CHAPTER TWO

History of the Formation and Conservation of Iowa's Natural Communities

***Required Element # 2*: Descriptions of the extent and condition of habitats and community types essential to conservation of species identified in Element 1.**

Physiography

Topography: Iowa is a state of 56,239 square miles (36,016,500 acres) 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.

Climate: Iowa's climate is classified as humid continental and is characterized by warm summers and cold winters. The average annual temperature is 47.6^{o} F. Average temperature in the summer is 71.5^{o} F. December to February winter temperatures average 21.2^{o} (NOAA 2015) with an average winter difference of 6.5 degrees between north and south. Temperature minimums of -25^{o} F are not uncommon in northern Iowa.

Iowa's temperature has been gradually increasing (see Figure 1-1). Average annual temperature has increased 0.1^{o} F per decade since 1895. Much of this increase has occurred during the winter months; 3-month averages during the period of December-February have increased 0.2^{o} F per decade since 1895. Iowa's three-month averages during June-August remained stable in that time period (NOAA 2015).

The long-term (1901-2000) statewide average annual precipitation is 32.09 inches (NOAA 2015). A shorter-term average used to estimate "normal" rainfall amounts (1981-2010) is 34.76 inches. The trend in average annual precipitation since the 1870s has been an increase of 0.36 inches per decade (Takle 2011). The northwest part of the state is the driest with an annual precipitation of 30.12 inches (1980-2010 average) while the southeast is the wettest with an annual precipitation of 37.68 inches (1980-2010 average) (Midwestern Regional Climate Center 2015).

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. 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.

Statewide winter snowfall averages 32 inches. Northern Iowa (north of U.S. Highway 30) receives frequent snow often associated with strong winds, blowing and drifting. Southern Iowa may experience substantial snowfall as well as more frequent ice storms. 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, even less in the south half.

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 statewide average growing season is 158 days long.

Iowa now has a statewide average of five more frost-free days per year than 50 years ago, and 8 to 9 more than at the beginning of the 20th century. This provides Iowa with a longer growing season, earlier seasonal snowmelt, and longer ice-free period on lakes and streams (Takle, 2011).

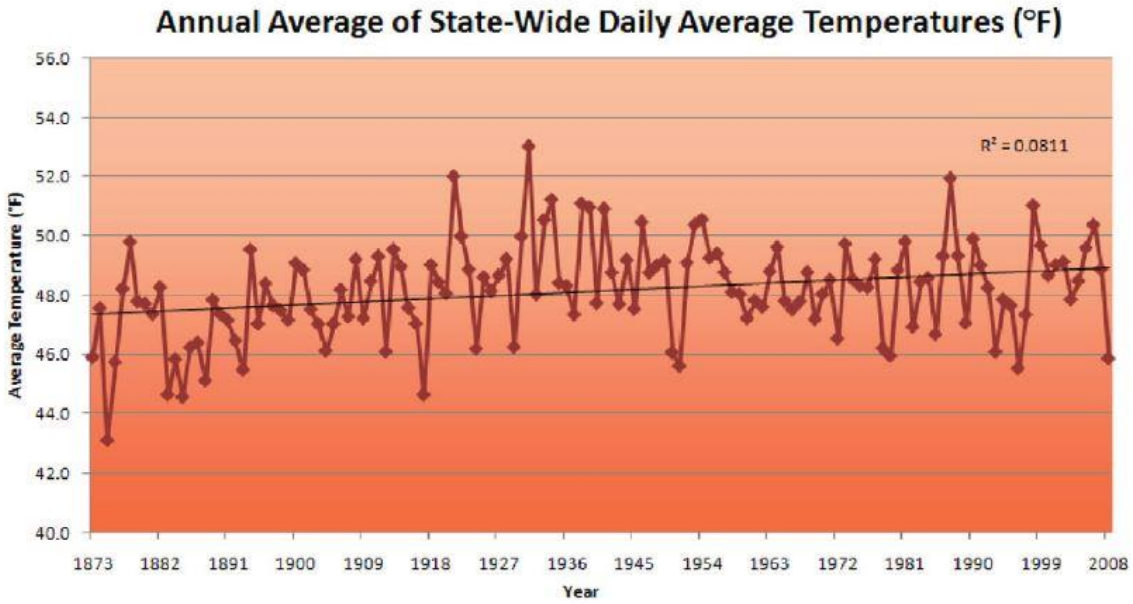


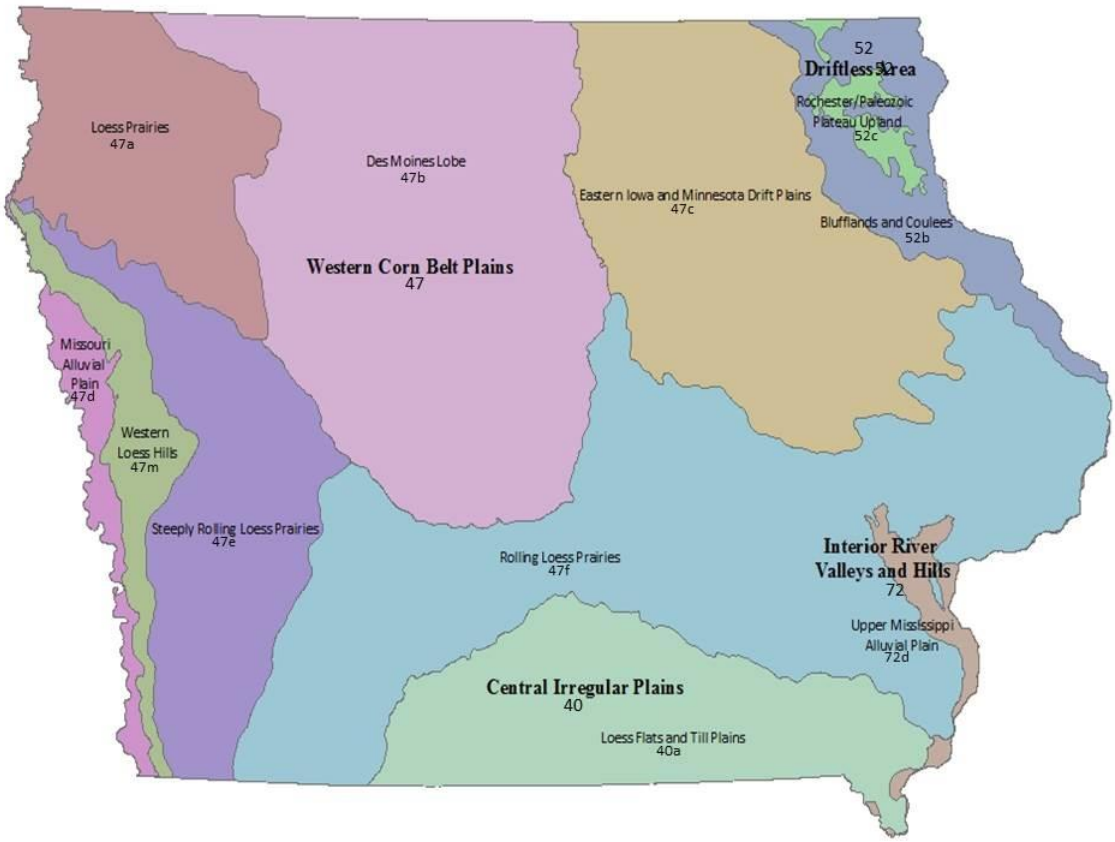
Figure 2-1. Iowa's average annual temperature has increased 0.1 degrees F per decade since 1895. From Takle (2011).

Geology: Iowa's natural communities are as much a result of its recent geologic past as they are a result of climatic conditions (Prior 1991). The boundaries of the ecoregions that resulted from this geologic history coincide well with the boundaries of other habitat based classification systems (See Map 2-1). The names of the ecoregions follow the US EPA (Omernik) Level III and IV Ecoregions. The names in parentheses are habitat-based names for the landforms that describe the native vegetation that was present at the time of settlement. The numbers and descriptions of each Level IV ecoregion are taken from Chapman et al. (2002). Descriptions of Level III ecoregions

are taken from the US Environmental Protection Agency (EPA)'s Descriptions of Level III Ecoregions, accessed on the EPA website: http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm.

Map 2-1. Level III & IV Ecoregions of Iowa (US EPA – Omernik).

Large font denotes the names of Level III ecoregions and small font, Level IV ecoregions.



Level III Ecoregion Descriptions

The following narrative is organized by EPA Level III ecoregions. Although Level III ecoregions are relatively homogeneous, tables under each major heading describe subtle differences in landform, geology and native plant communities that characterize the EPA Level IV ecoregions they encompass.

40. The Central Irregular Plains

The Central Irregular Till Plains have a mix of land use and are topographically more irregular than the Western Corn Belt Plains (47) to the north, where most of the land is in crops. The region, however, is less irregular and less forest covered than the ecoregions to the south and east. The potential natural vegetation (PNV) of this ecological region is a grassland/forest mosaic with wider forested strips along the streams than historically found in Ecoregion 47 to the north. The mix of land use activities in the Central Irregular Plains includes mining operations of high-sulfur

bituminous coal. The disturbance of these coal strata in southern Iowa has degraded water quality and affected aquatic biota.

Table 2-1. Characteristics of Level IV Ecoregions within the Central Irregular Plains

Level IV Ecoregion Name	Physiography	Geology	Potential Natural Vegetation
40a. Loess Flats and Till Plains	Glaciated. Low hills and smooth plains. Perennial streams with many channelized.	Moderate loess over loamy till and clay loam till. Pennsylvanian sandstone, limestone, shale. Also Mississippian limestone in Iowa.	Mosaic of Little Bluestem-Sideoats Grama prairie, Bur Oak woodland, and Chinkapin Oak woodland.

47. Western Corn Belt Plains

Once mostly covered with tallgrass prairie, over 80 percent of the Western Corn Belt Plains is now used for cropland agriculture and much of the remainder is in forage for livestock. A combination of nearly level to gently rolling glaciated till plains and hilly loess plains, an average annual precipitation of 26 to 37 inches, which occurs mainly in the growing season, and fertile, warm, moist soils make this on of the most productive areas of corn and soybeans in the world. Agricultural practices have contributed to environmental issues, including surface and groundwater contamination from fertilizer and pesticide applications as well as concentrated livestock production.

Table 2-2. Characteristics of Level IV Ecoregions within the Western Corn Belt Plains

Level IV Ecoregion Name	Physiography	Geology	Potential Natural Vegetation
47a. Northwest Iowa Loess Prairies	Irregular plains. Dendridic streams.	Moderate to thick loess over clay-loam till. Cretacious shale, sandstone, and limestone, some Precambrian Sioux Quartzite.	Big Bluestem-Indiangrass prairie, Little Bluestem-Indiangrass prairie, limited areas of Bur Oak woodland.
47b. Des Moines Lobe	Smooth to irregular plains. Dendridic streams and drained depressional wetlands.	Loamy till with no loess cover. Ground, stagnation and end moraines.	Big Bluestem-Indiangrass prairie, Cordgrass wet prairie, limited areas of Bur Oak woodland.
47c. Eastern Iowa and Minnesota Drift Plains	Irregular to smooth plains. Low gradient streams.	Thin loess cover over loamy till. Devonian and Silurian limestone and dolomite.	Big Bluestem-Indiangrass prairie, areas of Bur Oak mixed savanna and woodlands.
47d. Missouri Alluvial Plain	Smooth to irregular alluvial plain.	Alluvium over Pennsylvanian and	Northern floodplain forest, pin oak forest,

Level IV Ecoregion Name	Physiography	Geology	Potential Natural Vegetation
	Channelized streams.	Cretacious shale, sandstone and limestone.	and cordgrass wet prairie.
47e. Steeply Rolling Loess Prairies	Open low hills. Intermittent and perennial streams, many channelized.	Moderate to thick loess, 25-50 feet, over clay loam till. Pennsylvanian shale, sandstone and limestone.	Big Bluestem-Indiangrass prairie, and White Oak-Red Oak Woodland, Bur Oak mixed woodland.
47f. Rolling Loess Prairies	Irregular plains to open low hills. Intermittent and perennial streams, many channelized.	Moderate to thick loess, generally less than 25 feet, over clay loam till. Pennsylvanian and Cretacious shale, sandstone and limestone.	Mosaic of Big Bluestem-Indiangrass prairie, and Bur Oak woodland.
47m. Western Loess Hills	Open hills and bluffs. Intermittent and perennial streams.	Thick loess, 60-150 feet over clay-loam till. Pennsylvanian shale, sandstone and limestone in southern half of region; Cretacious shale, sandstone and limestone in the northern half.	Mosaic of Bur Oak woodland and Big Bluestem-Indiangrass prairie.

52. The Driftless Area

The hilly uplands of the Driftless Area easily distinguish it from surrounding ecoregions. Much of the area consists of a deeply dissected, loess-capped, bedrock dominated plateau. The region is also called the Paleozoic Plateau because the landscape's appearance is a result of erosion through rock strata of Paleozoic age rather than glacial or post-glacial deposition. Although there is evidence of glacial drift in the region, its influence on the landscape has been minor compared to adjacent ecoregions. In contrast to adjacent ecoregions, the Driftless Area has few lakes, most of which are reservoirs with generally high trophic states. Livestock and dairy farming are major land uses and have had a major impact on stream quality.

Table 2-3. Characteristics of Level IV Ecoregions within the Driftless Area

Level IV Ecoregion Name	Physiography	Geology	Potential Natural Vegetation
52b. Paleozoic Plateau/ Coulee Section	Dissected hills, rolling to steep-sided valleys.	Thin loess and patches of glacial drift over Silurian, Ordovician and	Mosaic Little Bluestem-Indian grass prairie, Bur Oak and White Oak

Level IV Ecoregion Name	Physiography	Geology	Potential Natural Vegetation
	Perennial streams.	Cambrian dolomite, shale, sandstone, and limestone.	forests, and areas of Maple-Basswood forests.
52c. Rochester/ Paleozoic Plateau Upland	Rugged region of bluffs and valleys cut by tributaries of the Mississippi River.	Thinly deposited loess and pre-Wisconsin glacial till over an eroded Paleozoic sedimentary plateau. Pre-Wisconsin till exposed mainly in the west where loess deposits are thin and discontinuous	Mosaic Little Bluestem-Indian grass prairie on flat, fire-prone remnants of the plateau, with oak forests developing downslope. Mesic forest of basswood and sugar maple on north and east-facing slopes with wet mesic forests on silty bottomlands.

72. Interior River Valleys and Hills

The Interior River Lowland is made up of many wide, flat-bottomed terraced valleys, forested valley slopes, and dissected glacial till plains. In contrast to the generally rolling to slightly irregular plains in adjacent ecological regions to the north (54), east (55) and west (40, 47), where most of the land is cultivated for corn and soybeans, a little less than half of this area is in cropland, about 30 percent is in pasture, and the remainder is in forest. Bottomland deciduous forests and swamp forests were common on wet lowland sites, with mixed oak and oak-hickory forests on uplands. Paleozoic sedimentary rock is typical and coal mining occurs in several areas.

Table 2-4. Characteristics of Level IV Ecoregions within the Interior River Valleys and Hills

Level IV Ecoregion Name	Physiography	Geology	Potential Natural Vegetation
72d. Upper Mississippi Alluvial Plain	Smooth to irregular alluvial plains. Channelized streams.	Alluvium. Brown to gray silt, clay, sand, and gravel. Thickness of alluvial and older fluvial deposits > 100 feet.	Cottonwood-willow riparian forest, Pin Oak forest, Cordgrass wet prairie.

The glacial history and topography of each landform affect the type and distribution of current wildlife habitats and agricultural land use. These land uses are displayed in Map 4-X. Present-day land uses and habitats are discussed further in Chapter 4.

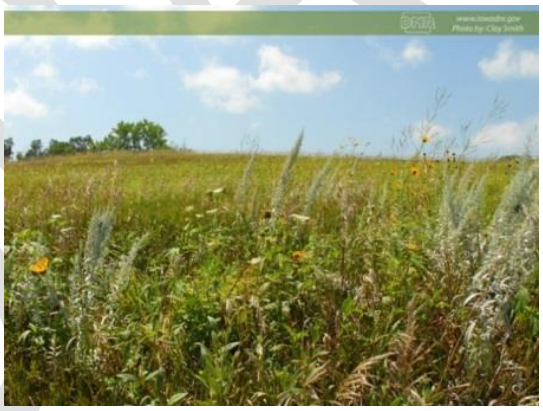
Historic Plant Communities

Pre-settlement Iowa lay at a biological crossroads. Hardwood forests dominated the cooler and more humid lands east of the Mississippi River. The warmer, drier mixed grass prairie and prairie potholes of the northern Great Plains lay to the west. To the north, great maple-basswood and pine

forests covered the Great Lakes region. To the south, oak savannas gradually gave way to the vast oak-hickory forests of the Missouri Ozarks. These different ecological regions blended together in Iowa to produce a unique landscape of great biological diversity (Map 2-2).

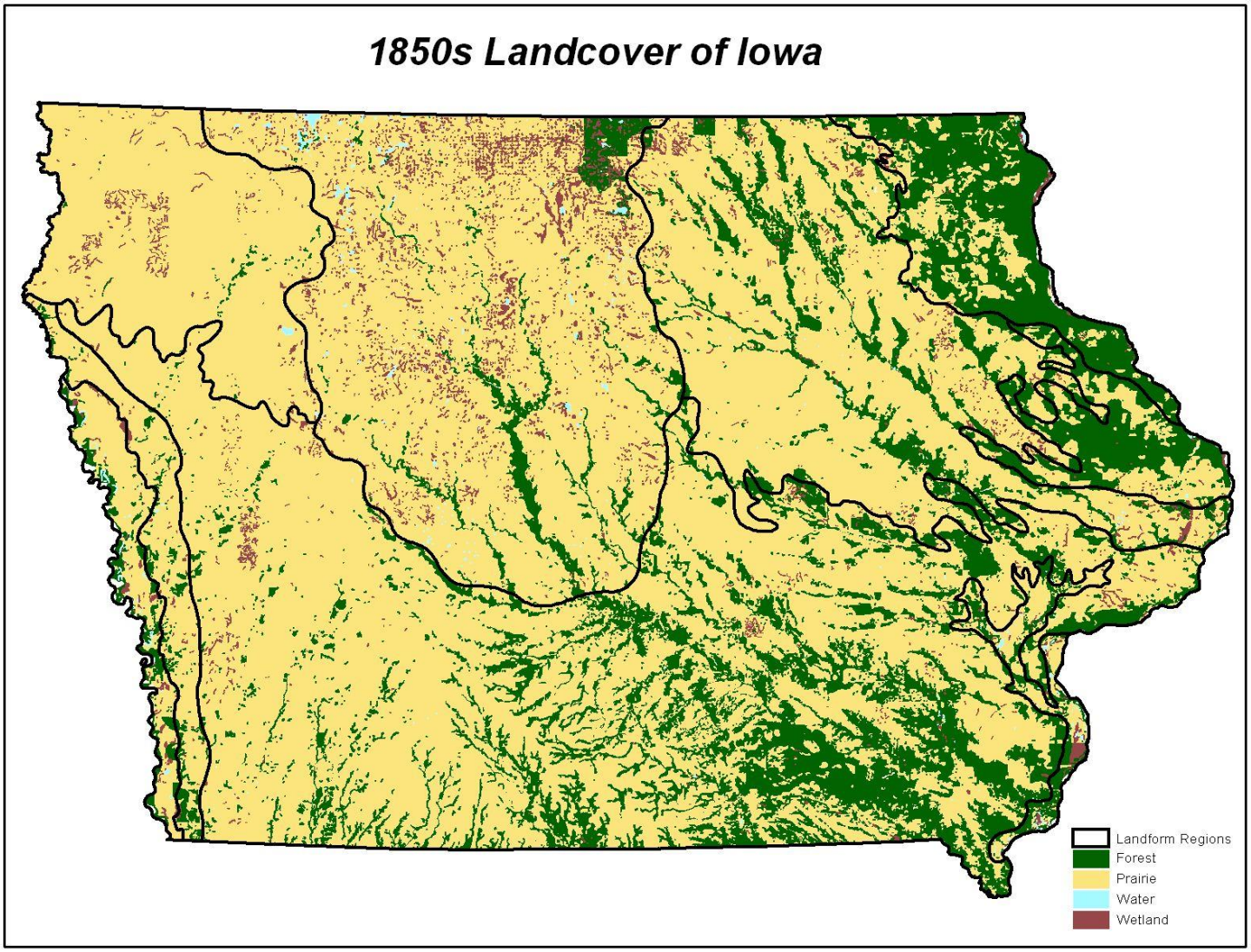
Roughly two-thirds of the state (an estimated 23 million acres) was dominated by lush prairies. Most was tallgrass prairie, although short grasses were present on hot, dry sites. Nearly 7 million acres of forest or forest-prairie savanna covered much of the eastern third of Iowa and followed the river valleys into the prairies to the north and west. Around 4 million acres of prairie pothole marshes dotted recently-glaciated and poorly-drained northcentral and northwest Iowa where larger wetlands and lakes protected oak savannah from prairie fires. Another million acres of backwaters, sloughs and flooded oxbows were found in the floodplains of the Mississippi, Missouri and larger inland rivers.

Prairies. The prairie was more than just a monolithic sea of grass. Prairie plants are adapted to subtle changes in moisture and soils that occur along a gradient from lowlands to drier prairie ridges. Poorly drained wetlands and wetland margins supported rank growths of sedges, cord grass, bluejoint, prairie muhly grass, and panic grass, with common forbs such as gayfeather, prairie dock, Turk's-cap lily and New England aster. Better-drained loamy soils on slopes and broad ridges were covered with more moderate stands of switchgrass, big bluestem, Indian grass and forbs like compass plant, rattlesnake master, smooth aster, wild indigo and goldenrod. Drier sites on gravel and sand ridges or steep slopes supported shorter and more open stands of little bluestem, side-oats grama, and needlegrass, with forbs like pasque flower, silky aster, yellow pucoon and common milkweed.



Forests. Closed-canopy mature forests as we know them today existed only on the floodplains where fire could not routinely penetrate. Silver maple, American elm, and swamp white oak dominated the wettest sites, with hickories, hackberry, black walnut, white ash, red oak, basswood and slippery elm on lower slopes. Shrubs were not abundant and were primarily young silver maples and hackberry with catbriar, poison ivy and grape.

Map 2-2. Landcover of Iowa in the 1850's (from Government Land Office original public land survey of Iowa). Prairie ~ 23,300,000 acres (65%); Wetlands/prairie pothole marshes ~ 4,000,000 acres (11%), Forest ~ 6,700,000 acres (19%), Water, floodplains, and backwaters ~1,800,000 acres (5%).



Forests on drier slopes and uplands were primarily oak openings or savannas - scattered old oak trees or small clumps of oaks with an understory of prairie or mixed prairie-forest shrubs and herbs. Burr oak, with its thick, fire-retardant bark dominated with some red and white oaks on moister sites. The understory was primarily prairie grasses and forbs but hazel, coralberry, sumac and grape occurred where fire was less common.

The heaviest concentrations of timber were in the cooler and moister eastern third of the state. In the west only the floodplains and the coolest sites on north and east facing slopes in the deepest river valleys were timbered. Because of the many river systems that penetrated the prairies to the north and west at least some timber and shrub lands were found across most of the state.

Fire and grazing. Drought, fire and grazing combined to make Iowa's prairie-wetland-forest communities dynamic ecosystems. In wet years, water levels were high, and multiple years of high water levels caused wetland vegetation to gradually die out, and marshes began to look like ponds or small lakes. But dry weather runs in approximately 10 to 15-year cycles on the prairies, with severe drought at roughly 20-year intervals. Drought caused wetland basins to temporarily de-water. Seeds buried in moist wetland soils were able to germinate once again and dense stands of emergent vegetation were reestablished and accumulated plant material decomposed in the aerobic sediments liberating nutrients. Thus regenerated wetlands awaited only the end of drought to return them to their former productive condition.

In wet years fire was less prevalent on the prairie. Without burning the dead stems and leaves of grasses and forbs accumulated on the ground and this litter created a cooler, moister environment. In some cases sun tolerant trees, and coralberry and other shrubs were able to survive and spread from forest edges farther into the grasslands. During drought fire burned off large areas of prairie and forest, killed invading shrubs and trees, eliminated the litter, returned nutrients to the soil and allowed grasses to regain their dominance. Thus the boundary between forest and prairie ecosystems was a dynamic back and forth movement. Fire also allowed annual plants like ragweed, fleabane, thistle and primrose to take a temporary foothold before the longer-lived grasses and forbs recovered and choked them out.

Although fires were common, it is impossible to say how much and how frequently the prairies burned. Weather is seldom in complete synchrony over all of Iowa. Local dry spells undoubtedly created mini-droughts that lowered wetlands and produced frequent fires, while just a few miles away precipitation was normal. Even in normal years a dry late summer could result in a partial drawdown of marshes and occasional fires. The network of wetlands, creeks and rivers probably stopped smaller fires from expanding too greatly.

Grazers and browsers like bison, wapiti and deer relied on this mosaic of habitat condition and also contributed to it. They suppressed trees and shrubs and slowed the growth of tall grasses where they fed intensively. Wapiti and bison created wallows - sandy areas where they rolled in the loose earth to remove hair and dislodge insects. Prairie dogs, though not common in Iowa, kept the vegetation around their towns clipped short. Even plains pocket gophers created small openings over their mounds where annual plants could gain a foothold.

The result of all this variety in soils, topography, weather, fire and animal activity was a great patchwork of plant communities in both time and space. On some sites 250 species of plants could be found. Not only were prairies, forest and wetlands in close proximity, but at any given location plant communities were in a state of growth, retrenchment or suppression depending on their local history.

Historic Wildlife Communities

Game Animals

The great diversity of plant communities that covered pre-settlement Iowa also supported a diversity and abundance of wildlife that was foreign to settlers from the East. Iowa native Aldo Leopold, writing in 1931 in his *Game Survey of the North Central States*, said, "*...no region in the world was originally more richly endowed with game than this one, quantity and quality both considered. Contrary to common belief, the cream of its game country was the prairie type…*" Prairie animals like wapiti were common, and bison, pronghorn, prairie chickens and sharp-tailed grouse penetrated the tallgrass prairies from the west. White-tailed deer, wild turkeys, passenger pigeons, northern bobwhite quail, ruffed grouse and woodcock followed the deciduous woodlands and river valleys into the prairie from the East.

Waterbirds. The prairie pothole and riverine wetlands provided excellent nesting habitat and attractive resting and feeding stops for millions of migrating waterfowl between their nesting and wintering grounds. Giant Canada geese, trumpeter swans and over a dozen species of ducks nested in Iowa, mainly blue-winged teal, mallards, redheads, and wood ducks. Between 3-4 million ducks may have been raised annually.

Photo Credit: USDA NRCS, Tim McCabe

Other waterbirds were also plentiful. White pelicans migrated along corridors of major rivers and lakes and used some large marshes and lakes for breeding. Sandhill cranes were abundant during migration and nested here occasionally. Whooping cranes were less numerous, but nested frequently in the marshes of northcentral and northwest Iowa. More than 30 species of shorebirds migrated through Iowa. Of these, long-billed curlew, marbled godwit and upland sandpiper nested here, and the American golden-plover, Eskimo curlew and common snipe were abundant during migration. Sora was an extremely common marsh rail.

Furbearers. Beaver, muskrat and river otters were found throughout Iowa, associated entirely with marshes, streams and rivers. Muskrat were most abundant in the prairie marshes of northcentral Iowa and maintained very high numbers. Beaver and river otters were associated more with riparian habitats. Mink, badger, and striped skunks were not highly sought after, but each must have been abundant. Many farm boys made pocket change by trapping highly abundant spotted skunks, locally known as civet cats and until recently thought to be extirpated from the state. Raccoon and opossum, two of the most abundant furbearers today, may have spread westward onto the prairie in association with the spread of agriculture and farmsteads.

Photo Credit: Iowa DNR

Canids and other Large Predators. Carnivorous and omnivorous furbearers fed on the diversity of small mammals, birds and their nests and other prey. Although descriptions of canid communities are often confusing and varied over time as settlement progressed, it seems that two subspecies of gray wolves occurred in Iowa – the smaller Great Plains wolf that followed the bison and wapiti herds and was most common in the western two-thirds of the state, and the eastern timber wolf, a slightly larger and often darker subspecies, inhabited the forested eastern third, mostly in the northeast corner of the state. Coyotes were found statewide, living between wolf packs and

perhaps becoming more common as wolves were extirpated. Red foxes were found in the prairies and at the prairie-forest border in northern Iowa. Since in some parts of their range red foxes are actively excluded, even killed by coyotes, they may have become common after wolves were exterminated and predator control began to focus on coyotes. The gray fox, more omnivorous than other canids, seemed to occupy a niche that enabled it to co-exist with them and was found primarily in the eastern third of the state, perhaps because of its tendency to climb trees for fruit and bird eggs. Bobcats were numerous, occurring statewide in a variety of forested and shrubby habitats. Mountain lions, or cougars, were scattered across the state, but reports are few, perhaps because of their secretive nature. The lynx, a larger version of the bobcat which principally inhabited the coniferous forests of the Great Lakes states and Canada, was at least occasionally found here.

The Black Bear was the largest predator in pre-settlement Iowa. Although their preferred habitat was woodlands, they occasionally wandered into the prairies, usually along river corridors. Reports of Black Bears originate from 48 counties fairly uniformly scattered across the state but they were almost certainly most common in eastern Iowa.

Fish and Mussels. The historical baseline for Iowa fishes is based on the work conducted in the middle and late 1880s by Seth Meek for the United States Fish Commission while he was a professor at Coe College in Cedar Rapids. Meek surveyed streams and natural lakes in most major river basins in Iowa, and his survey was published in 1892. Even though his surveys were conducted approximately 50 years after urban and agricultural development of the state began, Meek's surveys suggest an exceptionally diverse pre-settlement fish community in Iowa's streams, rivers, and natural lakes and suggest considerably different and higher quality aquatic ecosystems than exist today.

Roughly 145 fish species are considered native to Iowa, with five of these species now considered extirpated. In the 2012 version of this Plan, 49% of fish species were listed as SGCN, comprising 24% of all Iowa SGCN. The most significant declines appear to be in fish species that require vegetated backwater habitat in which to spawn. In addition, lowered levels of water quality and decline of aquatic habitat quality has either eliminated or caused reductions in the Iowa distributions of some Iowa fishes.

Historically, Iowa's rivers and streams hosted huge mussel beds. Burial mounds along the Mississippi River provided evidence that the Mississippi River provided abundant food supplies of freshwater fishes and mussels to pre-historic Native American tribes (Harlan et al. 1987).

Today, 54 mussel species are considered native to Iowa (including 3 that are now considered extirpated from Iowa). In the 2012 version of this Plan, 53% of mussel species were listed as SGCN, comprising 9% of all Iowa SGCN.

Nongame Species

Records of the un-hunted fauna that inhabited Iowa are largely nonexistent. The early explorers and settlers were concerned mostly with wildlife as a source of food, hides or feathers, or as perceived threats to livestock and crops. But of 440 species of birds and mammals that resided here or migrated through Iowa, less than 15 percent were ever hunted or trapped. Serious scientific efforts to describe Iowa's wildlife did not begin until nearly 40 years after settlement, and by then significant changes had already occurred.

Birds and Mammals. In all, more than 180 species of birds nested in Iowa. Abundant wetlands were habitat for countless yellow-headed blackbirds, marsh wrens, American and least bitterns, black and Forster's terns, black-crowned night-herons, rails and dozens of other species. Wetland-prairie margins were nesting sites for song sparrows, sedge wrens and northern harriers. *Wooded wetlands and floodplain forests were the favored habitat of colonies of nesting herons and egrets as well as Carolina parakeets, an abundant species that flocked in the hundreds. Native parakeets were extinct in Iowa by the 1870s due to deforestation, hunting for feathers to adorn women's hats and possibly due to competition with introduced European honey bees that competed for tree cavity nest site*s. To see one today would indeed make our remaining most colorful species look drab by comparison.

Where shrubby, early successional stages of forest pushed into the prairies cardinals, yellowthroats, spotted towhees and rose-breasted grosbeaks and other forest edge species were abundant, as well as ruffed grouse. Larger stands of mature forests provided nesting sites for interior forest species like cerulean warblers, ovenbirds, scarlet tanagers, wood thrushes, pileated woodpeckers, and passenger pigeons. Riparian woodlands would have been habitat for black-billed cuckoos, red-headed woodpeckers, belted kingfishers and northern flickers. Red-headed woodpeckers would have been especially abundant in oak savannah. Each forest type had its own unique assemblage of small mammals as well.

Grasshopper and vesper sparrows would have nested in recently burned prairies. A year or two after burning or intensive grazing, regenerating prairie would have provided nesting cover for bobolinks and dickcissels. Henslow's sparrows, savanna sparrows and upland sandpipers would have nested in oldest and rankest prairies with dense ground litter. Loggerhead shrikes and mourning doves would have sought out grasslands with a shrub component.

Reptiles, Amphibians, and Invertebrates. Even less is known of the historic reptiles, amphibians and invertebrates of Iowa. More than 60 species of reptiles and amphibians were eventually found in Iowa. Prairie and prairie potholes, riverine wetlands, prairies and woodlands provided homes for a diversity of lizards like the great plains skink and six-lined racerunner, common turtles like the ornate box and painted turtles, snakes like the timber and massasauga rattlesnakes and frogs like

the green and gray tree frogs and leopard frogs which erupted in incredible numbers in wet prairie during wet years.

Impacts of Settlement

Settlement in Iowa progressed roughly southeast to northwest. Most of the south half of the state had been inhabited by the end of the 1840's; northcentral and northwest Iowa were settled in the 1850's; Lyon County in extreme northwest Iowa was the last to be settled, receiving its first homestead family in 1866.

Human population growth was slow at first. By 1840 only 43,000 settlers had braved the prairies. Pressure for cheap land Increased after the Civil War, however, and massive land grants were made to railroad builders to stimulate completion of a trans-continental railroad network. By 1870, Iowa's population had increased to nearly 650,000; by 1900 it had skyrocketed to 2 million.

At the same time Iowa was being settled a revolution was overhauling industry and agriculture. The advent of improved farm implements, coupled with a rapidly expanding population base devoted mostly to agriculture, had a devastating and permanent impact on Iowa's native plant communities.

Forests. Woodlands were the first to go. Early pioneers, emerging from the eastern deciduous forest, often likened tallgrass prairie to an ocean of grass, with scattered savanna or woodlands along streams like a distant shoreline on the horizon. Some found the light and openness of the prairie invigorating, others found it oppressive, accustomed as they were to woodlands, where trees were a symbol of soil fertility. Some early settlers preferred farming woodlands rather than open prairie, fearing that land too poor to grow trees would not grow crops either. While experience would quickly prove that wrong, forests felt the bite of the pioneer's axe early in our history.

Early farmers tended to settle close to timber for building materials and fuel. By 1875 when most of the Iowa prairie had been settled, woodland acres sold for $35/ac while prairie land, thought to be less fertile, went for $5/ac. As late as 1867, in Marshall County Iowa, good timbered land was selling for up to $50/ac while prairie brought a paltry $3/ac (Madson 1995).

Most of the initial forest clearing in Iowa was done to allow conversion of the land to agriculture. Iowa's native hardwoods did not prove valuable as building materials. Most of the lumber that eventually built the farm homes, barns and livestock dwellings that dotted the countryside came from the great pineries of Minnesota and Wisconsin. Starting in the 1850's, however, railroad expansion and the discovery of coal in southern Iowa fueled a demand for oak ties and mine timbers that would last into the early 20th century. By 1875, just one-third of the original 6.7 million acres of primitive forest remained, most on rough land or in floodplains either too steep or too wet to plow.

Prairies. The effect on our extensive prairies and prairie-wetland complexes was even more devastating. When pulled by up to 5 teams of horses or yokes of oxen a steel *breaking plow* could shear through and break up 2 acres a day of the foot-thick sod with its intricately intertwined root systems. On the open prairie, huge breaking plows and teams of oxen were required to prepare the land for farming, requiring a major capital investment. If a farmer lacked such equipment he had to hire it done for as much as $600/quarter section, a staggering sum. The newly exposed soil was so fertile that a crop, first wheat and later corn, was planted directly on the overturned furrows. The next year a second plowing would complete the conversion of prairie to a field tillable by conventional methods. Starting in the 1850's, Iowa lost nearly 2 percent of its 25 million acres of native prairie a year, 3 million acres a decade, until less than 30,000 acres (0.1%) remained after 80 years.

Wetlands. The vast prairie-pothole wetlands of northcentral and northwest Iowa took longer to impact. Through the first 20 years of settlement there was plenty of good land available without trying to drain and farm wetlands. In 1850, Congress passed the SwampLand Act. It directed each county to survey all wetlands and sell them at auction for 5 cents an acre, the first of what would become a century-long succession of government-subsidized efforts to drain wetlands. County drainage commissions and drainage districts were soon organized. Eventually pothole soils were discovered to be some of the most productive when dry, further accelerating the demand for drainage.

The first drainage attempts were with hand-dug, open ditches that drained small, shallow wetlands. This reasonably ineffective approach was quickly replaced by massive teams of oxen pulling breaking plow that created a furrow through and beyond a wetland to a stream that received the water. Steam dredges did not replace manual labor until nearly 1900 and this was the era of draining lakes and large marshes into excavated ditches (bull ditches) that led to streams. Underground ceramic tiles were developed to drain smaller potholes into ditches as early as 1858. By 1917 modern clay tiles were used to drain seasonally wet fields into extensive, inter-connected drainage systems that had eliminated all but the largest wetlands. By 1906 just 25 percent of the original 4 million acres of pothole wetlands remained. By 1970 less than 1% of Iowa's historic wetlands remained.

Rivers. Even in the late 1800s, Meek noticed and reported impacts to the state's streams and fish communities:

> *The prairie was originally covered with a dense growth of prairie grass and herbaceous plants, which tended to produce a stiff sod. During heavy rains this sod absorbed the water, preventing its direct flow into the rivers, and it reached the latter chiefly by slowly filtering through the soil. The streams were thus relieved from overflow, and were kept from drying up during the summers. I have been informed that many streams, formerly deep and narrow, and abounding in pickerel, bass, and catfishes, have since grown wide and shallow, while the volume of water in them varies greatly in the different seasons, and they are now inhabited only by bullheads, suckers, and a few minnows. The breaking of the native sod for agricultural purposes has especially affected the smaller streams*

in this respect, while the construction of ditches and the practice of underdraining have had their effects upon the larger ones. Moreover, the constant loosening of the soil, in farming, tends to reduce it to that condition in which it is readily transported by the heavy rains to produce muddy currents.

Border Rivers - Engineering began on the Mississippi River starting in 1824. Initially, this consisted mainly of snag removal. An act of Congress in 1907 approved creation of a 6-foot navigation channel from the Missouri River northward to Minneapolis. In 1935, further legislation provided for a 9-foot navigational channel maintained through a system of locks and dams as well as dredging. Navigation locks and dams result in a series of pools within the river, leading to a change in the fish community within the river towards those preferring more slow-moving water. (Harlan et al. 1987).

Engineering along the Missouri River for flood control and navigation drastically altered the river system. Between 1923 and 1976, the Missouri was corralled from a wide, braided, dynamic river to a single narrow channel. The channel area was reduced by 80%, with ~35,000 acres of this reduction being in Iowa. By the 1980's, sport and commercial fisheries along the Missouri had dwindled to a tiny fraction of their former abundance.

Interior Rivers – Because Iowa has productive, and therefore intensively cultivated, soils, the rivers which run through and drain these areas are subjected to large and sometimes sudden fluctuations. Draining heavily cultivated lands also results in silt loads, leading to sedimentation. This has changed the fish community assemblage, especially in lower, more turbid reaches of streams where the remaining species tend to be tolerant of lower water quality.

Additionally, many low-head dams were constructed across the state, usually for milling or water supply uses. By 1870, more than 1000 low-head dams dotted the state's interior rivers, restricting seasonal movement of fish species, as well as mussel species dependent upon their fish-hosts for dispersal.

Wildlife. Iowa's original wildlife populations suffered a similar fate as its native habitats and plant communities. Species that competed with humans for space, or were particularly useful for food or fiber, or required very specific habitats that were eliminated or drastically reduced did not survive. Others of less importance to humans held on in low numbers wherever suitable habitat remained. Those species that could adapt to or favored agricultural environments thrived, at least until agriculture became too pervasive.

By 1900 the large game animals and the predators that lived on them were gone (bison, wapiti, white-tailed deer, gray wolves, mountain lions, black bear and bobcats). Smaller predators like coyotes and red and gray fox were more adaptable, fed on a wider range of smaller prey animals, and were able to survive in Iowa into the 20th century. Economically important furbearers like river otter and beaver were also essentially gone by 1900.

Wild turkeys, passenger pigeons, prairie chickens and waterfowl all fed occasionally on settler's crops and were considered pests, and all were valuable as table fare or to sell at local and big city markets like Chicago. The spread of railroads into the Midwest in the 1860's and 1870's allowed hunters to reach the best hunting grounds and permitted shipping frozen game to markets in Chicago, Milwaukee and as far as New York City. Game was served as a delicacy in many eastern restaurants in the late 19th century. As city dwellers developed more leisure time in the 1880's, hunting for sport or recreation also became more popular.

The take of game birds was enormous. A single net could capture 1,500 passenger pigeons. Entire flocks of turkeys could be pot shot from the roost on cold winter nights. Hunters could occasionally take 100 or more prairie chickens in a day (seasonal takes of 900 or more chickens were recorded). Sport hunters were able to take up to 100 ducks in a single day. The best market hunters could take up to 3,000 ducks in a season. One group of 7 hunters shipped 14,000 ducks east in a single year. A careful hunter willing to pick his shots could take a half dozen mallards or 8 or 9 prairie chickens with a single shot. Avid woodcock hunters could take 40 birds a day; one market hunter took up to 3,000 woodcock a year in northeast Iowa. A hunter could easily take several ruffed grouse in a day but apparently few were ever sold at market. A variety of shorebirds – snipe, long-billed and Eskimo curlews, marbled godwits, upland and golden plovers were frequently hunted and at least some sold at market. Whooping and sandhill cranes were also hunted for the table and because they were a pest in grain fields.

But as hunting pressure increased in the 1870's and 1880's, habitat loss was also accelerating. Iowa was becoming settled. Nearly every square mile of land had several farm families living on it. New farmers looked to more ways to create tillable land. Much of the forested land that remained into the 1870's was turned into pasture. Cattle, sheep and hogs destroyed the undergrowth and competed with wildlife for acorns and other native food. A variety of species that so far had been able to withstand the hunting pressure alone began to be affected by the increasing fragmentation and elimination of their habitats. Whatever the reason - unregulated hunting, habitat loss, or more likely a combination of both - much of the wildlife that had existed here for centuries was in severe decline by the late 1870's.

Ever smaller flights of passenger pigeons continued into the mid 1870's, dwindled more into the 1880's and 90's and were gone by 1900. Wild turkeys were gone from northeast Iowa by 1854, from most of central Iowa by the 1870's, and disappeared from southern Iowa by 1910. Ruffed grouse were able to hold on into the 20th century only in the most heavily forested counties of northeast Iowa.

Prairie chickens and bobwhite quail fared somewhat better. Opening the prairies to grain farming provided an alternate winter food supply in grain stubble. More reliable foods allowed their numbers to increase and their range to expand as long as there was enough prairie remaining for nesting and winter cover. Prairie chicken numbers may have peaked in the 1870's. After that prairie chickens and quail began declining as too much prairie was converted to crop fields. Both hung on at lower numbers well into the 20th century.

Waterfowl and shorebirds continued to migrate in large numbers through Iowa until the end of the 19th century. Fewer were produced here as prairies were turned over and wetlands drained, but spectacular migrations from the breeding grounds on the prairies to the north undoubtedly softened the blow of local habitat loss. By the 1890's, however, the loss of wetlands was taking a toll and by 1900 market hunting was a thing of the past. The last Sandhill and Whooping crane nests were found in Hancock County in 1894, the last long-billed curlew nest in 1890, and the last giant Canada goose nest in 1910.

Clearing of forests, conversion of native prairies to farm fields and the draining of wetlands eliminated many species of songbirds, reptiles and amphibians. Most of the loss went unnoticed by settlers, and by the time the first naturalists began studying the flora and fauna of Iowa, much change had already occurred and went unrecorded.

Species	**Suspected Extirpated from Iowa**
American Bison	1870
Wapiti (Elk)	1871
White-tailed deer	Prior to 1885
Bobcat	About 1900
Mountain Lion	1867
Black Bear	1876
Wolf	Prior to 1910
Passenger pigeon	1896
Greater prairie chicken	1955
Wild turkey	1913
Long-billed Curlew	1890
Eskimo curlew	1901
Sandhill crane	1894
Whooping Crane	1894
Trumpeter Swan	1883
Giant Canada goose	1930s
Carolina parakeet	1870s

Laws enacted to protect declining species generally addressed harvest levels but did not provide mechanisms for preventing habitat loss. For most of Iowa's early history harvest activity was totally unregulated. Seasons, bag limits, shooting hours and restrictions on weapons effectively did not exist or were not enforced. Settlers shot game for the table year around as they could find it. Sport and market hunters were active primarily in fall and spring to exploit concentrations of migratory birds. By the 1870's market hunters were building freezers to prolong their ability to market their products. Nesting birds suffered the additional indignity of having their eggs collected for food or by egg collectors, a common hobby in the later 1800's. There seemed to be no need for regulation - the game seemed limitless, far more than anyone could possibly use.

Fish. Since the time of settlement by Europeans in the early to mid-19th century, the natural resources of the state of Iowa have undergone extensive changes. The development of Iowa for

the agricultural, industrial, and urban-residential uses that exist today has caused several types of changes to the aquatic resources of Iowa. Extensive agricultural use of the landscape increased the levels of sediment and the turbidity in Iowa's lakes and flowing waters. The straightening of once-meandered stream and river channels reduced both the amount and quality of the habitats available for Iowa's aquatic life. The more rapid movement of water from the altered landscape increased the magnitude of flood flows in Iowa streams and rivers, thus causing erosion of stream banks and lowering (degradation) of the channels of streams and rivers. As part of channel straightening, the natural vegetation bordering stream channels, including trees, was removed. An additional threat to Iowa's native fishes is the introduction of non-native invasive fishes. Such impacts began almost 140 years ago with the intentional introduction of the Common Carp to Iowa waters in the early 1880s. Invasive species continue to be a concern such as the late 20th century arrival of the Bighead Carp and Silver Carp in the state's waters.

The types of aquatic life that inhabit a stream, river, or lake reflect the physical and chemical quality of the aquatic environment. Changes in distributions of Iowa's fishes closely reflect the changes that have occurred over the approximately 180 years of agricultural, industrial, and municipal development in the state. Several fish species that were unable to adapt to the changed aquatic environments have been eliminated from the state's waters. Another group of fishes continues to exist in the state but occur in an increasingly smaller number of areas with some limited to a single stream segment. The status of several species remains poorly-known. The majority of Iowa fishes, however, appears to have adapted to the changed conditions in the aquatic habitats and continue to thrive in the state.

Freshwater mussels. Mussels were a seemingly inexhaustible resource in Iowa's rivers and streams. Freshwater mussels were collected for use in a variety of industries, but primarily for use in the manufacture of pearl buttons. Use of freshwater mussels for the pearl button industry began in 1891. In three years alone (1912-14), it is estimated that 672 tons of mussels were taken from Iowa's interior rivers (Coker 1919). As Coker (1919) described:

> *"It was the custom of the early shellers, as now, to gather the river-run of mussels and cook out the meats of all, but the shells of only two or three species were saved, while the others were thrown away as worthless. The shellers cooked out the entire lot of mussels in the hope of finding additional pearls and slugs. The shelling and the button industries, therefore, have a history similar to many other American industries in that the pioneers wasted large quantities of good material through lack of knowledge and experience and while secure in the thought that the supply was inexhaustible."*

Shell button factories in Mississippi River towns began with the first big pearl strike on the Iowa reach of the Mississippi in 1889 and the beginning of the pearl button industry in 1891. Between 1898 and 1916 there were 300 professional "clammers" working the Mississippi between Burlington and Clinton, Iowa. However, in response to over- harvesting and pollution, large-scale clamming with dredges was outlawed in Wisconsin in 1915, and by 1946 it was outlawed altogether below Muscatine, Iowa.

It may be the entire historic mussel community in Iowa will remain unknown. What is known is that Iowa's rivers and lakes have changed radically over the last 150 years. The Big Sioux River in northwest Iowa was once known as the "Silvery Sioux" for its clear water flowing over a gravel bottom. Iowa's rivers today have been altered by channelization and levees that isolate them from their floodplains, sediment accumulation from uplands and incised banks covering their historic gravel beds, nutrient enrichment leading to low oxygen levels, higher high flows due to drainage in their watersheds, lower summer flows due to lowered water tables, dams that obstruct fish passage and a host of other factors related to fish and mussel habitat.

Change Continues in the 20th Century

In less than a century the landscape of Iowa was changed more by settlement than that of any other state. In 1900, most of Iowa's 2 million residents lived on small, nearly self-sufficient farms of 100 acres or less. They subsisted on corn, wheat, oats, hay and a variety of livestock. Iowa had been converted from a seemingly limitless prairie-forest-wetland mosaic into a domesticated landscape of small farms, grain fields and pastures. There were still undrained sloughs and wet pastures on many farms and tracts of prairie could still be found to remind farmers of vintage Iowa, but these native areas were scattered and becoming ever smaller. In the early 20th century they were still looked on as waste areas needing conversion to a more productive use. Most of Iowa's native wildlife was either gone or reduced to such low numbers that rabbits, squirrels, quail and the occasional prairie chicken were the only game animals available to most hunters.

The changes in Iowa's landscape in the 20th century were less dramatic but in some ways more devastating. Wildlife and its habitats were impacted by constant improvements in farming technology and the effects of government agricultural policy on farmers' decisions about how their land would be used.

Improved farming technology. Change was slow at first. Much of northern Iowa was too wet to permit iron-wheeled tractors to function so gasoline-powered equipment did not replace horses on a large scale until rubber balloon tires became available in the late 1930's. Hybrid seed corn was introduced in the 1930's to improve yields; for the first time more crop could consistently be raised than was needed for use on the farm. Farming ever so gradually became less a way of life and more of a business.

Industrial technology developed during World War II rapidly accelerated the pace of change. By mid-century mechanical planters, harvesters (hay balers, corn pickers and grain combines) and grain handling equipment were reducing the need for hand labor. Repeated field cultivation for weed control was the norm, but control in cultivated fields was a constant and frequently unsuccessful battle for farmers. Inefficient harvesting equipment often left a substantial part of the crop in the field.

Labor saving devices permitted farmers to handle ever-larger farming operations. In the 1950's the average northern Iowa farm had grown to 250 acres but was still a diverse operation of livestock,

small grains, hay and corn. Foxtail-choked cornfields with plenty of waste grain were a pheasant hunter's delight and a source of food and cover for a variety of other game and nongame wildlife.

The last half of the century brought even more change. Modern tiling machines could mechanically dig and insert underground perforated field tiles to drain even the wettest areas. The use of agricultural chemicals – herbicides, pesticides, and fertilizers – became the norm and weeds and insects were, if not conquered, at least minimized as a threat to crop yields. The first pesticides were organochlorines -DDT and its derivatives- that had devastating long-term effects on bird populations that led to the ban on their use in the 1970's. Soybeans were introduced as a cash crop and genetically modified crops with built-in pesticide resistance were developed. Livestock operations shifted from on-the-farm to confinement operations and the need for extensive livestock forage (hay and small grains) was reduced. Crop rotations eventually were simplified to continuous corn or soybeans or corn-soybean rotations over most of the state. Planting and harvesting equipment and the tractors to pull them became ever larger. Modern grain combines became so efficient that little waste grain or crop residue was left in the fields for wildlife food or cover.

By 2000, the average farm had increased to more than 340 acres (see Figure2-2). The number of farms in Iowa decreased from 203,000 in 1950 to just 93,000 in 2007 (USDA and Census Bureau - Census of Agriculture). Nearly every rural county in Iowa is experiencing a continuous outmigration, primarily by young people seeking jobs no longer available as farm size and mechanization has increased. Iowa is trending toward a more urban populace. By 2010, the population of Iowa was 64% urban, up from 25.6% in 1900, and 57% in 1970 (U.S. Census Bureau). In 2010, Iowa's population was about 3 million.

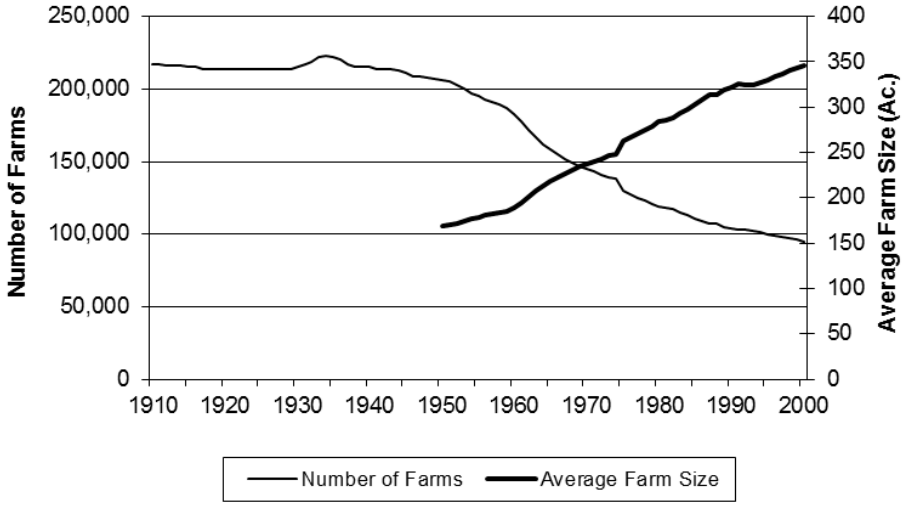


Figure 2-2. Trends in number and average size of Iowa farms.

USDA farm policies. Government farm policy also played a role in accelerating these changes. Congress passed the first of several programs to retire crop land and spur agricultural income in the

depth of the depression in the 1930's. Farm policy shifted to all-out production during World War II. By the mid-1950's farm prices were again depressed and a second, 10-year land retirement program (the Soil Bank) was implemented. Pheasants, bobolinks and other grassland birds responded to the increased habitat until the program ended in 1965.

For the next 20 years USDA required farmers to set aside up to 10 percent of their crop land in order to participate in subsidy programs. These set-aside acres were rotated annually and never developed permanent wildlife cover. Their value to wildlife was limited - some biologists claimed they had a net negative affect on pheasants and other ground-nesting birds because set-aside acres had to be mowed for weed control just at the time birds were nesting.

In the early 1970's grain export quotas were removed to open up international markets. Row crops in Iowa grew by more than 3 million acres at the expense of hay and pasture (Figure 2-3), most in the southern third of Iowa. The distribution of the ring-necked pheasant nearly reversed itself as a result. The new croplands in southern Iowa allowed pheasants to flourish where the bobwhite quail had been the dominant game bird. The added pressure to raise row crops eliminated most of the remaining wildlife habitat in northern Iowa, however, and pheasant populations there plummeted.

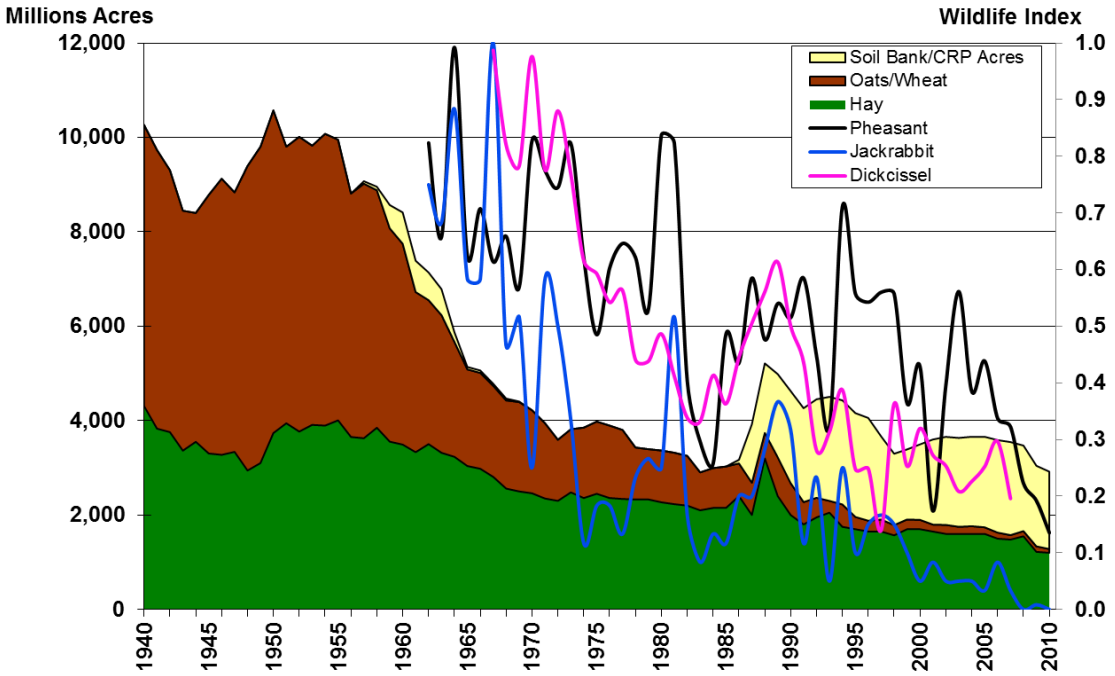


Figure 2-3. Changes in Cropping Patterns and Representative Grassland Wildlife.

The increased row crop acreage also put added pressure on Iowa's remnant forests. Pasture that was converted to row crops had to be replaced, so bulldozing timber to create new pasture

became a popular practice. Iowa's forestlands hit their all-time low - 1.5 million acres - during the U.S. Forest Service's 1974 inventory of forestlands.

In the midst of another farm economic crisis in the 1980's a third 10-year land retirement program – the Conservation Reserve Program (CRP) – was introduced to supplement farm income. CRP fields were mostly planted to cool season grasses like smooth brome that provided valuable nesting cover for grassland wildlife. Iowa's pheasant populations and harvest, both in the midst of a 20-year decline, rebounded quickly (Figure 2-4). In northern Iowa, pheasant numbers increased wherever CRP fields were planted and increases were also recorded in the southern half of the state. But, as the initial 10-year contracts matured, the benefits to game birds in southern Iowa declined. Brome developed a thick sod and annual weeds (important foods for birds) were eliminated. Southern Iowa counties that had the maximum of 25 percent of their cropland enrolled in CRP saw declines in pheasants and quail.

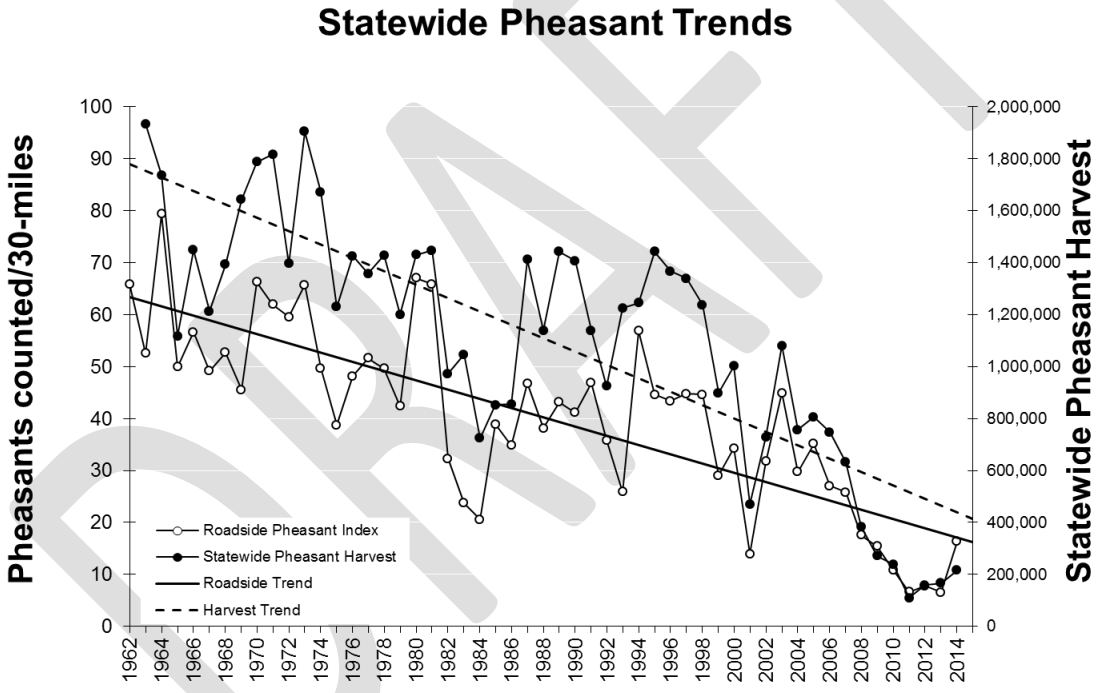


Figure 2-4. Mean number of pheasants counted in 30-mile August roadside survey routes, statewide, 1962-2014, compared to statewide pheasant harvest.

IDNR-sponsored research would eventually find that some nongame birds like Henslow's sparrows that nested in mature grasslands would respond to the habitat provided by older CRP fields. Small mammals and the avian and mammalian predators that fed on them would increase also. The return of the bobcat to Iowa is at least partly explained by the prey provided in CRP fields.

CRP acreages in whole fields peaked at 2.2 million acres, but modifications in the late 1990's and early 21st century reduced whole-field enrollments to 694,000 acres by 2014. Originally the

program was capped at nearly 40 million acres nationwide, but by 2017 the cap will be 22.5 million acres. Recent farm bills have included a number of permanent and short-term programs designed to provide soil and wildlife conservation benefits as well as subsidize the production of commodity crops. The Continuous CRP (buffer strips), Wetland Reserve Program (WRP), Wildlife Habitat Incentive Program (WHIP), Farmed Wetland Program (FWP) and others have been beneficial, but most have been implemented on smaller parcels than the original CRP fields. Potential problems with habitat fragmentation, connectivity between habitat blocks and their value to area-sensitive species is not well understood. These programs change with different iterations of the farm bill. As a result, conservation agencies must be aware of changes and be flexible in order to ensure that wildlife benefit from these programs.

Summary. The result of this improved technology and the flurry of often-conflicting farm legislation has been a gradual and long-term decline in wildlife habitat on private agricultural lands and a decline in rural communities. Farm operations have shifted from diversified agriculture to corn and soybean monocultures. Between 1900 and 2014 row crop acreages increased from 9.1 million acres to 23.4 million acres. Hay and small grain acreage decreased from 6.8 million acres to a current 1.2 million acres (NASS, 2015). Larger farms and field sizes have eliminated fencerows, windbreaks, waterways and other on-farm habitat. The nearly exclusive use of farm chemicals for weed and insect control has eliminated food and cover for songbirds and other wildlife. Conservation practices subsidized by various titles of recent farm legislation have helped slow this trend, but the funding available to implement them has never equaled the amount USDA has spent subsidizing commodity crops that encourages increased production.

The impact on of these trends on wildlife that utilize agricultural lands has been slowly devastating and is the subject of much of the remainder of this Plan. The loss of grasslands to row crop agriculture has resulted in substantial declines most native grassland wildlife, e.g., dickcissels and white-tailed jackrabbits (Figure 2-2). Even the popular ring-necked pheasant, until recently the state's most well-known game animal (Figure 2-3) is in the midst of a 50-year decline in numbers. Other examples can be found in *Trends in Iowa Wildlife Populations and Harvest* (2013 and earlier years) published by IDNR and available for download on the IDNR website.

These landscape changes have impacted aquatic wildlife as well, although they are not as well documented. Advertisements to attract settlers to Iowa in the 1850's stressed the vast acreages of fertile soils, abundant wildlife and sparking clean waters teeming with game fish.

By the early 20th century, however, conservationists Aldo Leopold and Jay N. "Ding" Darling were decrying the excessive erosion of soils that had been denuded of their vegetative cover and the excessive siltation of Iowa's waters that resulted. Loss of vegetative cover, excessive grazing, channelization of streams, and shoreline alterations led to accelerated siltation and the transport of pesticides and fertilizers into aquatic systems from agricultural fields. Heavy silt loads altered water turbidity and temperature regimes. Streambed degradation and the loss of submersed and emergent plants frequently followed. As the silt settles it can cover existing bottom substrates and alter the entire natural community.

All of these alterations to native habitats, aquatic plant communities and wildlife increase the opportunities for invasive exotic species to supplant native wildlife. Alien species like carp further increased water turbidity and in many cases made smaller water bodies unsuitable for native fish.

Wildlife Conservation

Wildlife Restoration. Not all wildlife trends of the past half-century have been negative. The creation of the Iowa State Conservation Commission (now the Iowa Department of Natural Resources or IDNR) in 1935, the gradual development of wildlife science and management as professions after World War II, and the formation of IDNR's Wildlife Diversity Program in 1981 have returned a portion of Iowa's native wildlife to the state. White-tailed deer, wild turkeys and giant Canada geese are now more abundant than at any time since the late 1800's. Other restoration programs have returned prairie chickens to southern Iowa, river otters to the state's streams, and peregrine falcons, ospreys and trumpeter swans nest again in Iowa. Bald eagles, bobcats and Sandhill cranes have reappeared as a result of successful conservation programs here and elsewhere. Details of these and other wildlife restoration programs are explained in *Trends in Iowa Wildlife Populations and Harvest - 2013.*

Land acquisition. IDNR has also pursued land acquisition programs to permanently protect and enhance wildlife habitat. Since 1972 Iowa waterfowlers have been required to purchase an Iowa Migratory Game Bird Stamp in addition to the Federal Migratory Bird Hunting and Conservation Stamp ("Duck Stamp"). Since 1979 all hunters have been required to purchase an Iowa Habitat Stamp along with their hunting license. Proceeds from these stamps are dedicated to habitat protection and management. Funds from the State Habitat Stamp are shared equally with Iowa's 99 County Conservation Boards.

IDNR has doggedly sought funds for habitat protection through the North American Waterfowl Management Plan, the North American Wetlands Conservation Act, State Wildlife Grants, the Environmental Protection Agency, Iowa County Conservation Boards and others. IDNR also partners with a number of NGOs to extend the reach of state and Federal funds. The Iowa Natural Heritage Foundation, Ducks Unlimited, Pheasants Forever, the National Wild Turkey Federation, and The Nature Conservancy have been major cooperators with IDNR's habitat protection programs. Numerous other NGO's and individual private contributors have helped as well.

In spite of the aggressive efforts to protect wildlife habitat, Iowa remains one of the states with the highest proportion of privately held land (Map 2-4). In 2004 as the IWAP was first being developed, public conservation lands accounted for just over 600,000 acres, or just 1.7% of the land area of the state (Iowa GAP). In 2015, public conservation lands are estimated at 895,924, or 2.48% of land area of the state. Some of this increase is due to land protection over the last decade. However, most of the increase is attributable to an improved estimate due to technological improvements which allow for increased data sharing between cities, counties, state, and federal entities.

The IDNR owns nearly half of the public conservation lands (371,578 acres), including wildlife management areas, state parks, and state forests. Federal land ownership accounts for 269,818 acres (0.75% of Iowa's land area). Primary federal land management agencies in Iowa include the Army Corps of Engineers, with 34,895 acres in four flood control reservoirs, and US Fish and Wildlife Service with its 5 national wildlife refuges in the State. IDNR has land management agreements on portions of the reservoirs but little control over water levels. County Conservation Boards own 168,339 acres. (This accounting does not include the Road Rights of Way owned and managed by the U.S. or Iowa Departments of Transportation.)

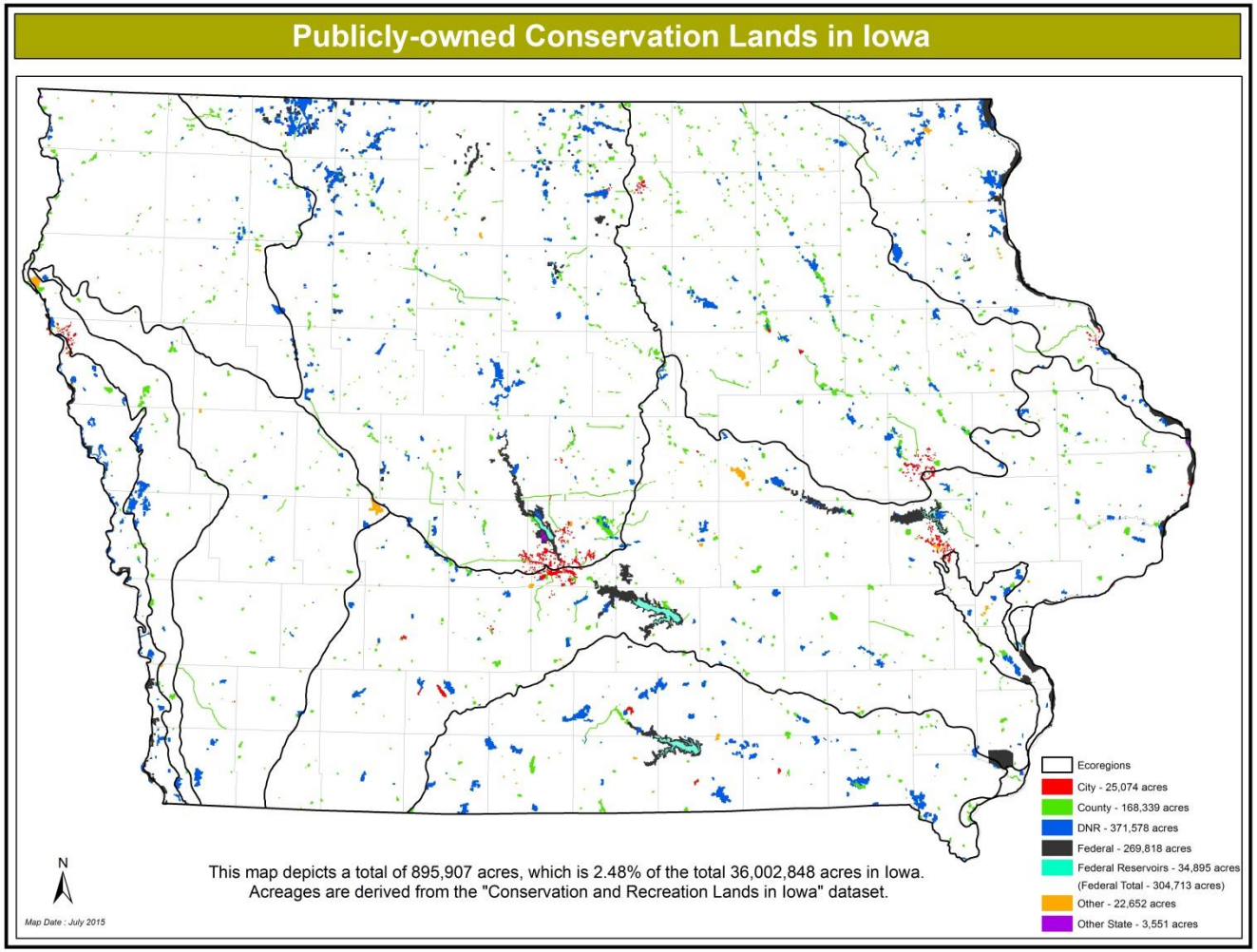
Unlike most other states across the Midwest and West, Iowa does not have a significant presence of lands owned by the US Forest Service, Bureau of Land Management, or the National Park Service (Table 2-5). Therefore, unlike other states which have significantly higher federal land bases, a relatively high proportion of Iowa's habitat base is managed by the Iowa DNR, County Conservation Boards, and of course, private landowners.

Table 2-5. Estimates of Federal Land Area for 8 Midwest States. From USDA National Resources Inventory, 2010 Summary Report.

State	Total Surface Area (acres)	Federal Land	Proportion Federal
Iowa	36,016,500	172,400	0.48%
Illinois	36,058,700	491,100	1.36%
Missouri	44,613,900	1,919,400	4.30%
Kansas	52,660,800	504,000	0.96%
Nebraska	49,509,600	647,600	1.31%
South Dakota	49,358,000	3,112,200	6.31%
Minnesota	54,009,900	3,336,100	6.18%
Wisconsin	35,920,000	1,845,300	5.14%

Habitat on private lands. Wildlife habitat on private lands has also received attention from IDNR programs. Farm Game Habitat crews roamed the state in the 1950's and 1960's helping landowners establish habitat on their property. In 1971 the number of IDNR wildlife management biologists was doubled and they were housed in USDA farm service center offices to promote contacts with private landowners. In the 1980's farmstead shelterbelts and switchgrass cost-sharing programs were introduced to promote these practices on private land. For the past 20 years IDNR biologists have actively promoted USDA farm bill practices (e.g. CRP, WRP) that provide landowners funds to assist with developing wildlife habitat.

Map 2-4. Publicly-owned Conservation Lands in Iowa



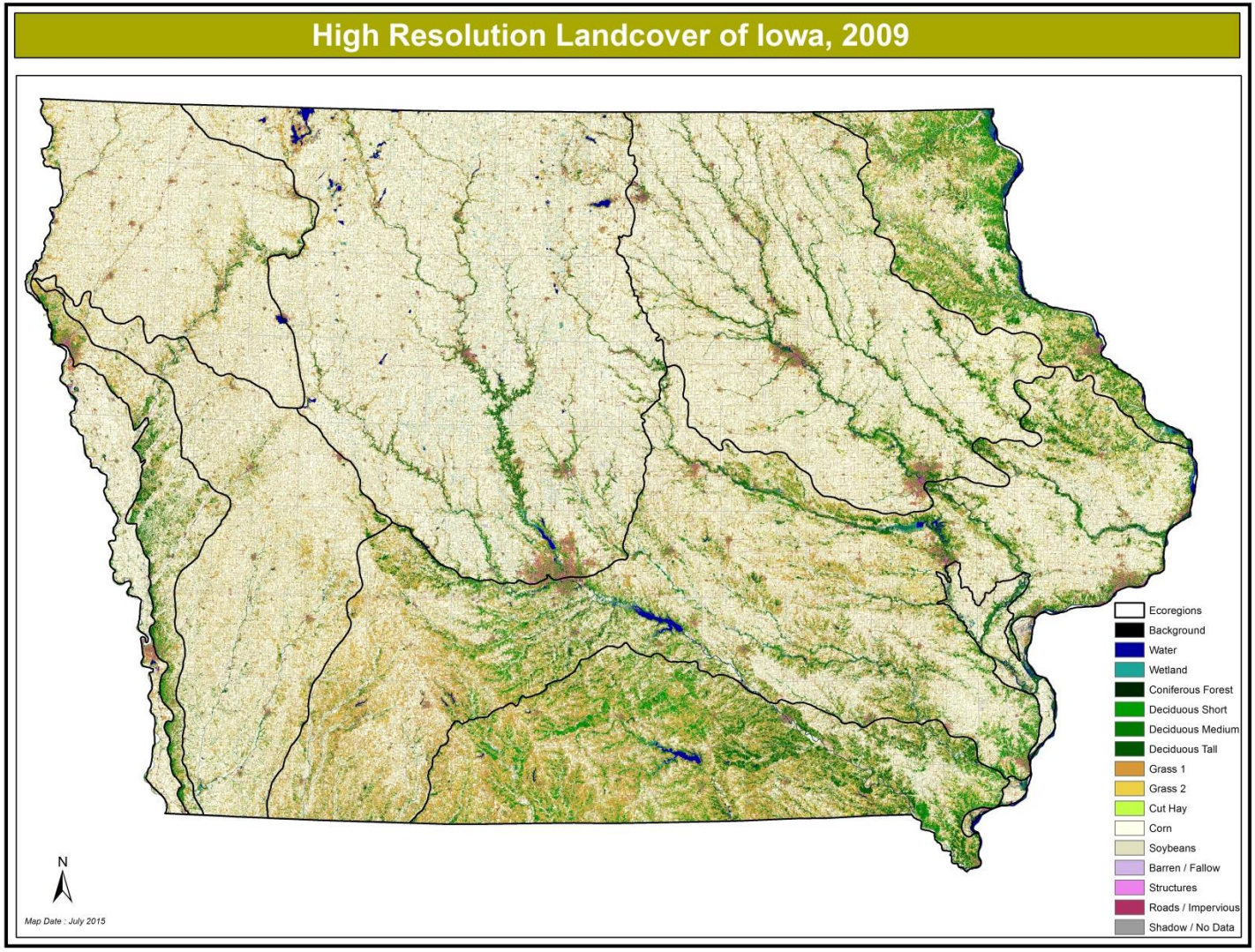
The Wildlife Bureau's Private lands Program was formed in 2002 to take better advantage of wildlife-friendly USDA farm programs and other Federal grants like the Landowner Incentive Program (LIP) or Wildlife Habitat Incentive Program (WHIP). Now in its 15th year, the Private Lands Program is successful in Iowa because of its many partnerships including Natural Resources Conservation Service, Farm Service Agency, Pheasants Forever, Fish and Wildlife Service, AmeriCorps, Local Soil and Water Conservation Districts, and most importantly, Iowa's landowners. The Program uses this Plan as strategic guidance, working with any interested landowners but also trying to direct staff and resources to highest priority wildlife conservation issues. Program specialists work with hundreds of landowners annually, providing technical assistance and ensuring that farm bill programs provide benefits to wildlife populations. Recommendations for wildlife habitat improvements have been developed for over 500,000 acres.

Iowa's Natural Communities Today

The result of a century and a half of change as a result of human intervention on Iowa's landscape has been a shift in the composition of Iowa's plant communities and the wildlife that inhabits them. Few undisturbed natural plant or wildlife communities exist today. Approximately 0.2% of Iowa's native prairies (47,000 acres including remnant, restored and reconstructed prairies), 5% of its wetlands (255,000 acres of wetlands estimate in 2009 HRLC), and 37% of its forests (2,477,000 acres) remain.

Map 2-5 shows the land cover in Iowa in the year 2009. The majority of the state is covered with row crop, primarily corn and soybeans. Most of the remainder of the state is in grassland, often conservation reserve, road ditches or pasture, with lesser acreages of timber and other habitat types. More details on the current status of Iowa's wildlife are provided in Chapter 3, and the status of wildlife habitats in Chapter 4.

Map 2-5. Landcover of Iowa in 2009 (IDNR High Resolution Land Cover)



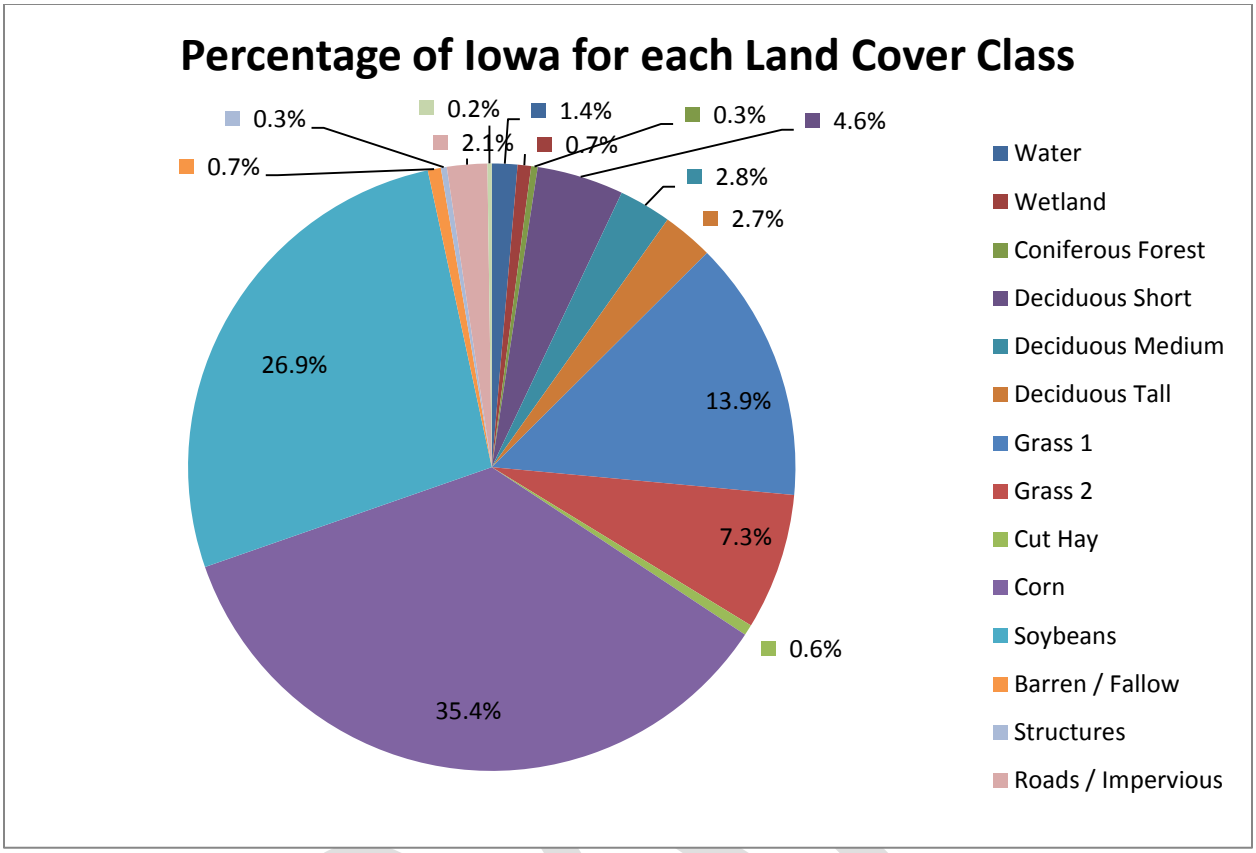


Figure 2-5. Percentage of Iowa's total acreage for each Land Cover Class. From 2009 High Resolution Land Cover dataset.

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