber Rattlesnake	*Crotalus horridus*		S3	N5
Central Newt	*Notophthalmus viridescens*		S2	N5
Blue-spotted Salamander	*Ambystoma laterale*		S1	N5
Smallmouth Salamander	*Ambystoma texanum*		S3	N5
Slender glass Lizard	*Ophisaurus attenuatus*		S2	N5
Western Worm Snake	*Carphophis amoenus*		S2	N5
Prairie Kingsnake	*Lampropeltis calligaster*		S3	N5
Speckled KingSnake	*Lampropeltis getulus*		S1	N5
Bull Snake	*Pituophis catenifer sayi*		S3	N5
Smooth earth Snake	*Virginia valeriae*		S3	N5
Butterflies				
Pepper and Salt Skipper	*Amblyscirtes hegon*	K	S?	N5
Columbine Duskywing	*Erynnis lucilius*	SC	S3	N4
Dreamy Duskywing	*Erynnis lcelus*	R	S3	N5
Zebra Swallowtail	*Eurytides marcellus*	R	S?	N5
Silvery Blue	*Glaucopsyche lygdamus*	R	S2	N5
Zabulon skipper	*Poanes zabulon*	LC	SC	N5
Edward's Hairstreak	*Satyrium edwardsii*	K	S3	N5
Striped Hairstreak	*Satyrium liparops*	K	S?	N5

Table 4. Wildlife of greatest conservation need found in wet forest habitat (Open stands of tree species with < 25% canopy cover).

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Birds				
Sharp-tailed Grouse	*Tympanuchus phasianellus*	R	S1B	N4
Northern Bobwhite	*Colinus virginianus*	CL	S5B	N5
Black-billed Cuckoo	*Coccyzus erythropthalmus*	C	S3B	N5B
Black-crowned Night Heron	*Nycticorax nycticorax*	R	S3B, S3N	N5B, N5N
Yellow-billed Cuckoo	*Coccyzus americanus*	C	S3B	N5B
Bewick's Wren	*Thryomanes bewickii*	R	S2B, S2N	N5B
Northern Mockingbird	*Mimus polyglottos*	R	S3B	N5
Loggerhead Shrike	*Lanius ludovicianus*	U	S3B, S3N	N4
White-eyed Vireo	*Vireo greseus*	R	S2B, S3N	N5B, N5N
Bell's Vireo	*Vireo bellii*	R	S3B, S4N	N4B
Willow Flycatcher	*Empidonax traillii*	C	S4B, S4N	N5B
Blue-winged Warbler	*Vermivora pinus*	R-W/U-E	S3B, S4N	N5B
Golden-winged Warbler	*Vermivora chrysoptera*	U	S1B	N4B
Yellow-breasted Chat	*Icteria virens*	R	S3B, S3N	N5B
Eastern Towhee	*Pipilo erythro-phthalmus*	CL	S4B, S4N	N5
Field sparrow	*Spizella pusilla*	C	S5B, S5N	N5
Rusty blackbird	*Euphagas carolinus*	U	S3N	N5B, N5N
Bell's Vireo	*Vireo bellii*	U	S3B, S4N	N4B
Mammals				

Common Name	**Scientific Name**	**Iowa Abundance**	**Iowa Status**	**National Status**
Least Shrew	*Cryptotis parva*	R	S3 Threatened	N5
Bobcat	*Lynx rufus*	U	S3	N5
Reptiles & Amphibians				
Northern Prairie Skink	*Eumeces septentrionalis*		S3	N5
Smooth green Snake	*Opheodrys vernalis*		S3	N5
Eastern Massasauga Rattlesnake	*Sistrurus catenatus catenatus*		S1	N3,N4

Table 5. Wildlife of greatest conservation need found in Savanna habitat.

Common Name	Scientific Name	Iowa Abundance	Iowa Status	National Status
Birds				
Swainson's Hawk	*Buteo swainsoni*	R	S3B, S3N	N5B
Barn Owl	*Tyto alba*	En	S1B	N5
Long-eared Owl	*Asio otus*	Th	S2B, S3N	N5B, N5N
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	C	S5B	N5B, N5N
Northern Mockingbird	*Mimus polyglottos*	R	S3B	N5
Loggerhead shrike	*Lanius ludovicianus*	U	S3B, S3N	N4
Bell's Vireo	*Vireo bellii*	U	S3B, S4N	N4B
Lark Sparrow	*Chondestes grammacus*	CL	S4B	N5B
Eastern Meadowlark	*Sturnella magna*	C	S4B, S4N	N5
Franklin's Round Squirrel	*Spermophilus franklinii*	R	S3	N5
Spotted Skunk	*Spilogale putorius*	R	Endangered	N5
Least Shrew	*Cryptotis parva*	R	S3 Threatened	N5
Short Tailed Shrew	*Blarina hylophaga*	CL	S4	?
Reptiles & Amphibians				
Six-lined Racerunner	*Cnemidophorus sexlineatus*		S3	N5
Slender Glass Lizard	*Ophisaurus attenuatus*		S2	N5
Six-lined Racerunner	*Cnemidophorus sexlineatus*		S3	N5
Slender Glass Lizard	*Ophisaurus attenuatus*		S2	N5

Common Name	**Scientific Name**	**Iowa Abundance**	**Iowa Status**	**National Status**
Ornate Box Turtle	*Tarrapene ornata*		S2	N5
Smooth Green Snake	*Opheodrys rernalis*		S3	N5
Speckled King Snake	*Lampropeltis getulus*		S1	N5
Prairie Kingsnake	*Lampropeltis calligaster*		S3	N5
Bullsnake	*Pituophis catenifer Sayi*		S3	N5
Butterflies				
Dreamy	*Erynnis icelus*	R	S3	N5
Dustywing				

Appendix G Forest Health Data.

Table 1: History of the Number of Gypsy Moth Catches and the Number of Acres Treated for gypsy moth eradication in Iowa (1972-2007). Unless specified, Bacillus thuringiensis var. kurstaki was the treatment method.

Year	Number of traps used in survey	Number of multiple catches	Number of moths caught	Number of acres treated
1972	253		1	
1973	1196		0	
1974	1210		1	
1975	1120		0	
1976	1650		0	
1977	1130		0	
1978	741		1	
1979	854		0	
1980	676		1	
1981	970		6	
1982	1123		11	
1983	1617		14	
1984	3585		10	
1985	2538		6	
1986	3217		15	
1987	3084		18	
1988	2259		13	
1989	2858		27	9
1990	2760		17	0
1991	2775		61	0
1992	4738		162	21
1993	4800		72	73.5
1994	5797		143	90
1995	6324		76	52
1996	5241		104	25
1997	5899		151	10
1998	7093		371	21.3
1999	7532		135	224 (pheromone flakes)
2000	6834		47	42
2001	5729		26	15
2002	5729		35	2
2003	3068		159	3 (carbaryl)
2004	4374		27	26
2995	4996		4	0
2006	4891		20	0
2007	4900		175	0
2008	4732		626	0
2009	5217		82	0

Table 2. Known Invasive Plants in Iowa 2008.

Key: ***NP*=** Not Present- Not known to exist in Iowa
***I*=** Isolated- the species is infrequent, not commonly seen
LA= Locally Abundant- the species is present but is not in the majority of the counties
***W*=** Widespread- commonly seen in the majority of counties in large or small populations

Species	Common Name	Abundance
Abutilon Theophrasti	Velvetleaf	W
Ailanthus Altissima	Tree-of-Heaven	W
Alliaria Petiolata	Garlic Mustard	LA
Berberis Thunbergii	Japanese Barberry	W
Bromus Tectorum	Cheatgrass	W
Butomus Umbellatus	Flowering Rush	NP
Carduus Acanthoides	Plumeless Thistle	I
Carduus Nutans	Musk Thistle	W
Celastrus Orbiculata	Oriental Bittersweet	I
Centaurea Maculosa/ Biebersteinii	Spotted Knapweed	LA
Centaurea Repens	Russian Knapweed	I
Centaurea Solstitialis	Yellow Starthistle	I
Cirsium Arvense	Canada Thistle	W
Cirsium spp.	Thistle	W
Cirsium Vulgare	Bull Thistle	W
Conium Maculatum	Poison Hemlock	I
Coronilla Varia	Crown Vetch	W
Daucus Carota	Queen Anne's Lace	W
Dipsacus fullonum/sylvestris	Common Teasel	I
Dipsacus laciniatus	Cutleaf Teasel	I
Dipsacus Sativus	Indian Teasel	NP
Elaeagnus Angustifolia	Russian Olive	I
Elaeagnus Umbellata	Autumn Olive	LA
Euonymus Alatus	Burning Bush	I
Euphorbia Esula	Leafy Spurge	W
Fallopia Japonica/ Polygonum Cuspidatum	Japanese Knotweed	LA
Frangula Alnus/ Rhamnus Frangula	Glossy Buckthorn	I
Heracleum Mantegazzianum	Giant Hogweed	NP
Hesperis Matrionalis	Dame's Rocket	W
Lespedeza Cuneata	Sericea Lespedeza	I
Ligustrum Japonicum	Japanese Privet	NP

Species	Common Name	Abundance
Ligustrum Obtusifolium	Blunt-Leaved or Border Privet	I
Ligustrum Sinense	Chinese Privet	NP
Ligustrum Vulgare	Common or European Privet	I
Lonicera Fragrantissima	Fragrant Honeysuckle	NP
Lonicera Japonica	Japanese Honeysuckle	LA
Lonicera Maackii	Amur Honeysuckle	W
Lonicera Morrowii	Morrow’s Honeysuckle	I
Lonicera Standishii	Standish’s Honeysuckle	NP
Lonicera Tatarica	Tatarian Honeysuckle	W
Lonicera X Bella	Bell’s Honeysuckle	I
Lonicera Xylosteum	European Fly Honeysuckle	NP
Lythrum Salicaria	Purple Loosestrife	W
Morus Alba	White Mulberry	W
Pastinaca Sativa	Wild Parsnip	W
Potamogeton Crispus	Curlyleaf Pondweed	I
Pueraria Montana	Kudzu	I
Rhamnus Cathartica	Common Buckthorn	W
Tamarix spp.	Salt Cedar	I

Appendix H Ginseng Harvested in 2008.

County	Dry Weight
Allamakee	137.49
Benton	4.06
Boone	4.32
Boone	4.32
Bremer	2
Buchanan, Linn, Clayton, Fayette, Hardin, Black Hawk, Grundy	5.5
Butler	1.8
Cedar	5.22
Clayton	153.66
Clinton and Scott	4.31
Delaware	12.53
Des Moines	0.2
Dubuque	24.69
Fayette	36.95
Franklin	1.5
Hardin	2.35
Henry	1.85
Howard	1.12
Iowa	1
Jackson	14.09
Johnson	8.95
Jones	13.07
Linn	25.78
Louisa	4.57
Mahaska	5.98
Marion	0.1
Mitchell	0.02
Muscatine	120.17
Polk, Jasper, Boone	14.75
Pottawattamie	7.31
Scott	17.15
Tama	18.7
Wapello	6.48
Warren	0.15
Webster	54.39
Winneshiek	44.37
Woodbury	1.31
Total	**758.71**

Appendix I Trees and Shrubs Native to Iowa.

Common Name	Scientific Name	Mature Height (feet)	Groath Rate	Shade Tolerance
American Basswood	*Tilia americana*	80	Fast	Tolerant
American Elm	*Ulmus americana*	70	Medium	Intermediate
American Hazelnut	*Corylus americana*	15	Medium	Intermediate
American Hornbeam	*Carpinus caroliniana*	35	Slow	Very Tolerant
Balsam Fir	*Abies balsamea*	50	Slow	Very Tolerant
Balsam Poplar	*Populus balsamifera*	50	Fast	Very Tolerant
Beaked Hazelnut	*Corylus cornuta*	6	Medium	Intermediate
Bebb Willow	*Salix bebbiana*	25	Fast	Intolerant
Bigtooth Aspen	*Populus grandidentata*	45	Fast	Very Tolerant
Bitternut Hickory	*Carya cordiformis*	70	Slow	Intolerant
Black Ask	*Fraxinus nigra*	50	Medium	Intolerant
Black Cherry	*Prunus serotina*	50	Medium	Intolerant
Black Maple	*Acer nigrum*	60	Medium	Very Tolerant
Black Oak	*Quercus velutina*	60	Medium	Intermediate
Black Walnut	*Juglans nigra*	80	Fast	Intolerant
Black Willow	*Salix nigra*	50	Fast	Very Intolerant
Blackhaw Viburnum	*Viburnum prunifolium*	12	Slow	Intermediate
Blackjack Oak	*Quercus marilandica*	35	Slow	Intermediate
Blue Ash	*Fraxinus quadrangulata*	40	Medium	Intermediate
Boxelder	*Acer negundo*	50	Fast	Tolerant
Buffaloberry	*Sheperdia argentea*	8	Medium	Intermediate
Bur Oak	*Quercus macrocarpa*	100	Slow	Intermediate
Butternut	*Juglans cinerea*	60	Slow	Intolerant
Canada Plum	*Prunus nigra*	20	Medium	Intolerant
Canadian Yew	*Taxus canadensis*	3	Slow	Tolerant

Common Name	Scientific Name	Mature Height (feet)	Groath Rate	Shade Tolerance
Chinkapin Dwarf Oak	*Quercus prinoides*	20	Slow	Intolerant
Chinkapin Oak	*Quercus muhlenbergii*	50	Slow	Intolerant
Chokecherry	*Prunus virginiana*	20	Medium	Very Intolerant
Cockspur Hawthorn	*Crataegus crus-galli*	20	Slow	Intermediate
Common Juniper	*Juniperus communis*	10	Medium	Intolerant
Common Pawpaw	*Asimina triloba*	25	Medium	Intermediate
Common Persimmon	*Diospyros virginiana*	40	Slow	Very Tolerant
Cottonwood	*Populus deltoides*	100	Very Fast	Very Intolerant
Coyote Willow	*Salix exigua*	25	Fast	Intolerant
Dotted Hawthorn	*Crataegus punctata*	25	Slow	Intermediate
Downy Hawthorn	*Crataegus mollis*	30	Slow	Intermediate
Downy Serviceberry	*Amelanchier arborea*	25	Medium	Tolerant
Eastern Red Cedar	*Juniperus virginiana*	40	Medium	Very Tolerant
Eastern Redbud	*Cercis canadensis*	15	Slow	Tolerant
Eastern Wahoo	*Euonymus atropurpureus*	15	Medium	Tolerant
Elderberry	*Sambucus canadensis*	8	Fast	Intermediate
Fleshy Hawthorn	*Crataegus succulenta*	30	Slow	Intermediate
Gray Dogwood	*Cornus racemosa*	10	Medium	Tolerant
Green Ash	*Fraxinus pennsylvanica*	60	Fast	Tolerant
Hackberry	*Celtis occidentalis*	60	Slow	Intermediate
Heart-leaved Willow	*Salix rigida*	10	Fast	Very Intolerant

Common Name	Scientific Name	Mature Height (feet)	Groath Rate	Shade Tolerance
Honeylocust	*Gleditsia triacanthos*	70	Fast	Intolerant
Hophornbeam	*Ostria virginiana*	30	Slow	Tolerant
Hoptree/ Water Ash	*Ptelea trifoliata*	15	Slow	Intermediate
Hortulan Plum	*Prunus hortulana*	15	Medium	Very Intolerant
Inland Serviceberry	*Amelanchier interior*	20	Medium	Tolerant
Kentucky Coffeetree	*Gymnocladus dioicus*	60	Medium	Intolerant
Margaret's Hawthorn	*Crataegus margaretta*	30	Slow	Intermediate
Meadow Willow	*Salix petiolaris*	10	Fast	Very Intolerant
Mexican Plum	*Prunus mexicana*	20	Medium	Very Intolerant
Missouri River Willow	*Salix eriocephala*	40	Fast	Intolerant
Mountain Maple	*Acer spicatum*	20	Slow	Tolerant
Nannyberry	*Viburnum lentago*	15	Medium	Intermediate
Northern Pin Oak	*Quercus elipsoidalis*	50	Medium	Intolerant
Ohio Buckeye	*Aesculus glabra*	50	Medium	Tolerant
Pagoda Dogwood	*Cornus alternifolia*	20	Slow	Tolerant
Paper Birch	*Betula papyrifera*	70	Fast	Intolerant
Peachleaf Willow	*Salix amygdaloides*	40	Fast	Intolerant
Pear Hawthorn	*Crataegus calpodendron*	30	Slow	Intermediate
Pecan	*Carya illnoensis*	70	Slow	Intolerant
Pignut Hickory	*Carya glabra*	70	Slow	Intermediate

Common Name	Scientific Name	Mature Height (feet)	Groath Rate	Shade Tolerance
Pin Cherry	*Prunus pennsylvanica*	30	Fast	Very Intolerant
Pin Oak	*Quercus palustris*	60	Slow	Intolerant
Post Oak	*Quercus stellata*	30	Slow	Intolerant
Prairie Crabapple	*Malus ioensis*	22	Medium	Intolerant
Prickly Ash	*Zanthoxylum americanum*	12	Slow	Intolerant
Pussy Willow	*Salix discolor*	15	Fast	Intolerant
Quaking Aspen	*Populus tremuloides*	40	Fast	Very Intolerant
Red Maple	*Acer rubrum*	50	Medium	Tolerant
Red Mulberry	*Morus rubra*	35	Medium	Tolerant
Red Oak	*Quercus rubra*	70	Medium	Intermediate
Redosier Dogwood	*Cornus stolonifera*	8	Fast	Tolerant
River Birch	*Betula nigra*	80	Fast	Intolerant
Rock Elm	*Ulmus thomasii*	70	Medium	Intermediate
Rough-Leaf Dogwood	*Cornus drummondii*	8	Medium	Tolerant
Roundleaf Dogwood	*Cornus rugosa*	8	Medium	Tolerant
Roundleaf Serviceberry	*Amelanchier sanguinea*	20	Medium	Tolerant
Sandbar Willow	*Salix interior*	30	Fast	Intolerant
Saskatoon Serviceberry	*Amelanchier alnifolia*	18	Medium	Tolerant
Shagbark Hickory	*Carya ovata*	70	Slow	Intermediate
Shellbark Hickory	*Cary laciniosa*	70	Slow	Very tolerant
Shingle Oak	*Quercus imbricaria*	45	Slow	Intermediate

Common Name	Scientific Name	Mature Height (feet)	Groath Rate	Shade Tolerance
Shining Willow	*Salix lucida*	25	Fast	Intolerant
Showy Mountainash	*Sorbus decora*	20	Medium	Intolerant
Silky Dogwood	*Cornus obliqua*	10	Medium	Tolerant
Silver Maple	*Acer saccharinum*	120	Very Fast	Tolerant
Slippery Elm	*Ulmus rubra*	60	Medium	Tolerant
Smooth Sumac	*Rhus glabra*	15	Medium	Intermediate
Speckled Alder	*Alnus incana*	30	Medium	Intermediate
Staghorn Sumac	*Rhus typhina*	20	Medium	Intermediate
Sugar Maple	*Acer saccharum*	60	Medium	Very Tolerant
Swamp White Oak	*Quercus bicolor*	70	Slow	Intermediate
Sycamore	*Platanus occidentalis*	100	Fast	Intermediate
White Ash	*Fraxinus americana*	70	Medium	Intolerant
White Oak	*Quercus alba*	100	Slow	Intermediate
White Pine	*Pinus strobus*	90	Medium	Intermediate
Wild Plum	*Prunus americana*	20	Fast	Very Intolerant
Witchhazel	*Hamamelis*	10	Medium	Intermediate
Yellow Birch	*Betula alleghaniensis*	100	Medium	Intermediate

Appendix J Stakeholders Consulted.

This table shows the organizations and people that were either contacted for information by e-mail or who attended stakeholder meetings that were hosted. Their input is incorporated into this document where applicaable.

Stakeholder	Number of Representives
Alliant Energy	1
Army Corps of Engineers	1
Black Hills Utility	1
Black Walnut Council	1
Central Iowa Paddlers	1
Conservation Districts of Iowa	1
County Conservation Boards	10
County Roadside Vegetation Managers	3
Department of Transportation	1
Des Moines Area Community College	1
DNR- Climate Change Program	1
DNR- Endangered Species Program	1
DNR- Fisheries Bureau	1
DNR- Forestry Bureau	40
DNR- Geological Services Bureau	1
DNR- Parks Bureau	1
DNR- Water Quality Bureau	1
DNR- Wildlife Bureau	5
Drake University	1
Ducks Unlimited	1
East Central Iowa Furtakers	1
Farm Service Agency	1
Forestry Consultants	5
Friends of Iowa	1
Hawkeye Communtiy College	1
IEC	1
Iowa Arborist Association	3
Iowa Audubon	1
Iowa Bowhunters Association	1
Iowa Chamber of Commerce Executives	1
Iowa Chapter Ruffed Grouse Society	1
Iowa Department of Agriculture	4
Iowa Farm Bureau	1
Iowa Lodging Association	1
Iowa National Guard	1
Iowa Native Plant Society	1
Iowa Nursery Landscape Association	13

Stakeholder	Number of Representives
Iowa Nut Growers Association	1
Iowa OHV Association	1
Iowa Ornithologists Association	1
Iowa Parks and Recreation Association	1
Iowa Prairie Network	1
Iowa Rivers Revival	1
Iowa State Coonhunters Association	1
Iowa State University	2
Iowa Trails Council	1
Iowa Trappers Association	1
Iowa Tree Farm	2
Iowa Urban and Community Forestry Council	5
Iowa Volunteer Fire Departments	12
Iowa Whitewater Coalition	1
Iowa Wildlife Federation	1
Iowa Wildlife Society	1
Iowa Woodland Owners Association	38
IPF	1
ISU Extension	4
Izaak Walton League	1
Keep Iowa Beautiful	1
Meskwaki Nation	1
Mid-American Energy	1
National Rifleman's Association	1
National Wild Turkey Federation	1
Natural Heritage Foundation	2
Natural Resouce Conservation Service	1
North Raccoon Watershed Association	1
Northeast Iowa Communtity College	1
NRCS- Rural Development- Forestry	1
Pheasants Forever	1
Prairie Edge Sustainable Forestry COOP	1
Quad Cities Conservation Alliance	1
Quail Forever	1
Resource Conservation and Development	3
Sawmills	7
SEIA Forestry Advisory Council	1
State Forest Stewardship Coordinating Committee	5
State Soil Conservation	1
State Technical Committee	1

Stakeholder	Number of Representives
Sustainable Funding Coalition	1
The Nature Conservancy	3
Trees Forever	2
U.S. Fish & Wildlife Service	1
U.S. Forest Service	1
Waterfowls Association of Iowa	1
Whitetails Unlimited	1
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Appendix K Data Gaps

- County level FIA data is unusable.
- Would like species specific FIA data- not forest types; need a better breakdown to understand trends better.
- High standard error (>10%) associated with FIA data misleads people into thinking that information is known, because most users do not check the standard error.
- No dedicated GIS specialist or communications people on staff to develop this document.
- Effects of timber management techniques (tsi, harvesting, etc) on wildlife populations: to help address impacts on "species of greatest conservation need" some recent, quality research on these "species of greatest concern" would be important. Research should be done in Iowa, so that foresters and biologists can quantify trends that are occurring in this state and not have to assume / extrapolate data and conclusions from other states forest types.
- Effects of uneven aged management techniques on oak forests in Iowa.
- Possible marketing / utilization for previously 'unmerchantable' timber – pine, alternative forest products, small diameter, woody biomass, etc.
- Inability to compare private land FIA data to public land FIA because of std. error.
- Baseline forestry information to know how things have changed over time.
- Quality of the forest compared to past .
- Amount of forest that has landowners willing to manage the property.
- Lack of urban inventory information to help communities with planning efforts.
- Invasive species presence has not been documented very thoroughly.
- Lack of information about carbon sequestration by tree species.
- Lack of timely information about the value of the wood products industry in the state.
- Lack of available information about the economic value trees have to Iowa's economy, number of jobs in Iowa related to forestry and wood products.
- Lack of available information about the economic value trees have for businesses and homeowners.
- Lack of Iowa related forest research to resolve issues affecting Iowa's forest resources.
- State specific data if not available for most issues affecting Iowa's forest resources.

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