State of Iowa

Iowa Comprehensive Emergency Plan

Part B: Iowa Hazard Mitigation Plan

September 2023

State of Iowa Hazard Mitigation Plan
Chapter 1: Introduction and Administration

1. Introduction and Administration

1.1. Purpose

The State of Iowa Hazard Mitigation Plan (Plan) is a plan for prudently directing public and other resources to reduce or eliminate long-term risk to people and property from hazards and their effects. The plan is developed and maintained by a State Hazard Mitigation Team (SHMT) established by executive order of the governor. The SHMT has representatives of several State, federal and nonprofit agencies and associations, with the lead agency being the Iowa Department of Homeland Security and Emergency Management (HSEMD). The plan has been developed in such a manner that it will comply with Title 44 CFR §§ 201.4-201.5.

1.2. Assurances and Plan Administration

1.2.1. Assurances

For this assurance and other assurances required in the plan, the State may:

1. Cite by number the statutory or regulatory provisions requiring the assurances and affirm that it gives the assurances required by those provisions
2. Repeat the assurance language in the statutes or regulations
3. Develop its own language to the extent permitted by law

The State will comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR § 13.11 (c), and will amend its plan whenever necessary to reflect changes in State or federal laws and statutes as required in 44 CFR § 13.11 (d). The State will also comply with 2 CFR Part 200 in all its grant administration and related processes.

1.2.2. Plan Administration

As plan administrator, Iowa Homeland Security and Emergency Management's Recovery Division will coordinate the review, revision, and re-adoption of this plan at least every five years. All substantive changes requiring re-adoption will be coordinated in accordance with Iowa Code Chapter 17A and will be provided to all primary and secondary members of the Iowa Hazard Mitigation Team as described in Governor's Executive Order Number 62.

1.2.3. Plan Maintenance

Provisions for monitoring, evaluating, and updating the plan are located in the Code of Federal Regulations (44 CFR) and in the Code of Iowa. The 44 CFR regulations require that every five years the state "must review and revise its plan to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities, and resubmit it for approval to the appropriate Regional Director." The Code of Iowa requires the director of HSEMD to "prepare a comprehensive plan and emergency management program for homeland security, disaster preparedness, response, mitigation, emergency operation, and emergency resource management of this state."

HSEMD serves as the lead agency for preparation of the State of Iowa Hazard Mitigation Plan and serves as the lead agency for monitoring, evaluating, and updating the plan. The state hazard mitigation officer (SHMO) is responsible for coordinating plan updates and maintenance. This position is located with

HSEMD and is the lead coordinator with the State Hazard Mitigation Team. Significant input into all phases of the planning process is derived from the SHMT. As mentioned in the Planning Process section of this plan, the SHMT serves as required by the Governor's Executive Order Number 62. The SHMT also has significant roles in monitoring implementation of the plan over time and reviewing and evaluating progress. The Monitoring and Review section of this plan more fully describes those roles.

This plan will undergo a formal review not less than every five years. The intent is to formally incorporate all recommended changes at that time. Once the plan is updated and reviewed by the designated members of the SHMT, the opportunity to review and comment is provided to directors of agencies who have membership on the Iowa SHMT (both primary and secondary members). The public is also given a chance to review and comment. Once all reviews are complete and comments acknowledged, the plan will be redistributed to all SHMT members and other interested partners.

1.2.4. Plan Distribution

The State of Iowa Hazard Mitigation Plan will be distributed to the State Hazard Mitigation Team, which is comprised of a Primary Iowa Hazard Mitigation Team and a Secondary Iowa Hazard Mitigation Team as outlined in Executive Order 62. The Primary Hazard Mitigation Team has representatives from the following state agencies:

1. Iowa Department of Natural Resources
2. Iowa Department of Transportation
3. Iowa Economic Development Authority
4. Iowa Department of Cultural Affairs
5. Iowa Department of Public Safety
6. Iowa Department of Homeland Security and Emergency Management

The Secondary Hazard Mitigation Team has representatives from the following state agencies:

1. Iowa Department of Administrative Services – General Services Enterprise
2. Iowa Department of Public Health
3. Iowa Department of Agriculture and Land Stewardship
4. Iowa Department of Commerce
5. Iowa Department of Management
6. Iowa Department of Revenue
7. Iowa Department of Education
8. Iowa Department of Workforce Development
9. Iowa Governor's Office

Unless otherwise required by code, the plan will be distributed electronically. Additionally, the plan will be posted on the HSEM website.

1.3. Maps and Information Disclaimer

Unless otherwise noted, all data shown on maps in this document is considered preliminary. Neither the Iowa HSEMD, nor any of its employees, makes any warranty of representation, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately-owned rights. Unless otherwise noted, the projection of maps herein is NAD 1983 UTM Zone 15N, Transverse Mercator.

1.4. State Overview

This section contains a profile of the state of Iowa and includes a general description of Iowa in terms of geography and environment, climate and weather, population and demographics, housing characteristics, infrastructure, economy, labor force, income, productivity, and other conditions that impact the State or can be influenced by hazards in the state. This information both helps to identify the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas, as well as put them in context. Statistics were updated to include the most current information available.

1.4.1. Geography and Environment

Iowa ranks as the 23rd largest state by area among U.S. states with a total land area of 55,838.9 square miles and a water area of 418.8 square miles[1]. The state is roughly rectangular in shape and its extreme dimensions are roughly 200 miles from north to south and about 300 miles east to west. The latitude and longitude of Iowa is 40° 36' N to 43° 30' N and 89° 5' W. Iowa is in the Central Time zone and observes daylight savings time with UTC-D.

A. Location

Iowa is generally located in the north central portion of the United States. It is bound on the north by Minnesota, on the east by Wisconsin and Illinois, on the south by Missouri, and on the west by Nebraska and South Dakota. The Mississippi River forms the entire eastern border and the Missouri River forms much of the western border. Des Moines is Iowa's capital and its largest city.

Figure 1-1: State of Iowa

B. Land Use

[1] Source: Iowa Data Center and https://www.census.gov/search-results.html?q=state+of+iowa+2050&page=1&stateGeo=none&searchtype=web&cssp=SERP&_charset_=UTF-8

According to the U.S. Department of Agriculture (USDA) in 2015 rural farm lands occupied about 92 percent of Iowa's land area, representing the influence and importance of agricultural industries in the state. As of the most recent Maps and State Ranking of Major Land Uses (2012)[2], Iowa ranks first in percent of its land as cropland with 75% (391,074 acres); thirty-first with grassland with 8.1% (2,879 acres); and forty-fifth in forest with 8.3% (2,968 acres).

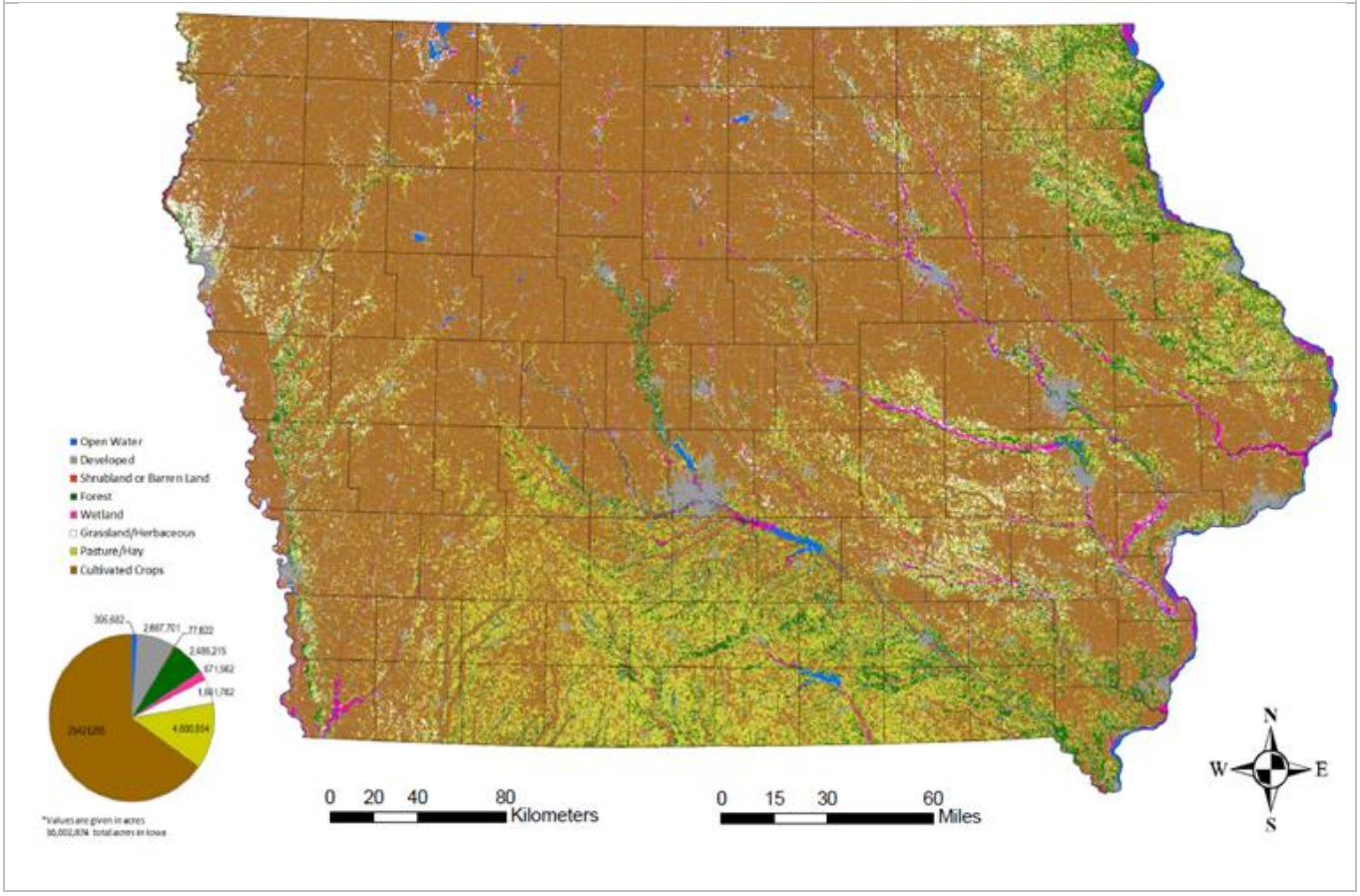
Large areas of pasture and hay are located in northeast Iowa, along with a broad, semicircular swath in south central Iowa. Rich cropland is particularly noticeable in north central Iowa. Most of the land originally covered by prairie is now in agricultural production. Along the western border of the state, grass and trees mark the boundary of the Loess Hills with the fertile Missouri River floodplain. Larger tracts of forest lands are found in the northeast and south central parts of the state. Most forest lands are concentrated in eastern Iowa along river corridors.

Figure 1-2: Land Use in Iowa, 2012
(Source: USDA Economic Research Service)

		Acres (1,000)	Percent
Cropland	Cropland idled	1,738	5%
	Cropland pasture	225	15%
	Cropland used for crops	24,750	69%
Grassland Pasture	Pasture and range	2,879	8%
Forest Use	Forestland grazed	878	2%
	Fores-use not grazed	2,090	6%
Special Uses	Defense and industrial	51	0%
	Farmstead	423	1%
	Parks and wilderness areas	510	1%
	Rural transportation	970	3%
Urban	Urban	628	2%
Miscellaneous	Miscellaneous	606	2%

[2] https://www.ers.usda.gov/data-products/major-land-uses/maps-and-state-rankings-of-major-land-uses/

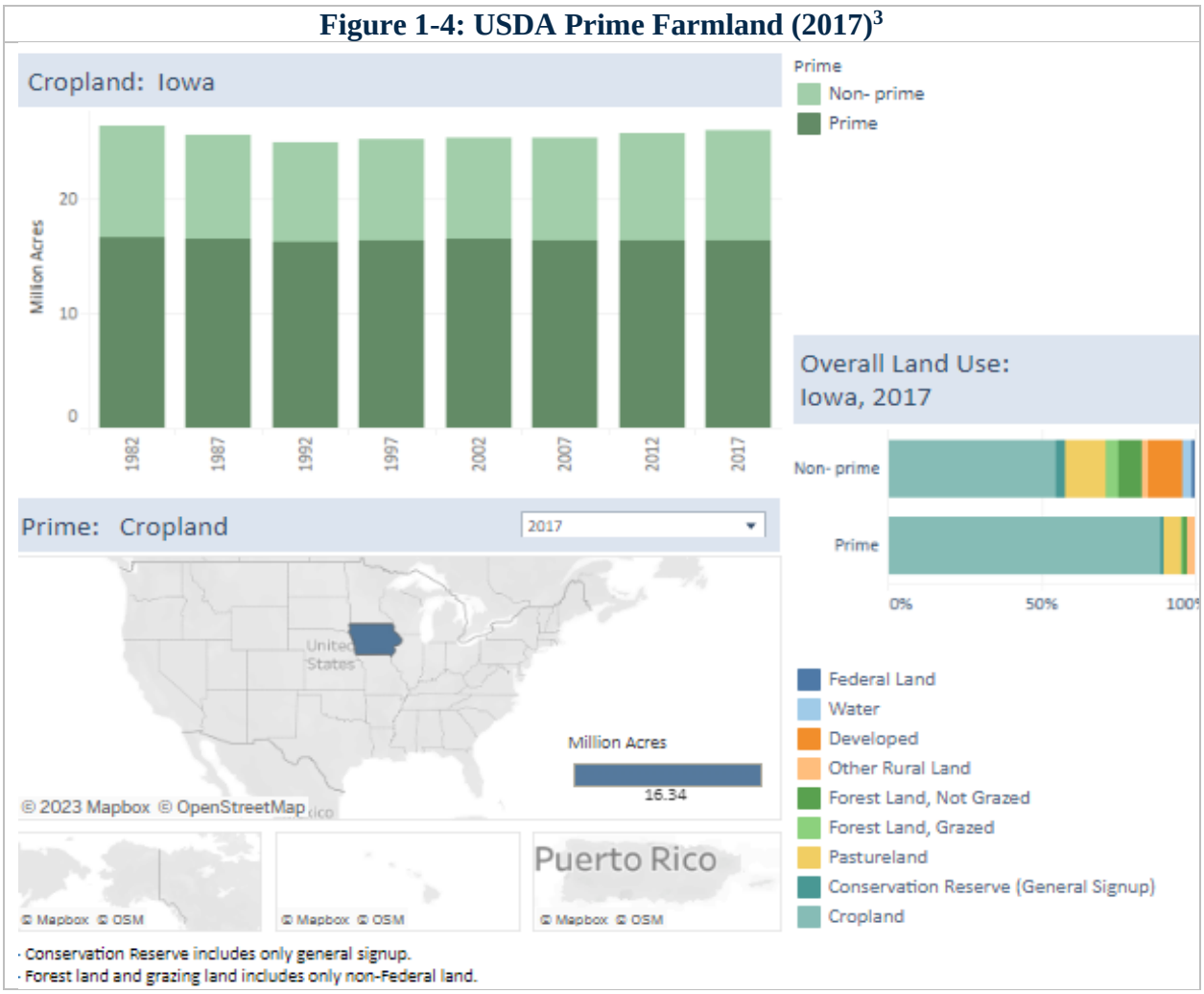
Figure 1-3: Land Use in Iowa. (Source: Iowa DNR GIS Library)



C. Prime Farmland

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent.

Figure 1-4: USDA Prime Farmland (2017)[3]



Prime farmland is of major importance in meeting the Nation's short and long range need for food and fiber. Iowa is ranked first in the nation with 74.7% cropland. More than 97% of Iowa farms are owned by families[4].

D. Changes in Land Cover and Use

Iowa has roughly 28.6 million acres of land that historically has been considered cropland or cropland pasture. Corn has been the most popular crop on this land for more than 100 years. In 1930 there were 10 major crops raised in Iowa. Corn occupied 40% of the cropland, and cropland pasture accounted for

[3] Source: National Resource Inventory, see https://publicdashboards.dl.usda.gov/t/FPAC_PUB/views/RCADVPrimeFarmlandNRI20171/StatePrimeFarmland?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n

[4] Source: https://stacker.com/business-economy/states-most-farmland

nearly 35% of the cropland while barley, flaxseed, oats, rye, sorghum, soybeans, sugar beets, and wheat took up the remaining 26% of the cropland acreage.

By 1982, corn had increased to 50% of the cropland acreage and cropland pasture had decreased to just 9% of the land area while soybeans were emerging as the new crop taking up 31% of the cropland acres. Barley, flaxseed, and sugar beets were no longer reportable crops in Iowa and a few years later rye and grain sorghum would drop off the list of crops that USDA reported on for Iowa.

Conservation and "idled" acres have been a part of the Iowa farm landscape since the 1930s. Annual idling of cropland was a significant policy tool that was used intermittently during the 1950s, 60s, 70s, 80, and up until 1995. Multi-year conservation programs such as the Soil Bank were instituted in the 1950s and 1960s but it was the Conservation Reserve Program (CRP) that was authorized in the 1985 farm bill that has endured as the center point of land devoted to conservation applications for the past 36 years. In Iowa CRP acres peaked at 2.2 million acres in 1994 and have declined to 1.69 million acres in 2022.

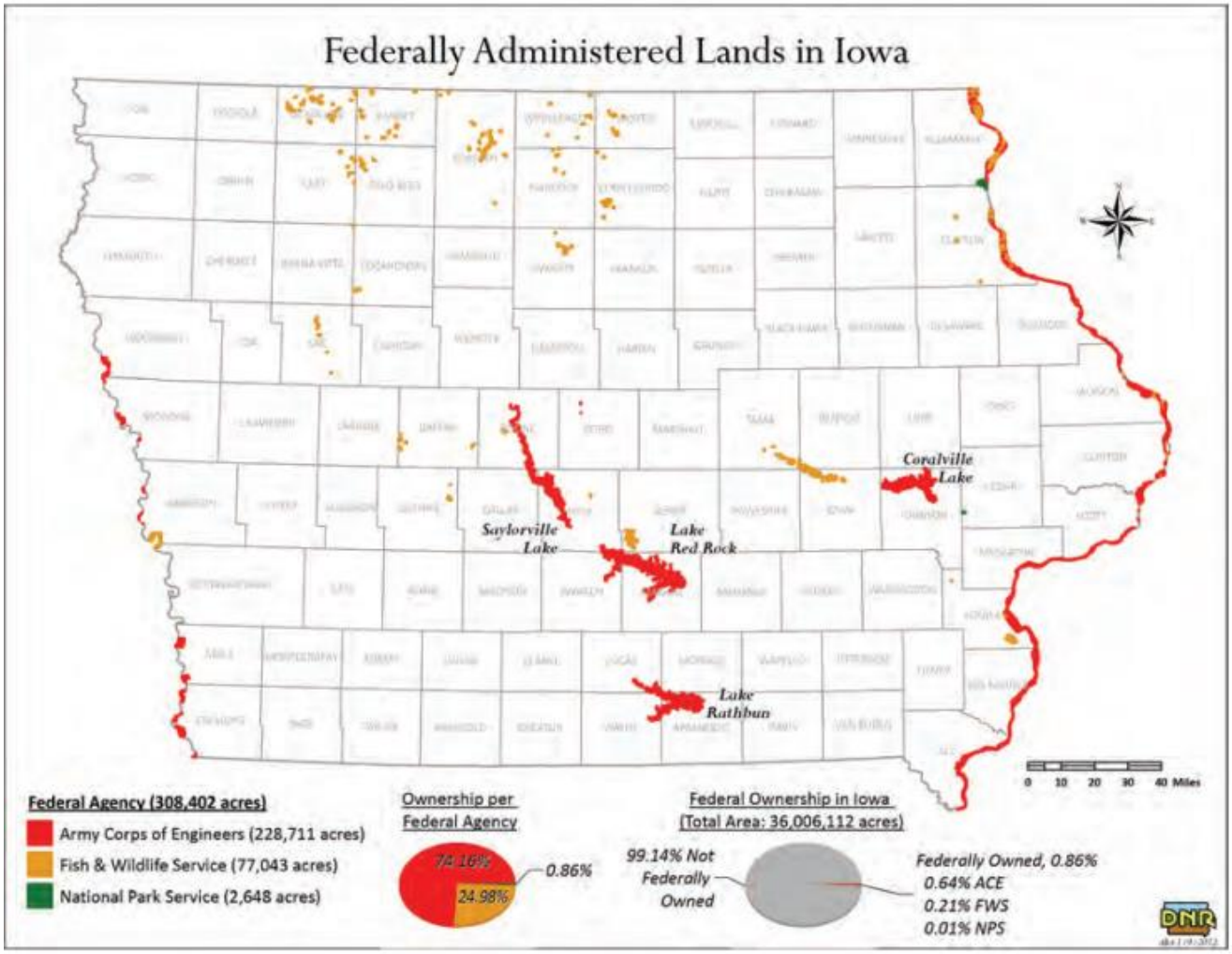
Harvested cropland in Iowa has stabilized between 25 and 26 million acres with corn and soybeans accounting for 88-89% of harvested cropland. Cropland devoted to pasture has declined over the past 80 years.

Total cropland acres in Iowa are also declining. Over the past 40 years total cropland acres have declined by 2.1 million acres in Iowa. Most of these acres have been lost to development which expands across Iowa at an average annual rate of about 51,700 acres per year. The reverse side of this is that non-farm land use in Iowa is increasing over time. In 1945 there were just over 6 million acres of non-farm land use in Iowa. By 2007 non-farm land use had grown to 8 million acres

Federally Administered Lands in Iowa

Only 0.86% of the land is federally owned making it and Connecticut and two states with the lowest percentage of federal land.

Figure 1-5: Federally Administered Land. (Source: Iowa DNR)

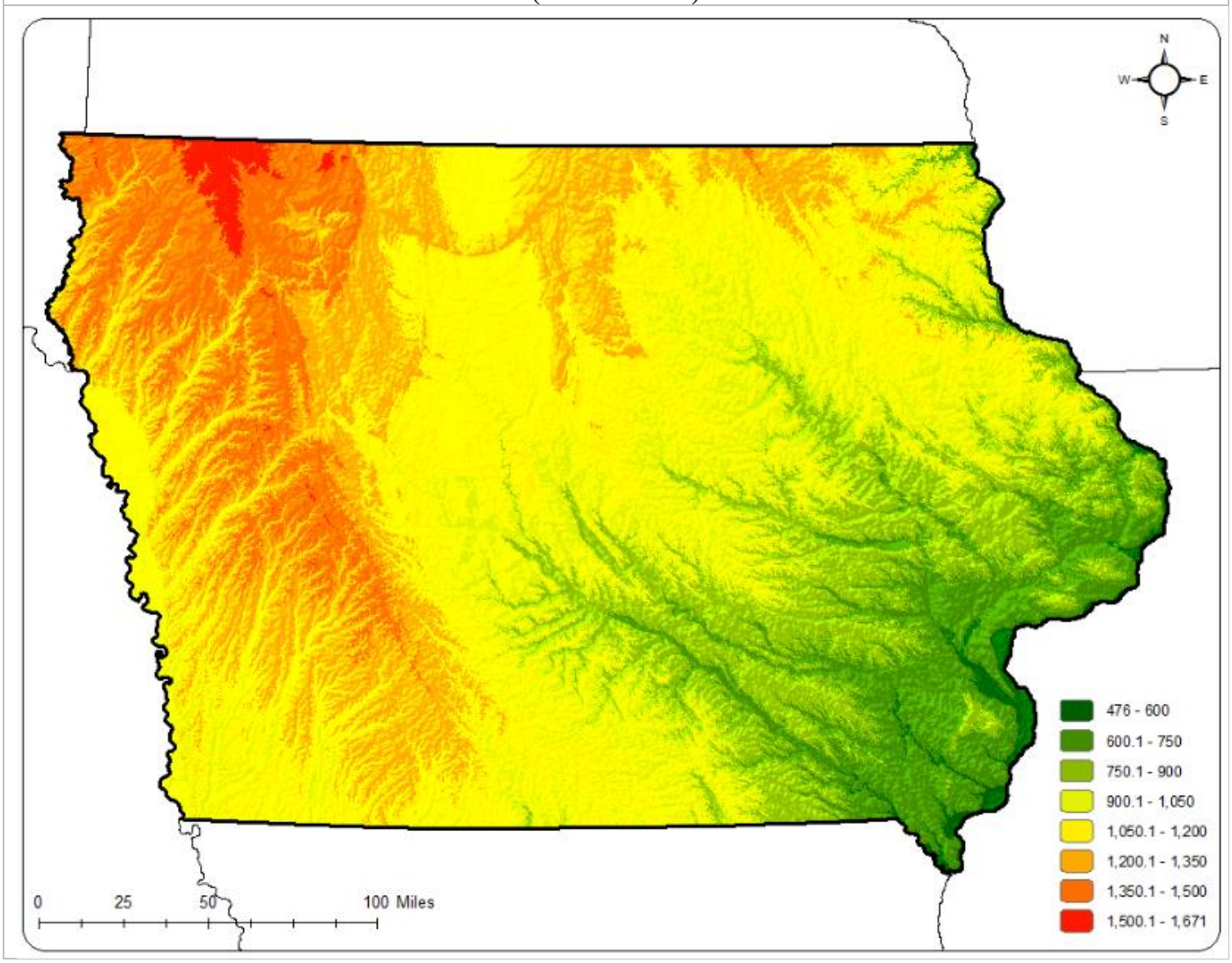


E. Elevation

Elevations in Iowa range from a low of 480 feet above sea level at the Mississippi River in the southeast to the high point of 1,670 feet in Osceola County in northwest Iowa. The approximate mean elevation is 1,100 feet. Iowa terrain is generally flat or gently rolling, but the extreme northeast has been deeply cut by streams as shown in the following map. In the northeast, hills frequently rise about 330 feet to 390 feet above the Mississippi River and its tributaries. The western portion of the state contains the Loess Hills, a stretch of hilly terrain reaching hundreds of feet in elevation formed from clay deposits blown eastward from the Missouri River.

Iowa's most level land is found in the north-central region and is the result of ice sheets scraping the land during the glacial periods. When the ice sheets melted, they deposited a mixture of rock and soil; some of the most fertile soil in the United States is found here. Most of the remainder of Iowa consists of rolling lands of the dissected till plains. These plains were formed by glacial deposition of till (a mixture of rock and silt) hundreds of thousands of years ago. Streams have had ample time to erode the land, forming rounded hills. A small area of flat till plains is found in the southeastern part of the state. Rich soil has formed on most of the till plains.

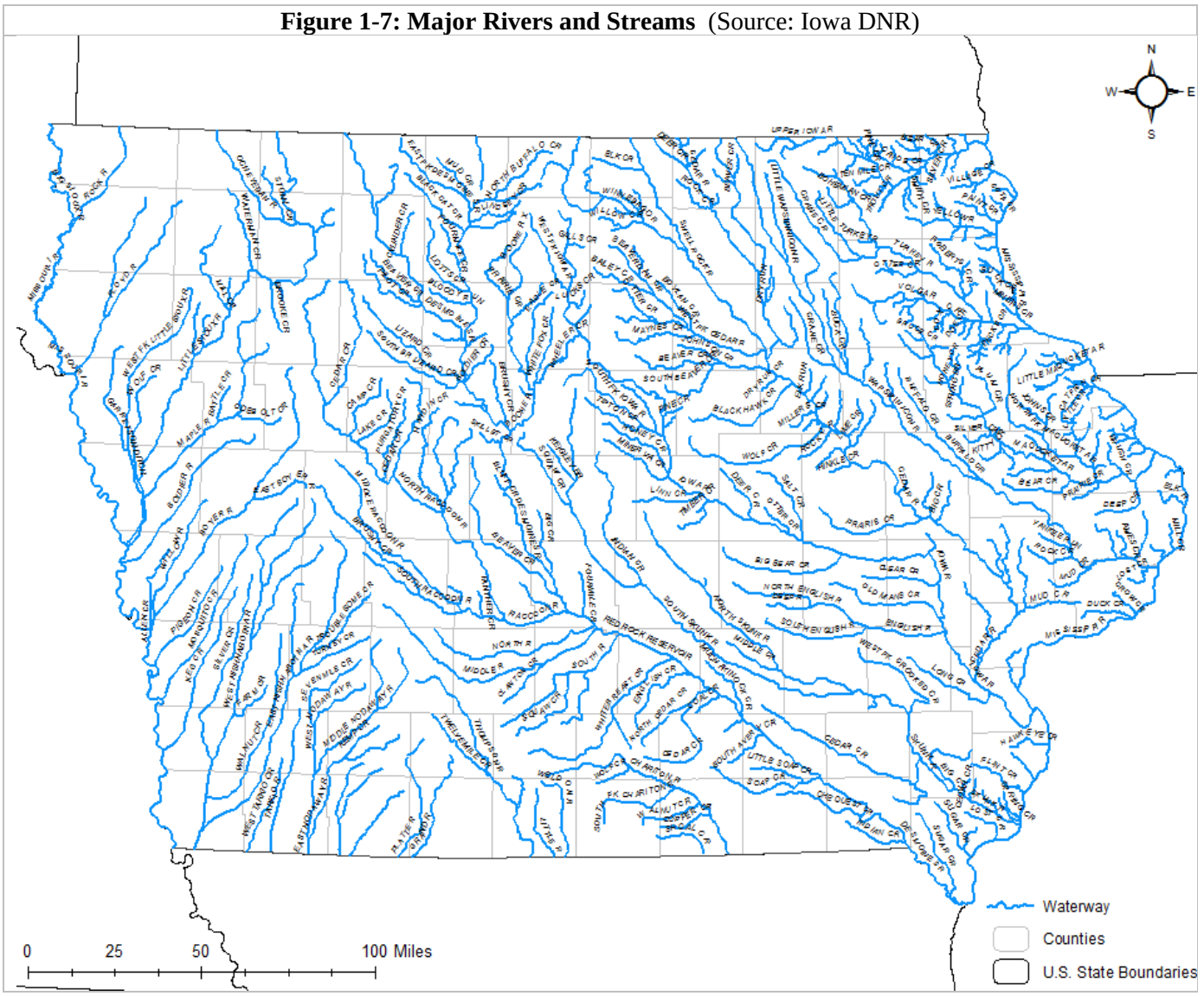
Figure 1-6: Iowa Elevations
(Source: USGS)



F. Rivers, Streams, and Lakes

The major types of waters in Iowa include lakes, ponds, streams, rivers, and wetlands. Iowa waters tend to be very productive–they are very rich in plant and animal life. This is due largely to the richness of Iowa soils. However, run-off from agricultural and urban areas also contains nutrients which can increase plant growth, sometimes to the extent it is undesirable.

Figure 1-7: Major Rivers and Streams (Source: Iowa DNR)



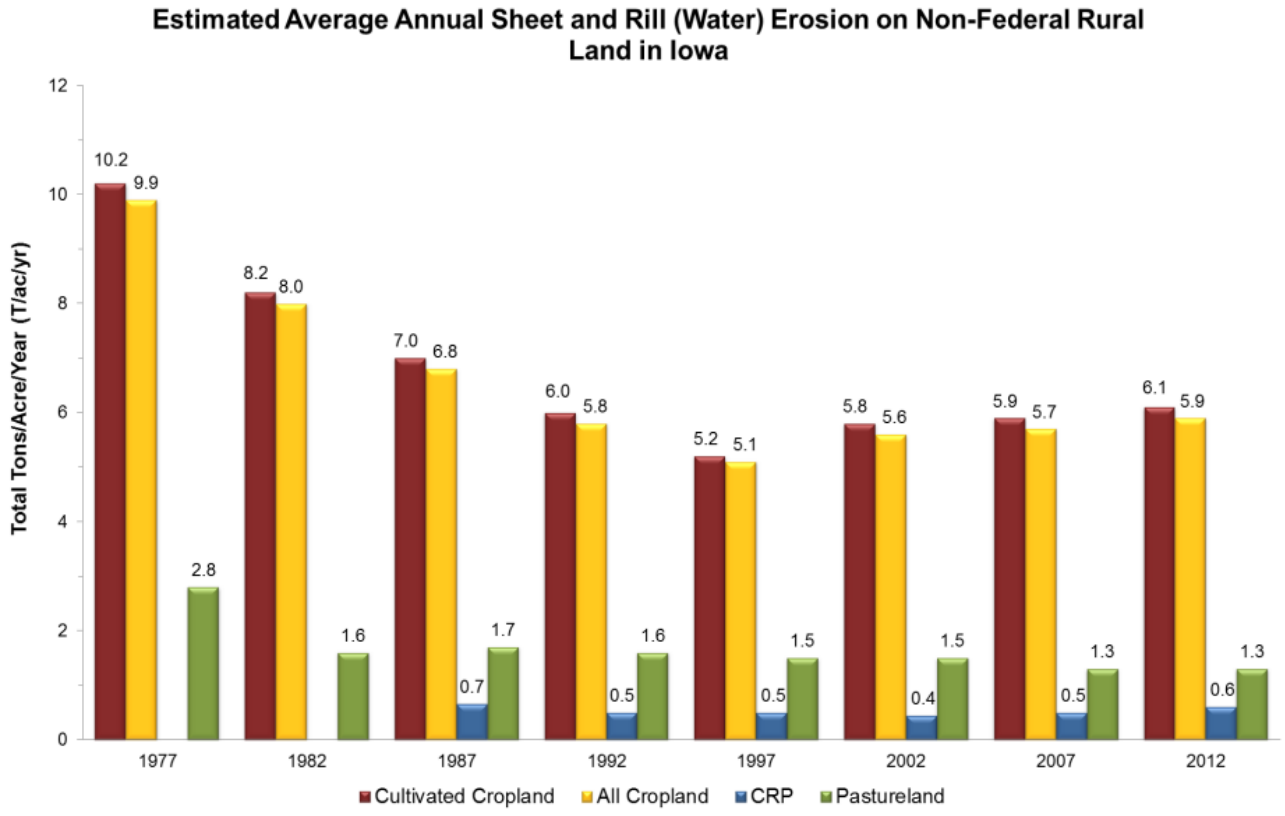
Natural lakes, formed by glaciations, are common in the northwestern and north central parts of the state. Many of the more shallow lakes and prairie "potholes" have been drained and/or filled in for agriculture, but 31 major natural lakes with a combined surface area of almost 29,000 acres, and 17 marsh-like lakes with over 3,000 acres of combined surface area, are still present in Iowa.

Iowa has nearly 19,000 miles of interior rivers and streams, approximately 209 square miles of lakes and reservoirs, and 79 square miles of wetlands. There are 87 cold water streams located in northeast Iowa with a combined length of 266 miles. The 25 largest interior rivers in Iowa extend over 3,500 miles and each is fed by numerous smaller creeks and streams (tributaries). All interior rivers in the state are part of either the Mississippi River or the Missouri River systems.

Iowa's flowing waters are subject to violent and sudden fluctuations because of the nature of our soils, intensive farming of small grain crops, and drainage. Headwaters of streams usually are quite clear and less subject to water fluctuations. Lower stream reaches tend to be more turbid and subject to greater agricultural and industrial pollution.

Water erosion is the most pertinent erosion problem in Iowa. Soil erosion by water occurs when bare-sloped soil surface is exposed to rainfall, and the rainfall intensity exceeds the rate of soil intake, or infiltration rate, leading to soil-surface runoff[5]. Soil erosion can occur in two stages: 1) detachment of soil particles by raindrop impact, splash, or flowing water; and 2) transport of detached particles by splash or flowing water. Therefore, soil erosion is a physical process requiring energy, and its control requires certain measures to dissipate this energy.

Figure 1-8: Iowa Soil Erosion Inventory Chart, 2015. (Source: USDA-NRCS)



The hydrologic processes of rainfall and runoff play an essential role in water erosion. The amount and rate of surface runoff can affect erosion and sediment transport. Thus, soil conservation practices are important in reducing soil erosion. Improving the soil infiltration rate, resulting in less surface runoff, can lead to reduction of soil erosion. Agronomic, cultural, or structural practices are available for controlling soil erosion. Structural practices involve physical changes in the shape and topography of the land. All these practices are not mutually exclusive. Some situations may require both management and structural

[5] Source: https://crops.extension.iastate.edu/encyclopedia/soil-erosion-agricultural-production-challenge#:~:text=Water%20erosion%20is%20the%20most,leading%20to%20soil%2Dsurface%20runoff.

changes, where the topography is highly complex. In other situations, erosion control can be achieved by implementing a single practice, where the erosion is minimum, such as the establishment of grassed waterways.

Streams and rivers naturally meander, changing their course over time. Pools and riffles between meanders support diverse aquatic life. Channelization (straightening of a stream) and replacement of surrounding natural vegetation with row crops eliminates habitat and, thus, much of the aquatic life disappears from the area.

Water in channelized streams flows faster, increasing erosion and deepening the channel. The chain reaction destroys the natural integrity of stream channels and often results in major damage to bridges. Likewise, floods are more severe.

Most of Iowa's interior rivers and streams have channelized stretches and approximately 3,000 miles of Iowa's rivers have been lost to channelization. Iowa is known as the land between two rivers. The Mississippi and Missouri rivers make up most of the east and west borders, respectively. (The Big Sioux and Des Moines rivers make up small portions of the northwest and southeast borders.)

All of the state's rivers flow into the Mississippi River (on the eastern border) or the Missouri River (on the western border). Prominent among the Mississippi's tributaries are the Des Moines River and the Raccoon River, which drain the east central plains; and the Iowa, Cedar, Skunk and Wapsipinicon rivers which drain the eastern plains. All flow south and east into the Mississippi River. Major tributaries of the Missouri River include the Big Sioux, Little Sioux, Boyer, and Nishnabotna rivers, all of which flow southwest. Most Iowa natural lakes are "middle-aged" and have partially filled with windblown and water-carried sediments, remains of water plants, and soils from eroding shorelines.

Marshes are older lakes that have filled with more sediment and plant remains. These waters generally have good water quality, but this can rapidly decline as a result of shoreline development or loss of soil and nutrients from unprotected land in the lake's watershed. A second type of natural lake, the oxbow, is formed when river channels change course and sediments block the ends of a meander in the old channel. Larger oxbows are found along the Missouri and Mississippi rivers and smaller, pond-like oxbows are found along many interior rivers and streams.

G. Dams

The Iowa DNR administers the state's dam safety program. All existing and proposed dams are classified according to the potential impact in event of dam failure. Of the almost 4,200 dams in the state[6]:

- 93 dams are classified as having high hazard potential meaning located in an area where failure would result in probable loss of human life;

[6] Source: DNR Dam Inventory
https://iowadnr.knack.com/dams#public/?view_136_filters=%5B%7B%22value%22%3A%22Existing%22%2C%22operator%22%3A%22is%22%2C%22field%22%3A%22field_431%22%7D%5D&view_136_search=anita&view_136_page=1

- 168 dams are classified as having significant hazard potential meaning failure would result in no probable loss of human life but may damage residential structure or industrial, commercial, or public buildings; may negatively impact important public utilities or moderately traveled roads or railroads,; or may result in significant economic losses or significant public damages; and
- the remaining dams are classified as low hazard potential dams meaning failure would result in no probable loss of human life, low economic losses, and low public damages.

There are also eight lock and dam systems along the Mississippi River on the Iowa side. The following map shows the location of Iowa's locks and dams along with their associated hazard potential. More information about Iowa dams is located in the Dam/Levee Failure hazard profile in Section 3.3.1.

Dams in Iowa are utilized for a variety of purposes. Many are used for municipal water storage, some are used for flood control, some for erosion control, and others for recreation. Some were originally built for one of these purposes, but no longer serve such purpose. Recreational reservoirs range in size from 15-acre Mitchell Lake to Lake Red Rock, which has a surface area of some 19,000 acres at normal pool level.

H. Ponds and Wetlands

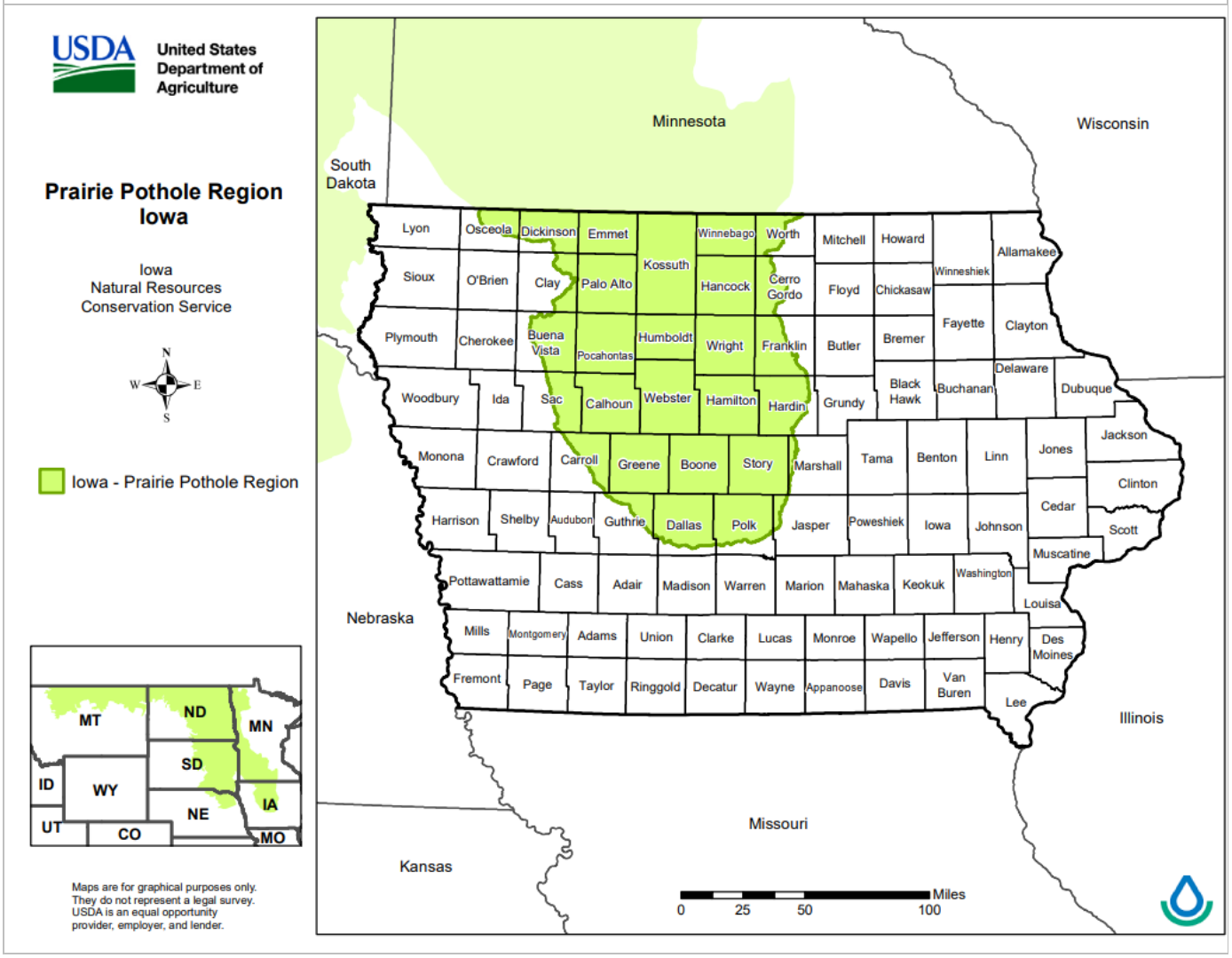
There are more than 110,000 ponds statewide. Most are in the southern half of the state because clay soils found there readily form a water-tight basin. (Soils in northern Iowa tend to be more porous.) Ponds generally are less than 10 acres in size. Water quality and habitat in a pond are especially dependent on management of the watershed (land that drains into the pond). Ponds with well-managed watersheds can support excellent fish populations and are important fisheries. Ponds also provide reliable water sources for livestock and wildlife.

Wetlands are areas where soil is saturated for various lengths of time during the growing season. They are transitions between terrestrial and aquatic systems. All wetlands have three things in common: hydric soils, a hydrology, and the presence of hydrophytes (water plants). Hydric soils form when soil is saturated and decomposition is slow due to low oxygen. They are characterized by a thick, dark layer of organic soil just below the topsoil, with a gray layer beneath mixed in with splotches of brown, orange, or yellow. Wetland hydrology is the presence of water on or near the soil surface for most of the growing season. Hydrophytes are specially adapted to living with their roots in wet soils.

Marshes are open and unforested. They are dominated by cattails, sedges, and grasses. Iowa marshes include prairie potholes formed during the last ice age, when the Des Moines lobe of the Wisconsin glacier melted (approximately 10,000 years ago). As the glacier receded, it gouged thousands of shallow depressions. This area of the northern Great Plains in the U.S. and southern Canada, known as the Prairie Pothole region, is ecologically diverse and economically important.

Other wetlands include wet meadows (dominated by sedges with very shallow water levels or are just saturated to soil level), bogs and fens (unique wetlands with peat, which is partially decomposed organic material), and wet prairies (soils almost always organic and saturated). Most Midwestern wet prairies have been drained and now are farmed. Fens are groundwater fed wetlands which are formed only under very specific conditions. Of the 200 species of plants associated with fens in the state, 24 are considered rare species.

Figure 1-9: Prairie Pothole Region, Iowa. (Source: USDA, see https://www.nrcs.usda.gov/sites/default/files/2022-09/PPWaterQualityandWildlifeProgram_FS_FY22.pdf)



From creeks and streams to major rivers, all flowing waters have a riparian zone. Riparian zone vegetation traps sediment, agricultural chemicals, and animal waste. Cottonwood, green ash, silver maple, willow, and many other trees, shrubs, and grasses stabilize stream banks and prevent erosion from storms and snow melt. Streambank vegetation provides shade, moderating temperature, humidity, and light for stream creatures during summer. Forest animals come to drink and find food, shelter, and hiding places. In Iowa, many riparian zones have been cleared and replaced by cultivation, converted to pasture, or developed. Loss of this zone of vegetation has caused serious environmental problems.

It is estimated Iowa had four million acres of wetlands in the mid-1800s (includes oxbows, floodplain wetlands, and natural lakes). As humans realized how rich the soils under wetlands and prairies were, these areas soon were drained or filled and converted to cropland, urban areas, housing complexes, industrial areas, railroads, and highways.

Iowa has lost approximately 99 percent of its original wetlands. Wetlands were, and still are, considered by many to be waste areas. Until recently, drainage of wetlands for agriculture was promoted by State and

federal programs. In 1997, approximately 1.2 percent of the state's surface area was covered by wetlands. Policies to protect wetlands have helped slow the rate of loss, and restoration programs are gradually reintegrating wetlands into the landscape.

Iowa wetland and riparian wetland restorations have included more than 78,000 acres enrolled in USDA Natural Resources Conservation Service (NRCS) programs, and another 10,000 acres through the U.S. Fish and Wildlife Service Partners for Fish and Wildlife program.

I. Mississippi and Missouri Rivers

The Mississippi River borders Iowa for more than 300 miles and drains two-thirds of the state. It originates in Lake Itasca, Minn., and flows some 2,350 miles to the Gulf of Mexico. Through the ages it has formed chutes, side channels, and sloughs while carving a valley two to six miles wide. It first served as a corridor for settlement by Native Americans from the South and later as a major mode of transportation for Euro-American settlers. The Upper Mississippi River (from the entrance of the Missouri above St. Louis to Minneapolis) was a mosaic of braided channels with rapids and shallow areas. Water levels were unpredictable and the river was vulnerable to drought and floods.

In 1824, Congress authorized improvement of the river for navigation through removal of snags and other obstructions. In 1907, work began to form a six-foot navigation channel in the Upper Mississippi. The Mississippi became a major transportation route and the U.S. Army Corps of Engineers (USACE) constructed locks and dams for navigation on the Upper Mississippi between 1930 and 1940. A nine-foot channel now is maintained by the USACE for barge navigation.

The level of the river along the Iowa border is controlled by 11 locks and dams. [7]Damming the Mississippi River raised water levels so many chutes between islands, and even islands themselves, were inundated. It also changed the habitat structure from a continuous, flowing body of water to a series of lake-like pools (stretch of river between two navigation dams). Each pool is numbered in reference to the dam at its downstream end. For example, Lock & Dam 12 in Bellevue, Iowa, creates Pool 12 above it.

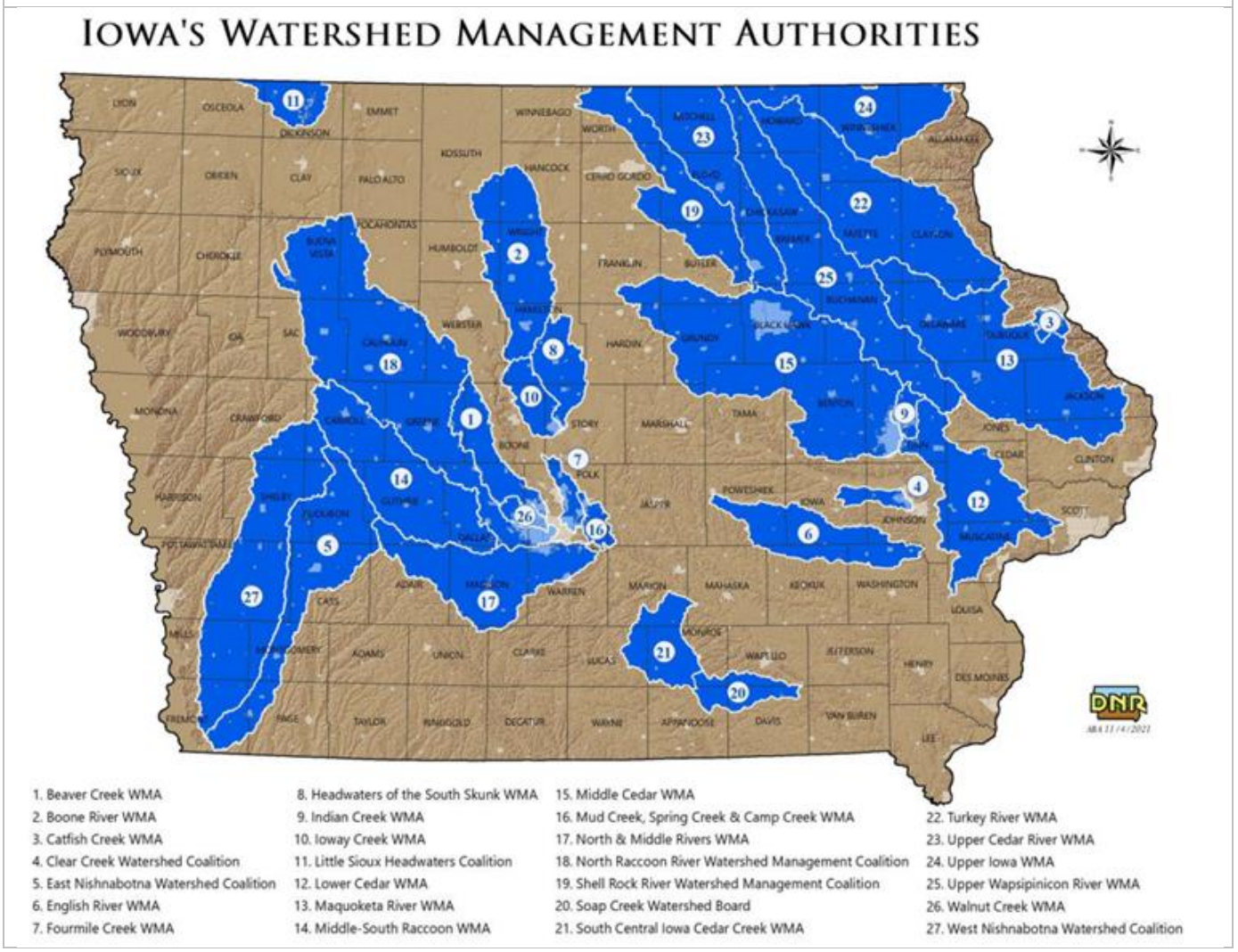
The Missouri River was dubbed the "Big Muddy" by early explorers because its shifting sands were swirled by relatively fast-moving currents through a broad series of braided channels. The Missouri River Valley bordering Iowa contained lush hunting grounds used by the Dakota, Iowa, Oto, Winnebago, Sac, Fox, and Potawatomi. Many fur companies established trading posts along the Missouri. Buffalo, elk, and deer, along with many species of small game and wild fowl, were common in the river valley. A variety of fish was plentiful in the river. Engineering work for navigation and flood control has had a profound effect on the Missouri. Work began as early as 1876, but accelerated channel stabilization occurred in the late 1920s and early 1930s. Between 1923 and 1976 the river channel was altered from its former braided appearance to a narrow, single channel with a series of gentle bends and well-armored shoreline. This reduced the channel area by nearly 35,000 acres along Iowa alone. Dikes and other structures regulate flows instead of locks and dams. The USACE maintains a nine-foot channel for commercial river traffic.

[7] See https://experiencemississippiriver.com/locks-and-dams-of-the-upper-mississippi/ and https://www.iowadnr.gov/Fishing/Where-to-Fish/Mississippi-River

J. Watersheds

Combined, all the rivers, streams, and lakes in Iowa represent watershed basins. Iowa has 56 watersheds that range from 390 to 1,954 square miles in size. Within these watersheds are 420 smaller basins ranging from 63 to 391 square miles in size. Within many of these watersheds, there is a strong history of work to solve problems like upland sheet and rill erosion, gullying, sedimentation of lakes and streams, and flooding. See Section 1.F. "Rivers, Streams, and Lakes" for more detail on the impact of water erosion on Iowa's prime farmland.

Figure 1-10: Watershed Management Authorities. (Source Iowa DNR)

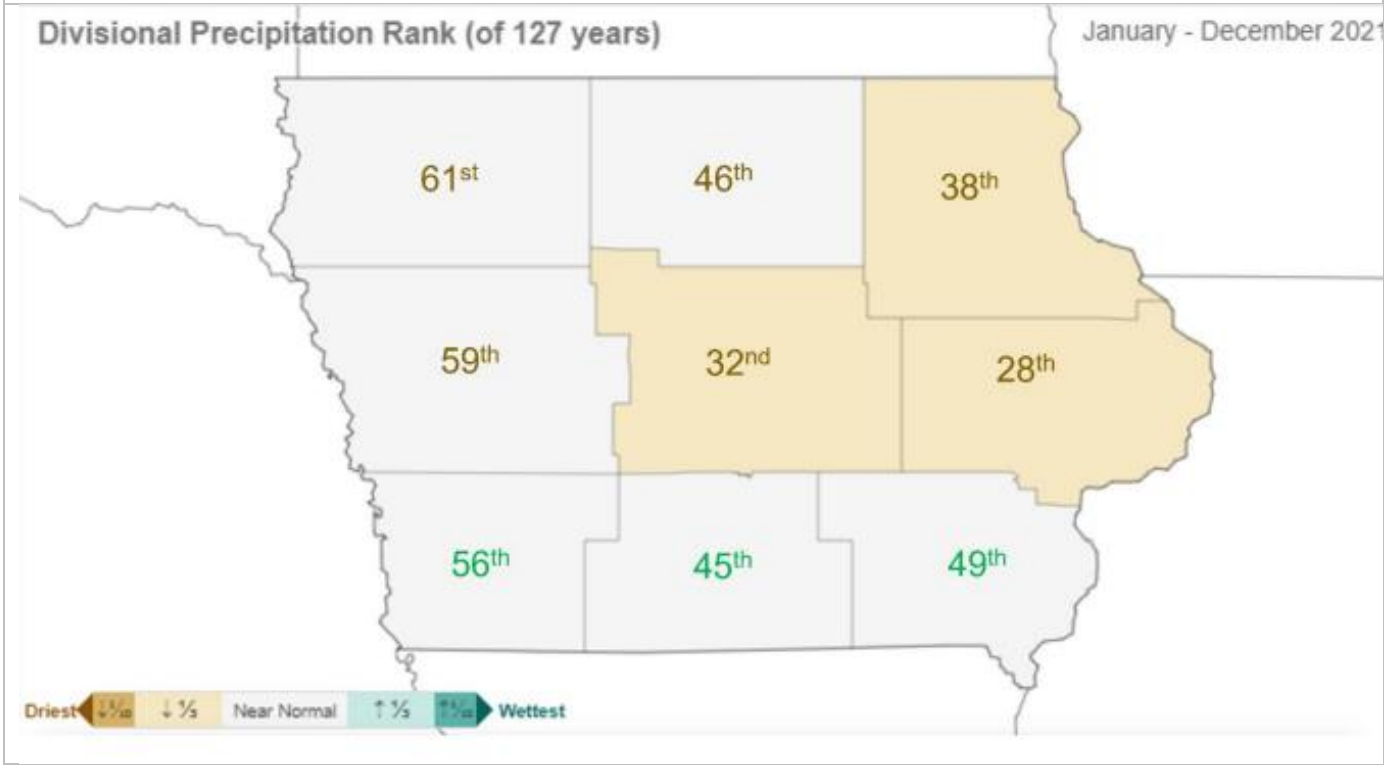


More recently, water quality-oriented watershed projects have been organized to address threats and implement water quality improvement plans. In 2010, the Watershed Management Authority was created as a mechanism for planning and management. In 2016, the Iowa Watershed Approach started as a five-year project to minimize flood risk and improve water quality. The project was funded through a $96.9 million award by the U.S. Department of Housing and Urban Development as a part of the National Disaster Resilience Competition. Through the Iowa Watershed Approach, hundreds of practices were implemented in eight watershed. The practices included wetlands, farm ponds, storm water detention basins, terraces, sediment detention basins, floodplain restoration, channel bank stabilization, buffer strips, saturated buffers, perennial cover, oxbow restoration, bioreactors and prairie strips.

1.4.2. Climate and Weather

Iowa has a continental climate with hot, moist summers and cold, generally-dry winters. The Iowa Annual Weather Summary for 2021 reported "temperatures averaged 50.0 degrees or 1.6 degrees above normal while precipitation totaled 31.06 inches or 4.49 inches more than normal." The year ranked as the 16th warmest and the 57st driest year on record.

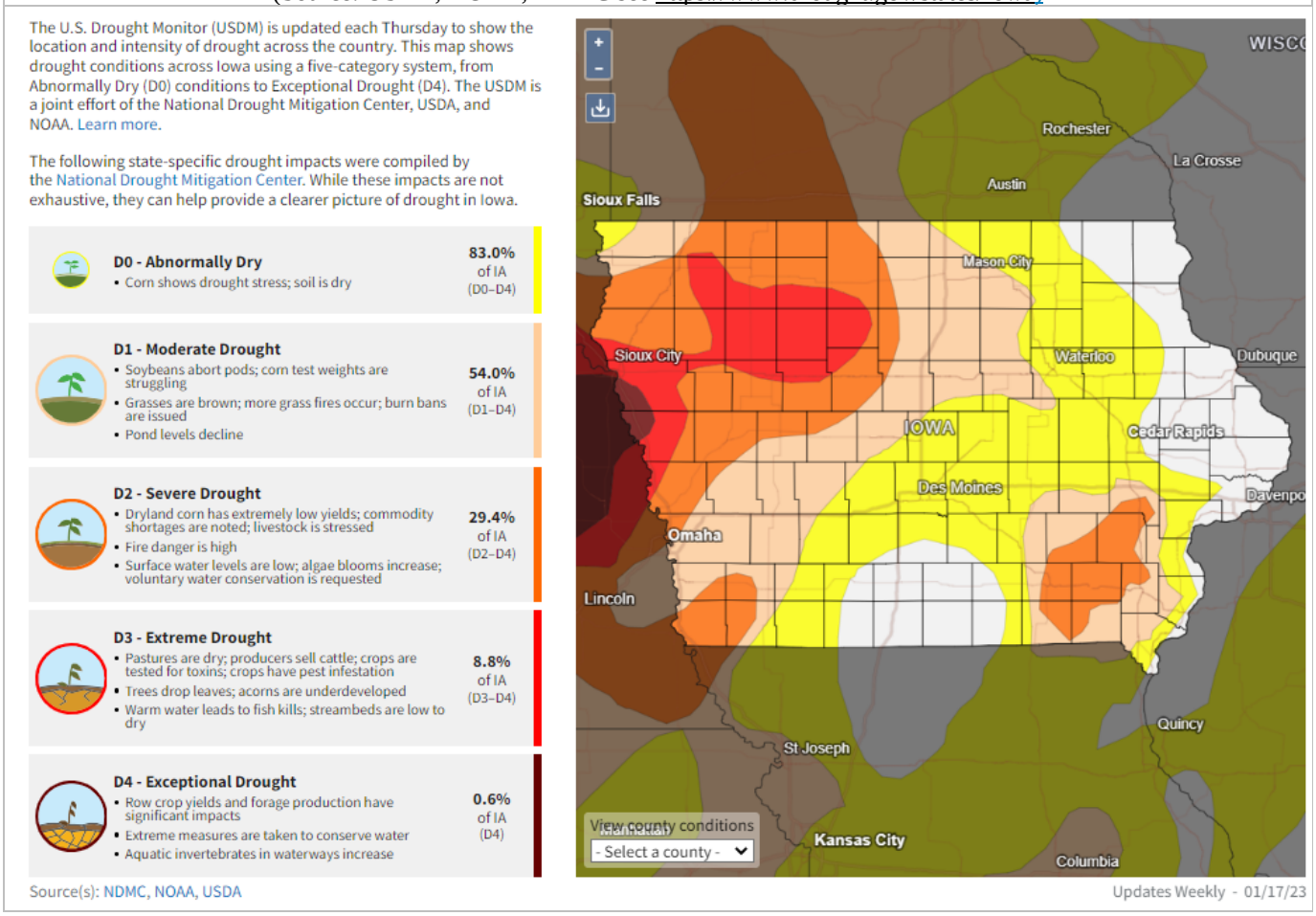
Figure 1-11: Iowa Annual Weather Summary, 2021.
(Source: Iowa Department of Agriculture & Land Stewardship)



Nearly every year, somewhere in the state a maximum temperature will exceed 100 degrees Fahrenheit and a minimum temperature of minus 20 occurs. The average annual precipitation is 34 inches for the state, ranging from about 26 inches in the northwest to about 38 inches in the southeast. The Great Flood of 1993 proved to be an extreme exception to historical averages. Although most of the annual precipitation falls in the warm months, snowstorms, ice storms, and occasional blizzards occur during the winter. Thunderstorms are common in summer.

The U.S. Drought Monitor started in 2000. Since that time, the longest duration of drought (D1-D4) in Iowa lasted 151 weeks beginning on August 9, 2011 and ending on June 24, 2014. There is approximately a 5 percent chance of a drought severe enough to cause major widespread crop losses in a given year.

Figure 1-12: Drought Monitor Report, January 2023
(Source: USDA, NOAA, NDMC see https://www.drought.gov/states/Iowa)



Evidence trends toward Iowa's climate growing warmer with more humidity, precipitation, and more frequent severe weather events. As the Earth warms there is more moisture contained in the air and more clouds, which cause nighttime temperatures to increase more than daytime temperatures. Iowa data shows small increases in average temperatures, but nighttime lows have been increasing at a much higher rate in the last 100 years. Seasonal cycles and ranges of species have been observed to be shifting. In 2006 the National Arbor Day Foundation updated its Hardiness Zone maps based on data from 5,000 weather stations, and northern Iowa moved from zone 4 to zone 5 indicating a wider variety of trees may now survive Iowa winter temperatures. The southeast corner of Iowa moved into Zone 6. Coldwater species of fish populations have been dropping due to groundwater temperatures and sedimentation. See the figure below for visual illustration of the changes.

Wind erosion occurs in Iowa even during winter. Its effect is especially noticeable when the snow is covered with black sediments from the erosive force of wind, even at subzero temperatures. Erosion caused by water far exceeds the amount of sediment loss by wind because of the high volume of precipitation, and its powerful erosive effects on removing sediments and associated organic matter and nutrients to water ways. However, wind erosion contributes to the significant loss of top soil, especially the loss of organic matter at the soil surface.

Figure 1-13: Hardiness Zone Map, 2015
(Source: Arbor Day Foundation see https://www.arborday.org/media/map_change.cfm)

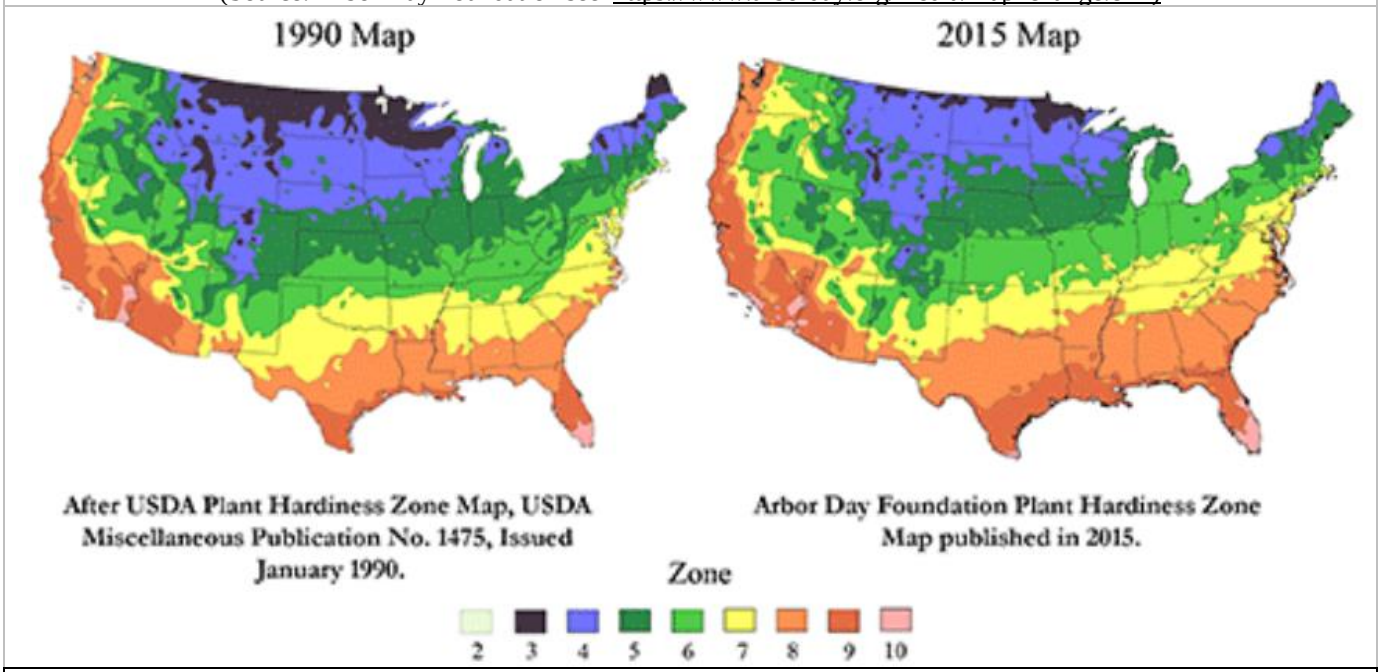
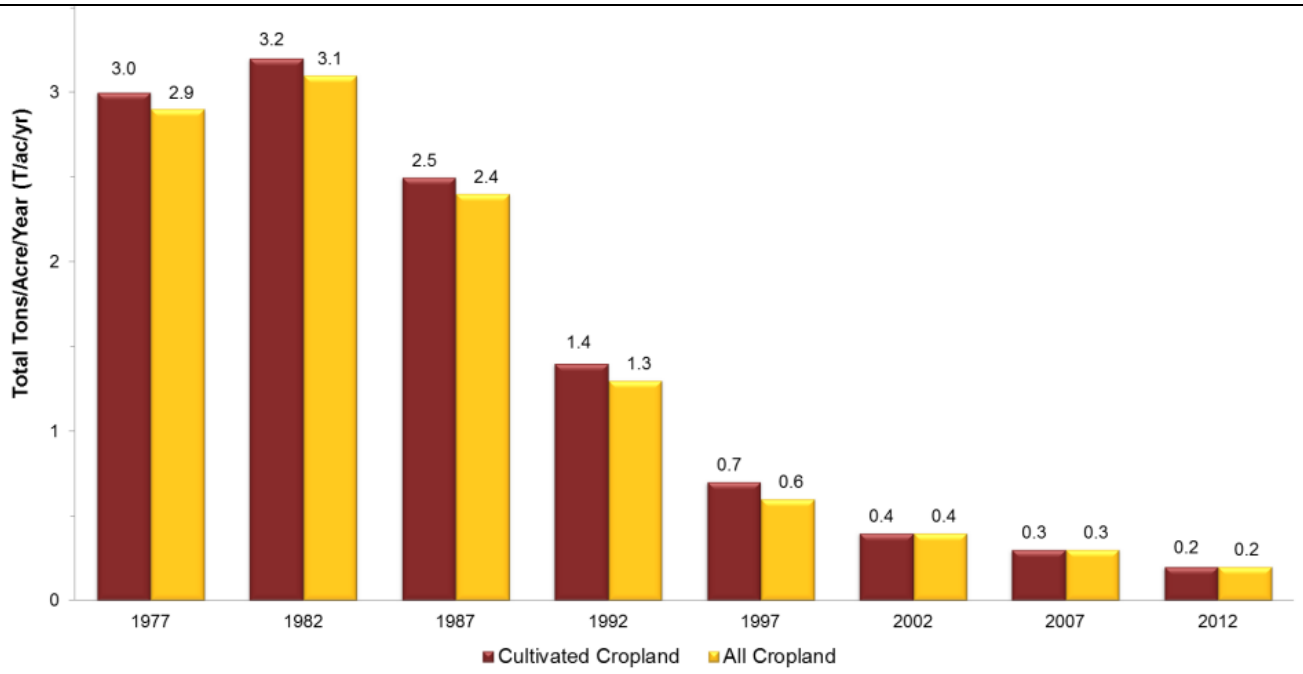


Figure 1-14: Estimated Average Wind Erosion on Non-federal Rural Land in Iowa, 2015.

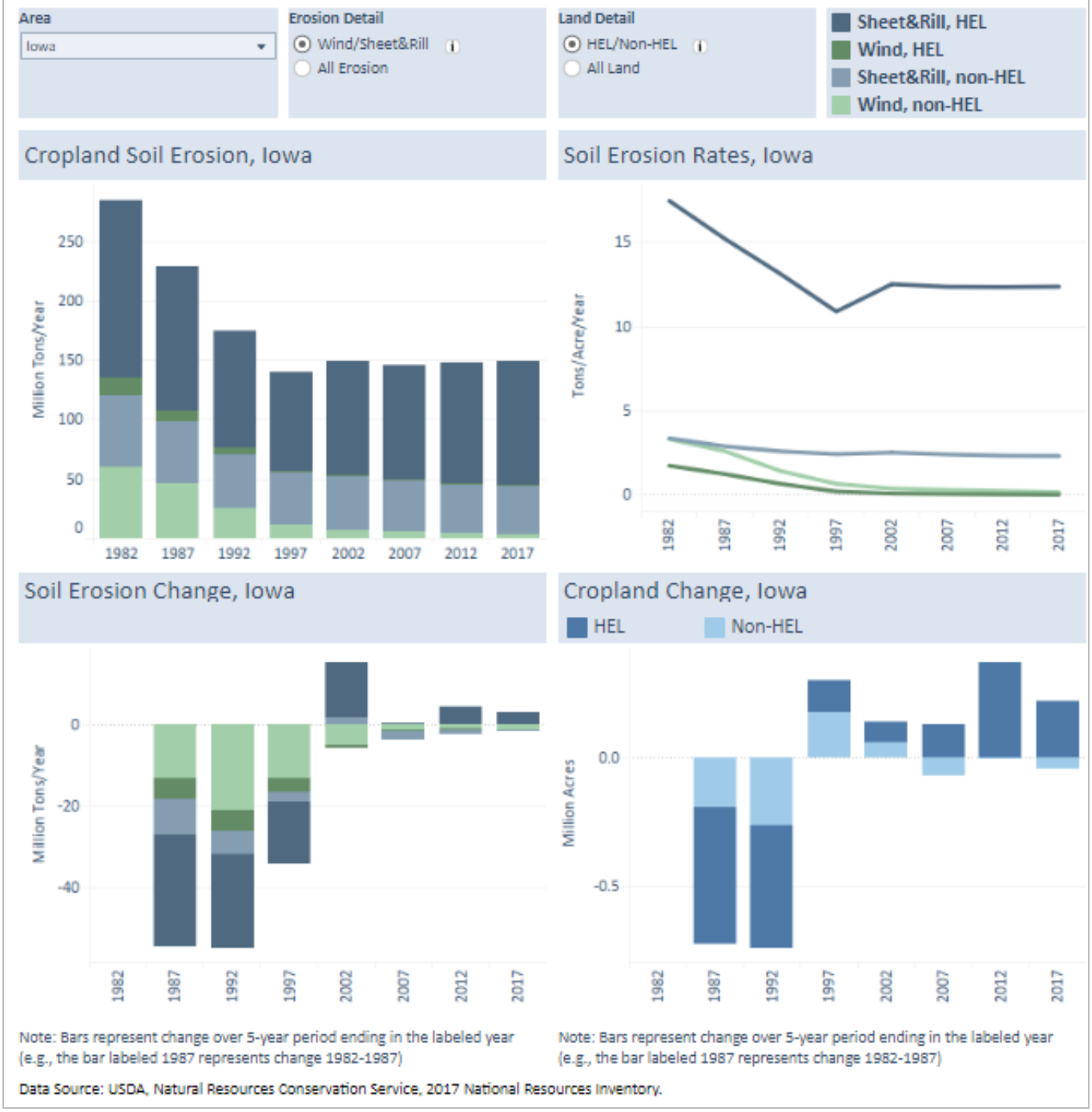


Source: USDA-NRCS 2015 National Resources Inventory Summary Report

Prepared by: Aaron Sassman, Gerald Miller, Professor Emeritus; and C. Lee Burras, Professor; Agronomy Department, Iowa State University

Updated: 01/29/2016

Figure 1-15: Cropland Soil Erosion Trends, 2017. (Source: NRCS National Resources Inventory)



1.4.3. Population and Demographics

Iowa's population according to the 2020 Census was 3,190,369. Estimates place the 2022 population at 3,200,517 earning Iowa a rank of 31st in the nation by total population. Iowa experienced as 4.7% change in population from 2010 (3,046,355) to 2020 (3,190,369). Population growth was driven largely by increases in metro areas. Current projections conclude that Iowa population in 2050 will be 3,474,647,

indicating an increase in population of 339,954 or approximately 10.8 percent. Population density in Iowa is 57.1 people per square mile for a rank of 38 when compared with other states[8].

Iowa's largest city is Des Moines. The metropolitan area spans five counties in central Iowa: Polk, Dallas, Warren, Madison, and Guthrie. The estimated total metropolitan population is 544,000, which includes the 214,133 people within the city limits of Des Moines. The second largest city is Cedar Rapids with a total population of 137,710. The chart below shows the populations of the largest cities in Iowa, according to the 2020 Census. Following the chart are county population figures based on the 2020 Census.

Figure 1-16: 2020 City Population.
(Source: US Census Bureau, see https://worldpopulationreview.com/states/cities/iowa)

Iowa's Largest Cities	City Population	County
Des Moines	214,133	Polk
Cedar Rapids	137,710	Linn
Davenport	101,724	Scott
Sioux City	85,797	Woodbury
Iowa City	74,828	Johnson
Ankeny	67,887	Polk
West Des Moines	68,723	Polk/Dallas
Ames	66,427	Story
Waterloo	67,314	Black Hawk
Council Bluffs	62,799	Pottawattamie
Dubuque	59,667	Dubuque

Population distribution within Iowa can generally be described as highest in the central and east-central regions of the state and lowest in the southwest and south-central regions. When Iowa counties are broken down by population size and proximity to a major city, central city metropolitan and outlying metropolitan counties were the only ones to experience significant growth in the number of children of any race or ethnicity during the 2000s – 10 percent and 19 percent, respectively. Rural counties saw an increase of less than 3 percent and regional centers and small urban counties saw losses in young child population[9].

Iowa is largely comprised of persons considering themselves White or Caucasian, totaling 90.1 percent of the population. As with other states, particularly those with significant agriculture, persons of Hispanic origin continue to represent a higher proportion of the population. In 2020 estimates, persons considering themselves of Hispanic or Latino origin accounted for 6.7 percent of the total state population which constitutes an increase of 1.1 percent from the last plan update. Iowa has a median population age of 38.3 years. This age ranks 28th in the country compared with other states[10].

[8] https://www.census.gov/data/tables/time-series/dec/density-data-text.html

[9] 16442 Iowa Legislation Statewide Population Trends Part 1

[10] https://datacommons.org/place/geoId/19?utm_medium=explore&mprop=age&popt=Person&hl=en

Figure 1-17: Population by County, 2020. (Source: Iowa Data Center)

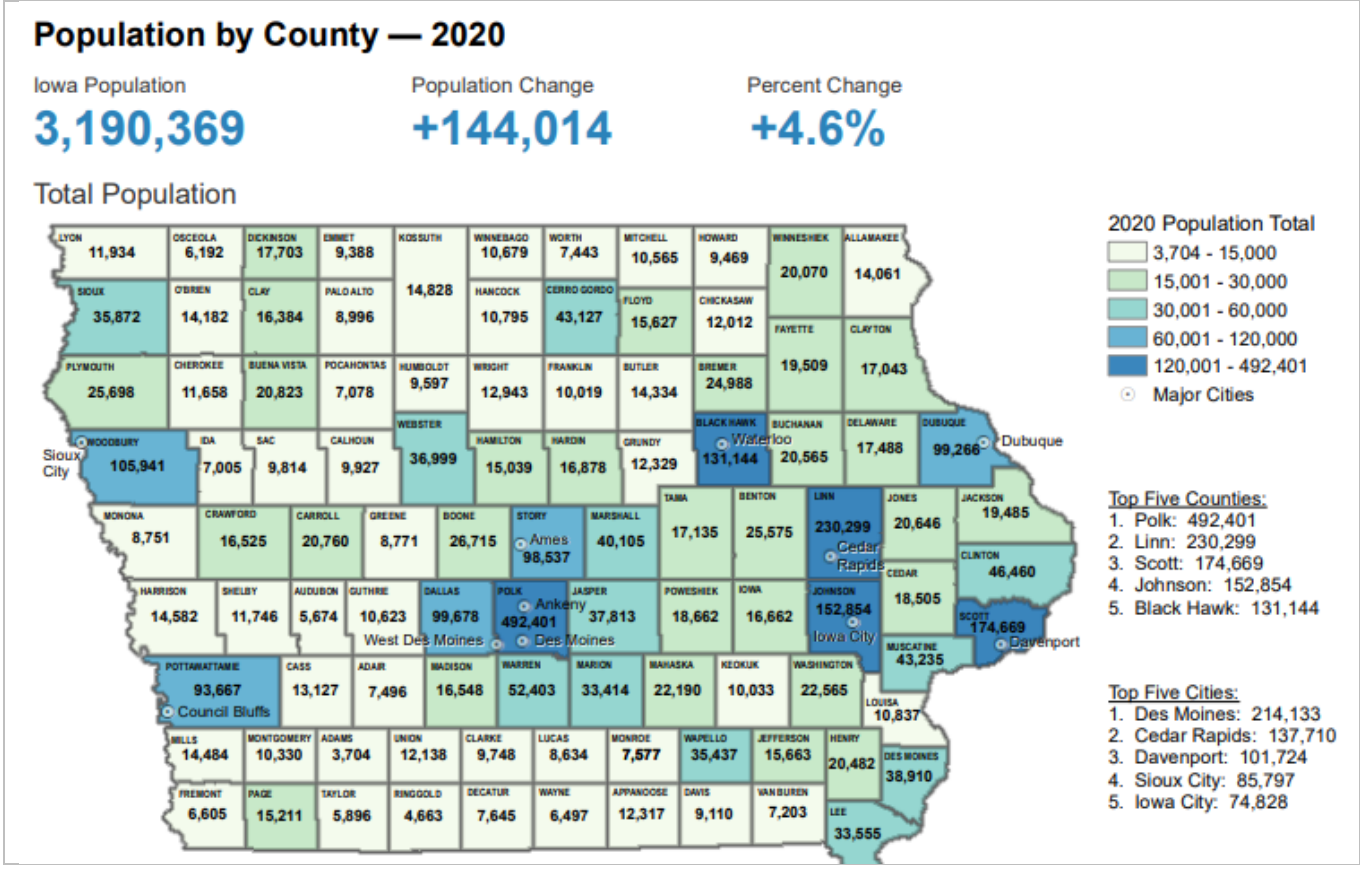


Figure 1-18: Iowa Demographics, 2020 (Source: US Census Bureau)			
Percent Population by Age		**Percent Population by Race**	
0-5 years	5.9%	White	90.1%
Under 18 years	23.1%	Black	4.3%
65+	17.7%	American Indian, Eskimo, Aleutian	0.6%
Median Age: 38.3 years		Hawaiian or Pacific Islander	0.2%
		Latino (of any race)	6.7%
		Reporting two or more races	1.9%

The US Census Bureau American Community Survey (ACS) estimated a total of 1,300,467 households in Iowa as of 2021. ACS estimated the average size of Iowa's households at 2.38 persons and the average family size at 2.99.[11]

Iowa's population living in urban areas represented more than 60 percent of the state in 1990. In 2016, more than 64 percent of Iowans lived in urban areas. Of the rural population, significant changes occurred between 1990 and 2000 relative to farm and nonfarm households.

Figure 1-19: Household Locations, 2019.
(Source: U.S. Census Bureau)

Percent Urban & Rural Households	1990	2000	2016	2019
Total Population: Urban	60.6%	61.1%	64.3	64.3
Total Population: Rural	39.4%	38.9%	35.7	35.7

1.4.4. Iowa Housing Characteristics

In 2021, the number of housing units in Iowa was estimated at 1,426,108, at 0.8% increase from a year prior. The owner-occupied housing rate is 71.6%. As of 2016, it was estimated that less than half of all housing units in Iowa were constructed before 1960, and units constructed before 1940 represented approximately 26.3 percent of Iowa's total units. In 2016, housing units in Iowa that were less than 16 years old represented 14.4 percent of all units.

Figure 1-20: Number of Housing Units, 2020
(Source: U.S. Census Bureau)

Year	Total Housing Units
1940	726,654
1950	811,912
1960	905,295
1970	964,060
1980	1,131,299
1990	1,143,669
2000	1,232,511
2010	1,327,302
2015	1,362,619
2020	1,412,789[12]

Home ownership in Iowa had increased over the past 20 years, but in 2015 a drop occurred. Time will tell whether this was a blip on the radar due to the housing crisis and economic downturn of 2008 or a new trend. The percentage of units rented has decreased proportionately with home ownership generally, but shows a small uptick in the most recent data. In 2015, 71.5 percent of Iowa's total housing units were owner occupied whereas the 2010 percentage was 73.2 for home ownership. In 2021, 71.6 percent of Iowa's total housing units were owner-occupied. However, given the economic impact of the COVID-19 pandemic on the economy, it is difficult to identify a trend.

[11] See DP02: SELECTED SOCIAL ... - Census Bureau Table

[12] Iowa: 2020 Census

Figure 1-21: Home Ownership and Median Rent in Iowa ,1900-2021
(Source: U.S. Census, American Community Survey)

Year	# Occupied	# Owned	%Occupied	Rented	% Rented	Median Rent
2021	1,426,108	1,021,093	71.6	405,014	28.4%	$845
2015	1,236,409	883,808	71.5%	352,601	28.5%	$718
2010	1,215,954	889,912	73.2%	326,042	26.8%	$663
2000	1,149,276	831,419	72.3%	317,857	27.7%	$470
1990	1,064,325	745,377	70.0%	318,948	30.0%	$336
1980	1,053,033	456,517	71.8%	296,516	28.2%	$226
1970	896,311	642,676	71.7%	253,635	28.3%	$99
1960	841,357	581,352	69.1%	260,005	30.9%	$68
1950	780,167	494,826	63.4%	285,341	36.6%	$43
1940	701,824	361,477	51.5%	340,347	48.5%	N/A
1930	635,704	340,778	54.7%	282,607	44.5%	N/A
1920	559,188	332,567	59.4%	239,880	42.9%	N/A
1910	498,943	292,951	58.7%	208,344	41.8%	N/A
1900	468,682	282,760	60.3%	183,053	39.1%	N/A

1.4.5. Public and Private Infrastructure

A. Highway and Roads

Figure 1-22: Road Miles by Owner, 2021
(Source: Iowa DOT)

Iowa DOT	8,871*
Counties	89,818
Municipalities	15,037
Parks & Institutions	622
Federal agencies	138
Total miles	114,486*

*Totals exclude ramps. The Iowa DOT maintains 9,387 miles of roadway, including 494 miles of ramps.

Iowa's highway network is the backbone of the state transportation system and accounts for the vast majority of investments. In 2017 the total number of registered vehicles equaled 3,750,077 with 2,277,194 of these classified as trucks and truck-tractors. More than 1.077 billion gallons of gasohol were purchased in 2004. Motor vehicles on Iowa's public roads traveled an estimated 33.13 billion miles in 2020. The busiest spot on Iowa's roadways is on I-235 in Des Moines between 56th Street and 42nd Street, where the average daily traffic count in 2015 was 130,800 vehicles per day. In 2017, motorists drove about 33.7 billion miles in Iowa compared with just under 31 billion miles in 2007.

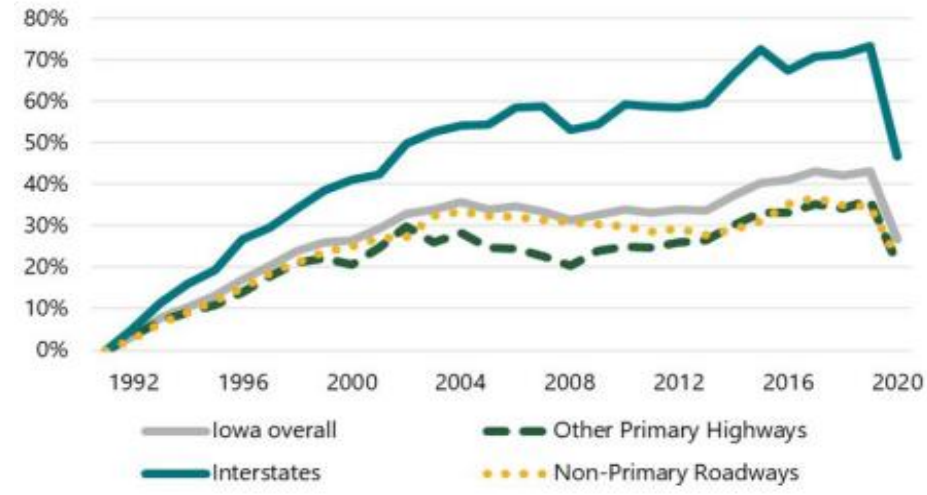
The primary road system, which is managed by the Iowa Department of Transportation (DOT), represents 8.2 percent of the total road mileage in the state. However, in 2015 these roads carried 62.8 percent of all vehicular traffic. The weighted average daily count on Iowa's interstate highway system is 21,910 vehicles in rural areas and 42,689 in municipal areas. The weighted average daily traffic on rural county roads is 163 vehicles and the average on municipal streets is 1,311 vehicles.

Figure 1-23: National Highway System. (Source: Iowa DOT)

Iowa's roadways have been built over the past century, and thousands of miles of the primary system have had significant resurfacing or overlay work to keep them in serviceable condition.

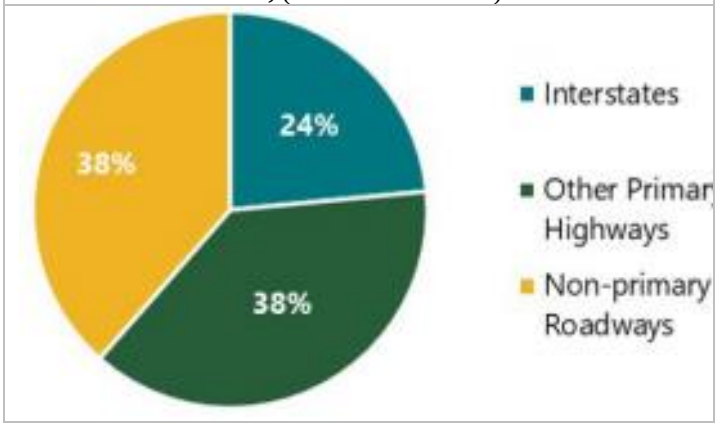
Figure 1-24: Year built and number of overlays for primary system pavements. (Source: Iowa DOT)

Figure 1-25: Percent Change in VMT, Base Year 1991 (Source: Iowa DOT)



The Iowa DOT reports that vehicle miles traveled (VMT) in the state increased steadily throughout the 1990s. Growth leveled off in the mid-2000s, then increased again in the late 2010s. However, the COVID-19 pandemic in 2020 caused significant drops in VMT. Preliminary 2021 data suggests a return to near pre-pandemic VMT levels, but uncertainty remains as to whether the future trend will stay relatively flat or begin to increase again.

Figure 1-26: Distribution of Vehicle Miles Traveled, 1991-2020, (Source: Iowa DOT)



VMT growth has not been equal across the system. Overall, Interstate VMT growth has far outpaced the remainder of the system, reflecting the continued importance of the routes for intrastate and interstate freight and passenger traffic. Over the last 30 years, Interstates and other primary highways have accounted for 62% of the VMT on Iowa's roadway system, with secondary and municipal highways and roadways accounting for the remainder. [13]

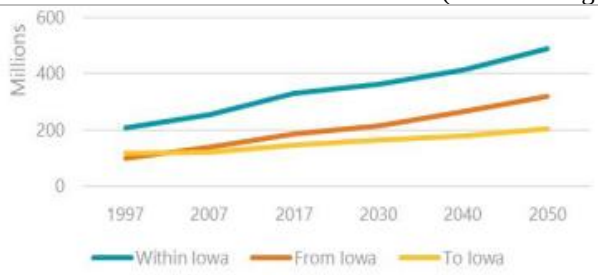
According to the Federal Highway Administration's Freight Analysis Framework (FAF) tool, freight tonnage moving in the U.S. will double in the next 20 years, which would prove to be a sizable challenge for the overall freight transportation system. This growth will be reflected in Iowa and likely won't be uniform across all modes.

FAF integrates data from a variety of sources (including the Commodity Flow Survey) to create a comprehensive picture of freight movement among states and major metropolitan areas. The tool estimates tonnage, value, and domestic ton-miles by region of origin and destination, commodity type, and mode for current and forecasted years. Understanding the flow of freight by weight provides insights into the infrastructure needs in Iowa, while understanding the flow of freight by value provides insights into the economic impact it has on the area. Iowa's transportation system facilitated the movement of over

[13] Iowa In Motion 2022 State Transportation Plan Chapter 3: System Overview

666 million tons of freight with an estimated value of $383 billion in 2017. The total weight of goods imported into and exported out of the state is expected to grow. Since the turn of the century, Iowa has remained an exporting state, meaning the state produces and exports more goods than it imports. This is true both in terms of tonnage and value. The gap between Iowa's imports and exports is projected to grow wider, from 40 million tons in 2017 to 115 million tons in 2050.

Figure 1-27: Iowa Freight Movement and Projected Growth by Tonnage
(Source: Freight Analysis Framework, 2019)



Mode	Percent of total tonnage (2017)	Percent of total tonnage (2050)
Truck	68.23%	68.11%
Pipeline	15.89%	16.57%
Rail	9.21%	8.43%
Multiple modes & mail	5.37%	5.69%
Water	1.29%	1.19%

Aviation and Other Modes were excluded as they account for less than 1% of total tonnage.
Source: Freight Analysis Framework

Truck, rail, and pipeline are the three top modes and collectively transport 93 percent of the tonnage to, from, and within Iowa. These three modes are expected to maintain their prominence through 2050. In addition, the share of each mode's tonnage is expected to remain consistent with small changes of less than one percent. The continued prominence of trucks coupled with the projected 52 percent increase in tonnage will have a large impact on the state's highway system. It will result in increased congestion and more rapid deterioration of pavement and structures along the roadway.

B. Bridges

The deck area of the bridges on the Primary Highway System is over 1074 or 1.68 square miles. The State is responsible for oversight of the statewide bridge inspection program according to federal regulations. All bridges are inspected by; the local jurisdiction responsible for the roadway crossing a bridge. The State has delegated this responsibility to the local agencies through Iowa Code section 314.18.

The State's oversight of local bridge inspections is managed through the Structure Inspection and Inventory Management System (SIMS). SIMS is a web-based software system used to document all bridge inspections statewide. Oversight is also performed through annual field inspections of a group of counties and cities for quality assurance.

The Average Daily Traffic (ADT) crossing a bridge is a major factor for making decisions to repair or replace a bridge. Many bridges on the Secondary Highway System (county and city routes) do not have a very high ADT.

Half of the poor bridges on the County Highway system carry fewer than 35 vehicles per day. The County highway system accounts for the majority of the Poor bridges in the state. An ADT of 40 Vehicles is considered "low volume".

Counties do a good job maintaining the bridges that carry the majority of the traffic. Over half of the Poor bridges on the County highway system are highway are posted for weight restrictions. The weight limits allows safe use of these bridges.

It is not cost effective for a local agency to spend a significant amount of money on their low volume bridges. With limited funding, it is best to keep a Poor bridge in service when it is able to accommodate the traffic crossing it.

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Figure 1-28: National Bridge Inventory, 2020
(Source: Iowa DOT)

Bridges in the National Bridge Inventory (NBI) require inspection frequency for most bridges not to exceed 24 months, according to the National Bridge Inspections Standards (NBIS).
Structures included in the NBI are highway bridges on public roads.
Bridges not part of the NBI are structures such as railroad, toll, privately owned, and pedestrian bridges.
There were 618,465 bridges in the 2020 NBI nationally. 45,031 were considered to be in Poor condition.

IOWA RANKING IN THE FOLLOWING CATEGORIES	
Number of bridges	7th
Number of poor bridges	1st
Total Deck Area (ft^2)	18th
Poor Deck Area (ft^2)	7th
Number of NHS bridges	24th
Number of poor NHS bridges	41st
Poor NHS Deck Area (ft^2)	27th
Poor NHS Deck Area (% of total area)	35th

WHO HAS THE MOST IN THE FOLLOWING CATEGORIES?	
Number of bridges	Texas
Number of poor bridges	Iowa
Total deck area	Texas
Poor deck area	California
Number of NHS bridges	Texas
Number of poor NHS bridges	California
Poor NHS deck area	California
Poor NHS deck area (% of total area)	Rhode Island

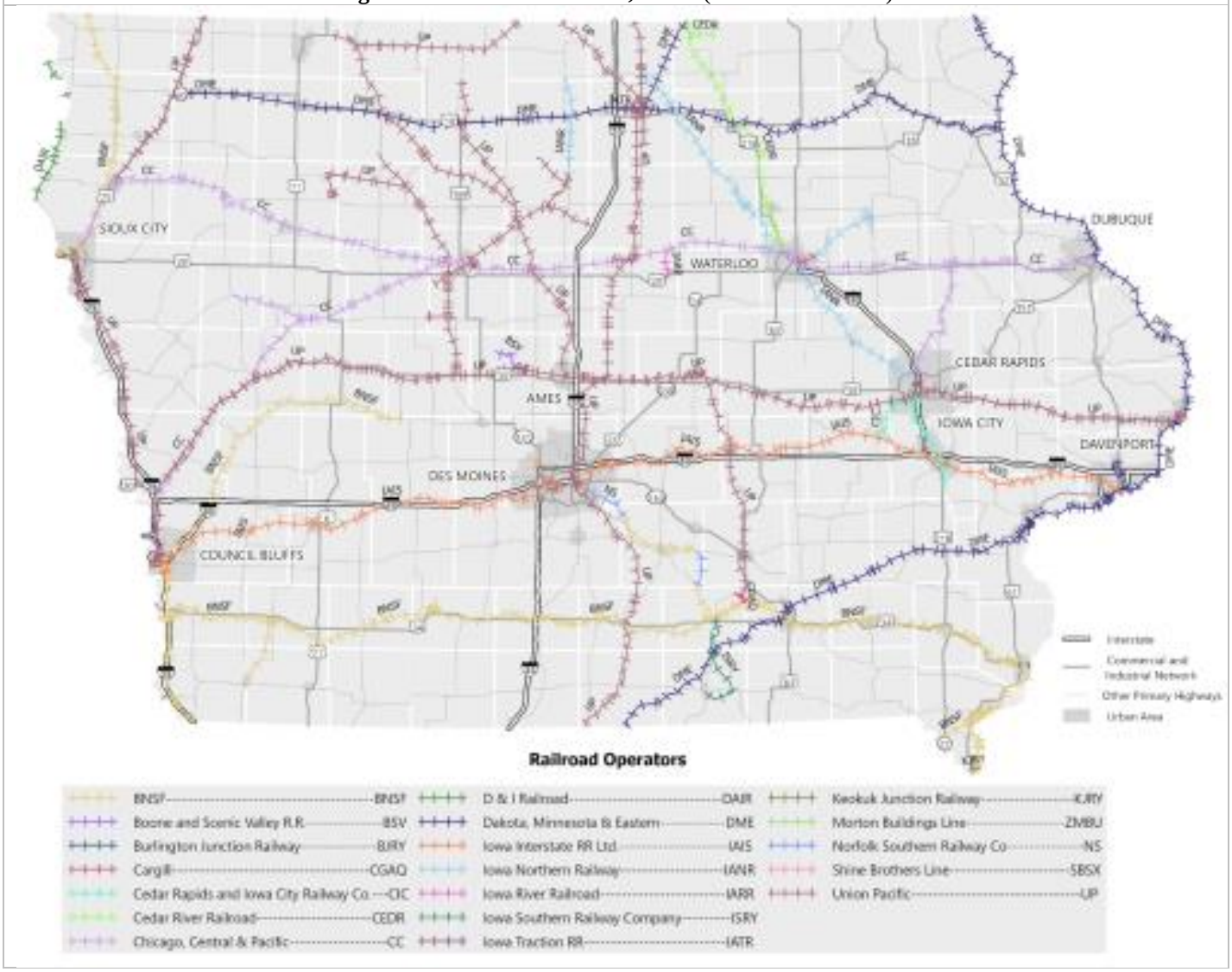
C. Railways

Iowa's rail transportation system provides both freight and passenger service. Rail serves a variety of trips, including those within Iowa and those to other states, as well as to foreign markets. While rail competes with other modes, it also cooperates with those modes to provide intermodal services to Iowans. Iowa's active railroad lines are shown in the map below and total 4, 207 operable miles.

Rail service in Iowa is privately owned and operated by 18 railroad companies. Five of these railroads are major national companies and operate nearly 85 percent of Iowa's total miles. In 2015, 53.9 million tons were shipped by rail, and 38.5 million tons were received.

In 2019 Iowa had 5,157 public highway-rail crossings on state, city and county highways. Of those crossings, 4,412 are at-grade crossings. Approximately 2,417 additional crossings are located on private property (at businesses, farms, and private homes). In 2020 there were 25 highway-rail crashes at public crossings. Since 1985 crashes at highway-rail crossings have decreased even as there have been increases in rail car miles and motor vehicle miles.

Figure 1-29: Railroad Service, 2022. (Source: Iowa DOT)



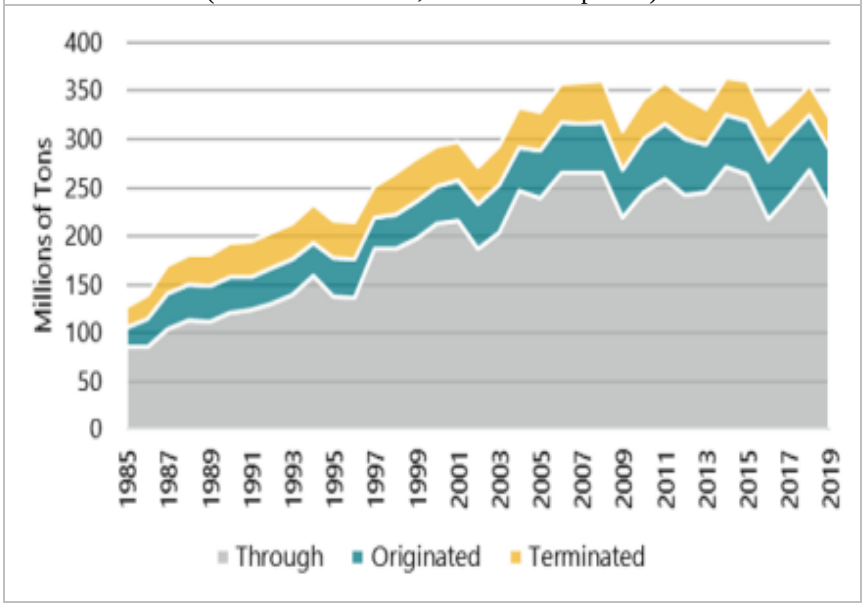
Iowa railroad mileage peaked in 1911 at approximately 10,500 miles. In 2016 Iowa had 3,851 miles, which is 36.7 percent of the peak mileage. A great variety of commodities, ranging from fresh fish to textiles to optical products, are moved by rail. However, most of the Iowa rail shipments consist of bulk commodities, including grain, grain products, coal, and fertilizers. The railroad network performs an important role in moving bulk commodities produced and consumed in the state to local processors, livestock feeders, river terminals, and ports for foreign export. The railroad's ability to haul large volumes for long distances at low costs will continue to be a major factor in moving freight and improving the economy of Iowa.

The condition of Iowa's rail network has improved substantially since the 1980s as a result of infrastructure investments and abandonment of inadequate rail lines. Before the 1980s, Iowa was plagued by rail lines that could not handle cars weighing 263,000 pounds, slow operating speeds, and rail weights of less than 90 pounds per yard.

Today's rail network is typified by heavier rail weights that can safely handle larger and heavier cars and locomotives at faster speeds. Between 1985 and 2010 net ton miles have nearly tripled while rail miles

have fallen by 830 miles. With today's rail equipment, railroads have placed an increased importance on the condition and clearances associated with their tracks and bridges.

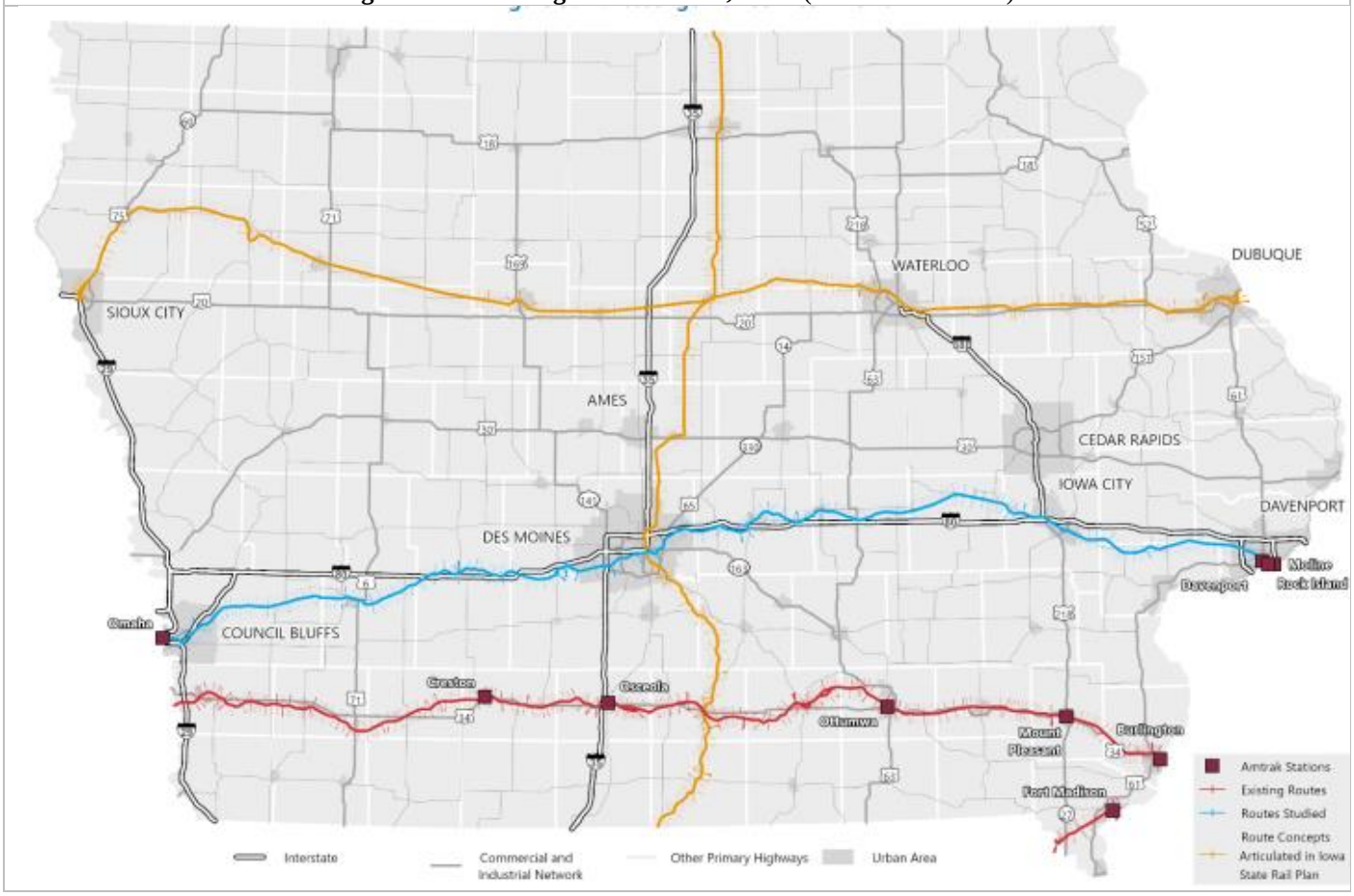
Figure 1-30: Rail movements in Iowa, 2020
(Source: Iowa DOT, Railroad Companies)



The majority of freight movements are passing through the state. Regarding freight that originates from or terminates in the state, Iowa produces more goods than it imports; in recent years, this has been by as much as a 2-1 margin.

Iowa AMTRAK passenger routes consist of 297 rail miles in Iowa. In 2018, the average annual ridership for AMTRAK was 57,955. Passenger service in Iowa is currently provided by the California Zephyr from Chicago, Ill. to Oakland, Calif., and the Southwest Chief from Chicago, Ill. to Los Angeles, Calif. The California Zephyr operates over the Burlington Northern Santa Fe (BNSF) tracks in southern Iowa, providing daily service in both directions.

Figure 1-31: Passenger Rail Service, 2022. (Source: Iowa DOT)

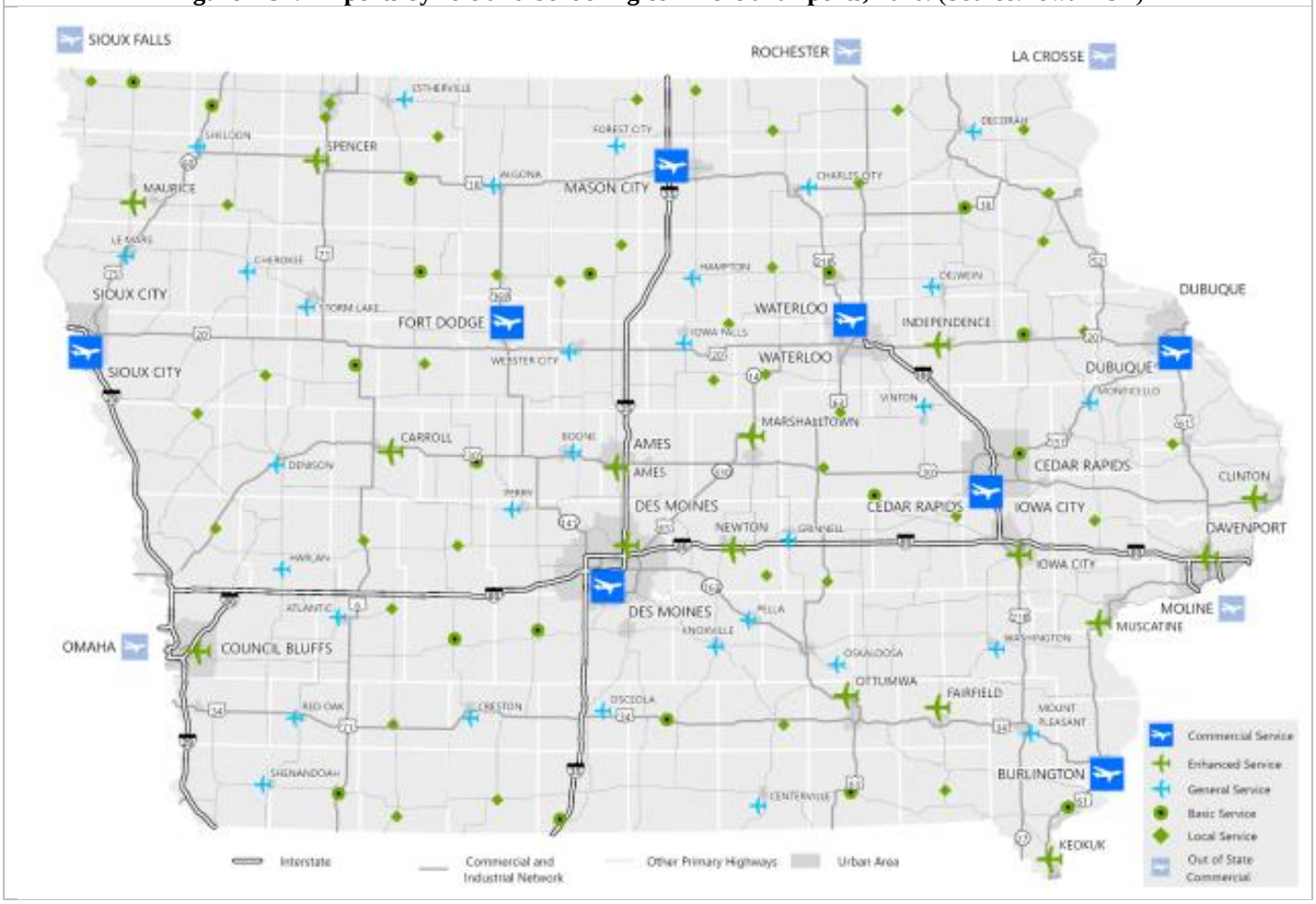


Stations include Burlington, Mount Pleasant, Ottumwa, Osceola, and Creston. The Southwest Chief also operates daily in both directions over the BNSF tracks in extreme southeast Iowa with one stop in Fort Madison. The map below identifies route concepts, those the subject of studies, and those articulated in the State Rail Plan.

D. Airports

Iowa's system of airports provides a variety of services vital to the state's economy and is an integral part of Iowa's overall transportation system. Iowa has 107 publicly-owned airports that serve general aviation activity, with eight of those airports offering commercial air service. An additional eight privately-owned airports are also open for public use. There are 125 private-use heliports and landing zones in Iowa used for helicopter EMS operations.

Figure 1-32: Airports by role and bordering commercial airports, 2020. (Source: Iowa DOT)



Scheduled air passenger service allows rapid access to national and international destinations. Iowa generates 2.5 million commercial airline passenger boardings each year. There are approximately one million aircraft operations at publicly-owned airports in Iowa each year, with nearly 90 percent of those operations from general aviation (non-airline, nonmilitary) activity.

More than 135 million pounds of cargo is transported through Iowa's airports each year. General aviation airports support business and recreational flying at communities throughout the state and are important economic assets for those communities. With an expanded UPS facility at the Eastern Iowa Airport (CID)

and the addition of Amazon at the Des Moines International Airport (DSM), air cargo growth rates will increase.

In 2016, there were more than 3,700 Federal Aviation Administration registered aircraft and 5,000 active licensed pilots. The following map indicates the location of commercial and general aviation airports, as well as private landing strips and heliports.

Both the commercial service and general aviation segments of the aviation industry continue to evolve in response to market forces, new technologies and regulatory actions. Within this dynamic environment, the Iowa Aviation System Plan provides direction for the development of Iowa's system of publicly-owned airports. It also addresses efforts to maintain and improve commercial air passenger service in the state. The plan identifies the airport infrastructure needs and initiatives the state can take to maintain a safe and efficient operating environment for aviation and respond to economic development opportunities.

E. Energy Utilities

Iowa is served by numerous electric and gas providers. These providers range from multistate firms to small municipal utilities and rural/area cooperatives. In addition to MidAmerican Energy and Interstate Power & Light, two other significant gas distribution companies include Black Hills Energy and Atmos Energy. Collectively, Iowa has 181 electric utilities serving 1,672,101 customers. More information about the number of customers of the different types of electric providers is shown in the adjoining table.

Figure 1-33: Electric Utility Profile, 2021
(Source: Iowa Utilities Board)

Type	Number of Customers and Percentage of market share	Number
Investor Owned Electric Utilities	1,209,421 (72.33%)	2
Municipal Electric Utilities	223,719 (13.38%)	136
Rural Electric Cooperatives-Distribution	238,961 (14.29%)	43
Electric Utility Totals	**1,672,101**	**181**

Having produced 8.65% of the electric energy in 2016, currently nuclear production is nonexistent in the state. No nuclear power plants are operating in Iowa. The Duane Arnold Energy Center in Palo, Iowa was decommissioned and closed in 2020. The plant ceased operating on August 10, 2020 due to Derecho Storm damage (federally-declared disaster #4557). The Derecho damage caused the permanent closure of the plant.

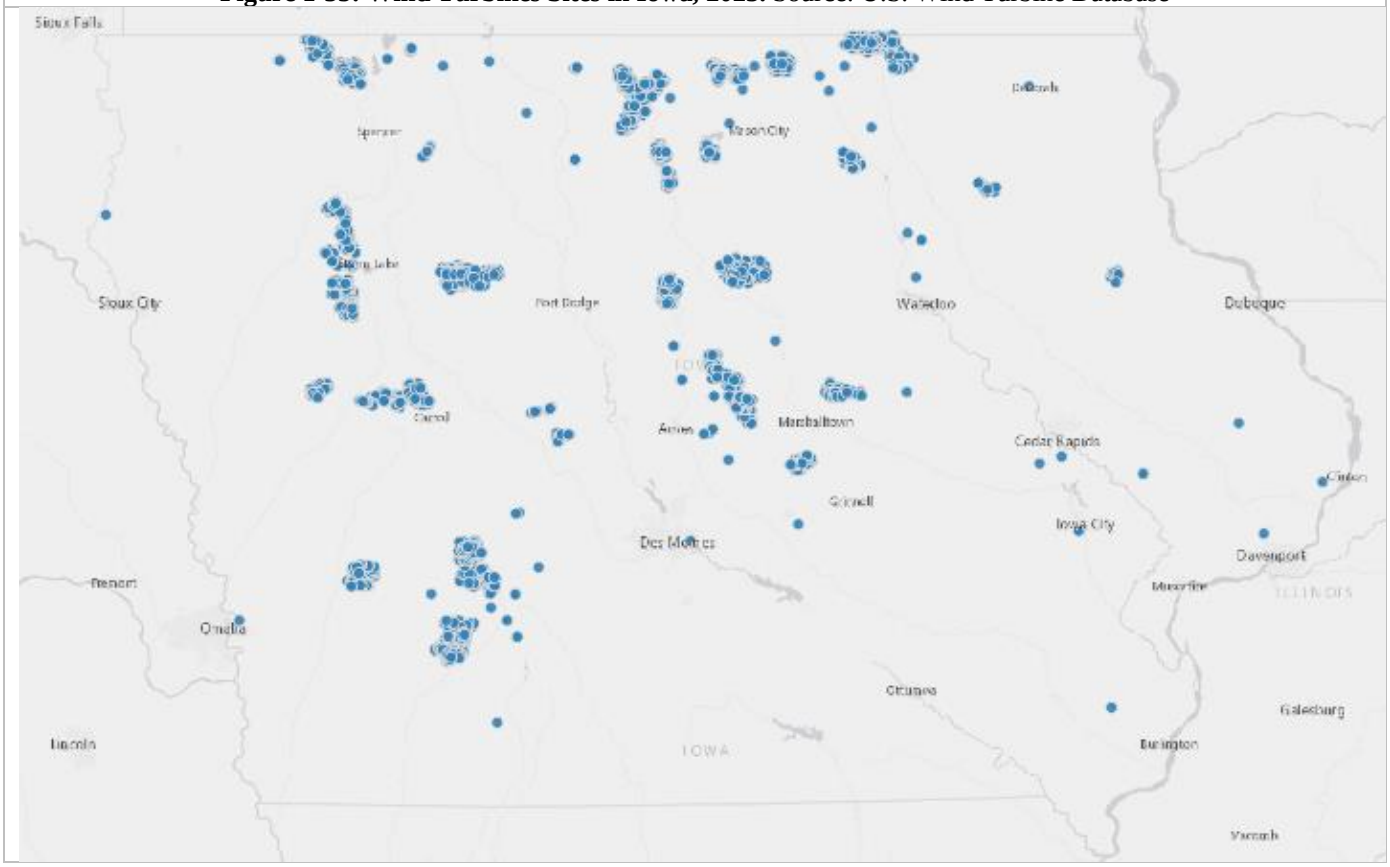
Figure 1-34: Electric Power Generation by Source, 2021. (Source: Iowa Utilities Board)

Source	2021 Generation (MWh)	Percent
Coal	22,106,594	32.89%
Natural Gas	6,463,644	9.62%
Wind	37,098,274	55.20%
Fuel Oil / Petroleum	132,111	0.20%
Solar	224,906	0.33
Hydro	980,071	1.46%
Other Renewables /Other	201,407	0.30%
Total	**67,207,008**	**100.0%**

Iowa continues to be a leader in wind energy production. From 2008 to 2010 the percent of energy produced in Iowa from wind more than doubled, and then from 2010 to 2016 the percentage doubled again. In the five year period from 2016 to 2021, wind energy replaced coal as the top means of electric energy production. Wind energy provides over half (55%) of the state's electric power and is expected to continue to rise. The adjoining chart and map provide detailed generation and other electric utility information.

At the close of 2019, Iowa ranked first in the nation for wind energy production as a share of electricity generation according to the American Wind Energy Association. The U.S. Wind Turbine Database identifies 6,220 turbines in the state.

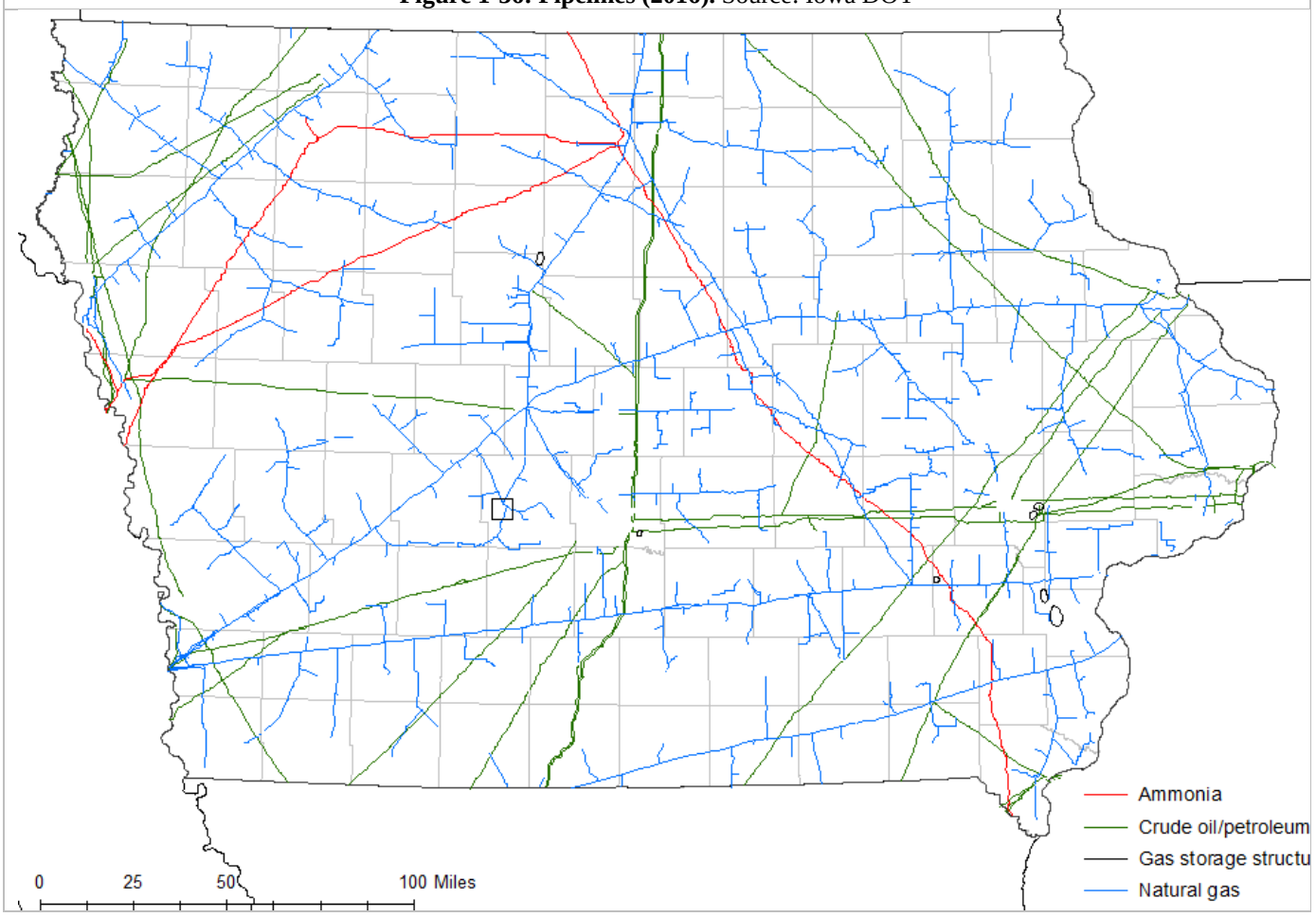
Figure 1-35: Wind Turbines Sites in Iowa, 2023. Source: U.S. Wind Turbine Database



F. Pipelines

Iowa has interstate natural gas pipelines as well as liquefied natural gas and liquefied propane facilities that provide additional supplies to customers. There are some 41,410 miles of hazardous liquid and natural gas pipelines in Iowa. Pipelines continue to provide a safe and efficient vehicle for movement of natural gas, petroleum products, and anhydrous ammonia to locations throughout the state. The adjoining map provides a visual representation of major pipeline locations in Iowa.

Figure 1-36: Pipelines (2016). Source: Iowa DOT

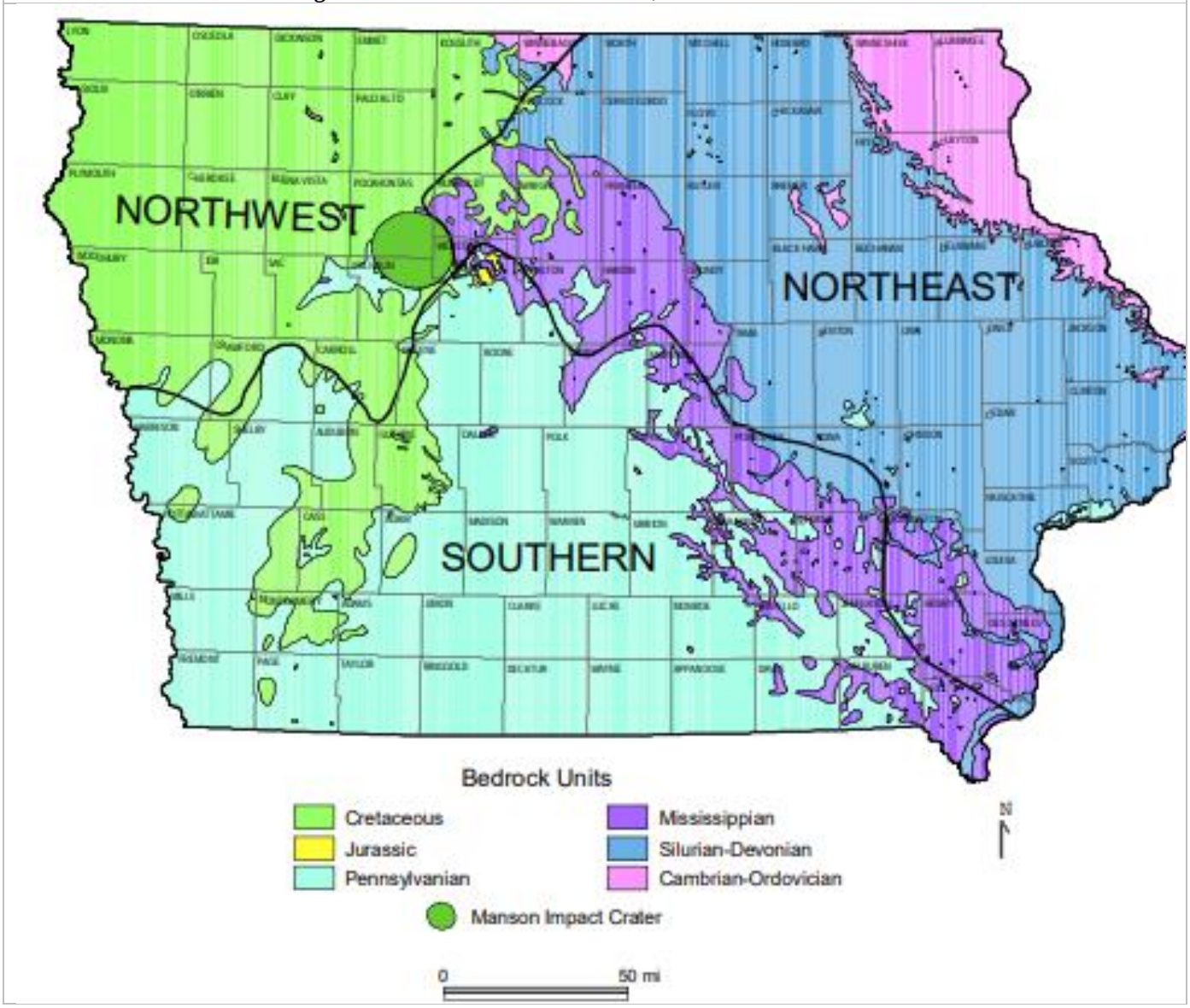


G. Source Water

A public water supply is defined in federal law as serving 25 or more people each day for at least 60 days out of the year, or having at least 15 connections. Wells that fall short of these benchmarks are defined as private. The Water Supply Section of the Iowa Department of Natural Resources regulates public drinking water supplies in Iowa according to the federal Safe Drinking Water Act, under authority from the U.S. Environmental Protection Agency.

In Iowa more than 80 percent of residents depend on groundwater for their daily water needs. The groundwater is accessed through the use of municipal or public water supply wells, or private water supply wells.

Figure 1-37: Groundwater Provinces, 2023. Source: Iowa DNR



H. Wastewater

The Iowa Department of Natural Resources (DNR) is responsible for maintaining and enhancing water quality in the state. To that end, the DNR develops waste load allocation for facilities that discharge treated wastewater (for example, domestic sewage treatment plants and industrial plants) into waters of the state in order to assure that the permitted effluent limits meet applicable state water quality standards. Local boards of health have primary responsibility for regulation of sewer systems serving four homes or fewer or less than 15 people, while the DNR has primary responsibility for larger (public) systems.

I. Communications

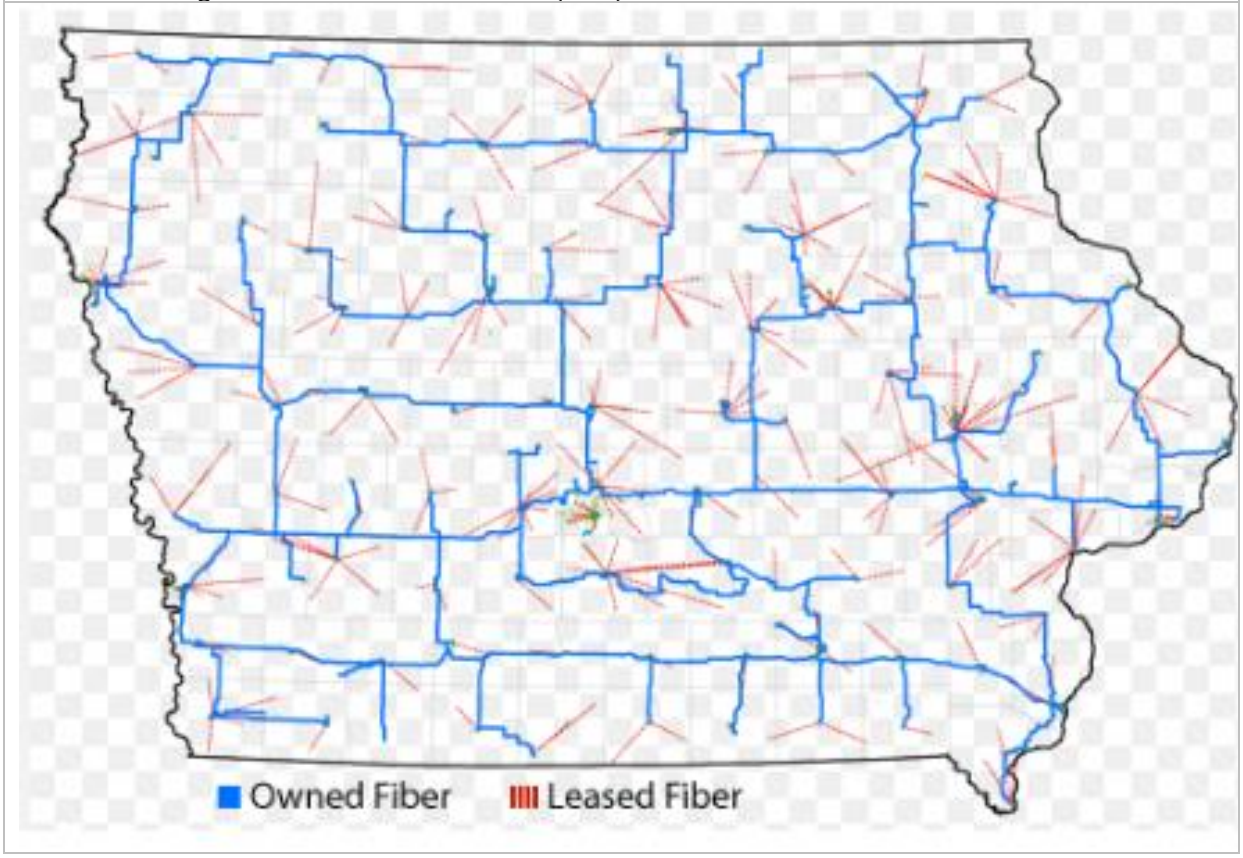
Commercial broadcast stations, both television and radio, represent the most prevalent communication systems in Iowa. The table below lists the most recent data on the number of television, radio, and newspaper resources available to Iowa's citizens. These media resources are available in a variety, and combination, of formats including visual, audio, and online.

According to University of Northern Carolina-Chapel Hill and the Knight Foundation study, each of the state's 99 counties have local newspapers with only 17 counties having a single newspaper. Of these, 33 were dailies and 229 were weekly publications for a total newspaper circulation of 1.2 million in 2019.

U.S. Census 2020 documented that 91.7% of Iowa households had a least one computer. Eighty-five (85%) of Iowa households had a broadband Internet subscription. 2019 data shows that among the number of children ages 3 to 18 living in households, 96.2 % have home internet access.

The American Community Survey (ACS), conducted by the U.S. Census Bureau, publishes detailed estimates on spoken language statistics in Iowa. In 2021, 8.37% of the households in Iowa reported speaking a non-English language at home as their primary shared language. This does not consider the potential multilingual nature of households, but only the primary self-reported language spoken by all household members. Ninety-six percent (96.8%) of the residents in Iowa are U.S. Citizens. The most common non-English languages spoken as the primary household language are: Spanish at 4.12% (121,749 households); Chinese to include Mandarin and Cantonese (11,330 households; and German (10,009 households). According to the Iowa Department of Education in 2018, 2,775 residents are deaf or hard of hearing and utilize on America Sign Language (ASL) as their native language. ASL is not an self-reporting option on the American Community Survey.

Figure 1-38: Fiber Line Network (2019). Source: Iowa Communications Network



The Iowa Communications Network (ICN) is a State of Iowa agency that administers a statewide fiber optics network. The capacity of the network enables authorized users such as hospitals, State, and federal government, public defense armories, libraries, schools, and higher education to communicate via high-quality, full-motion video using high-speed Internet connections and telephones. Each day across the state, the ICN is being used in a variety of ways by a variety of Iowans. The ICN provides a wide range of

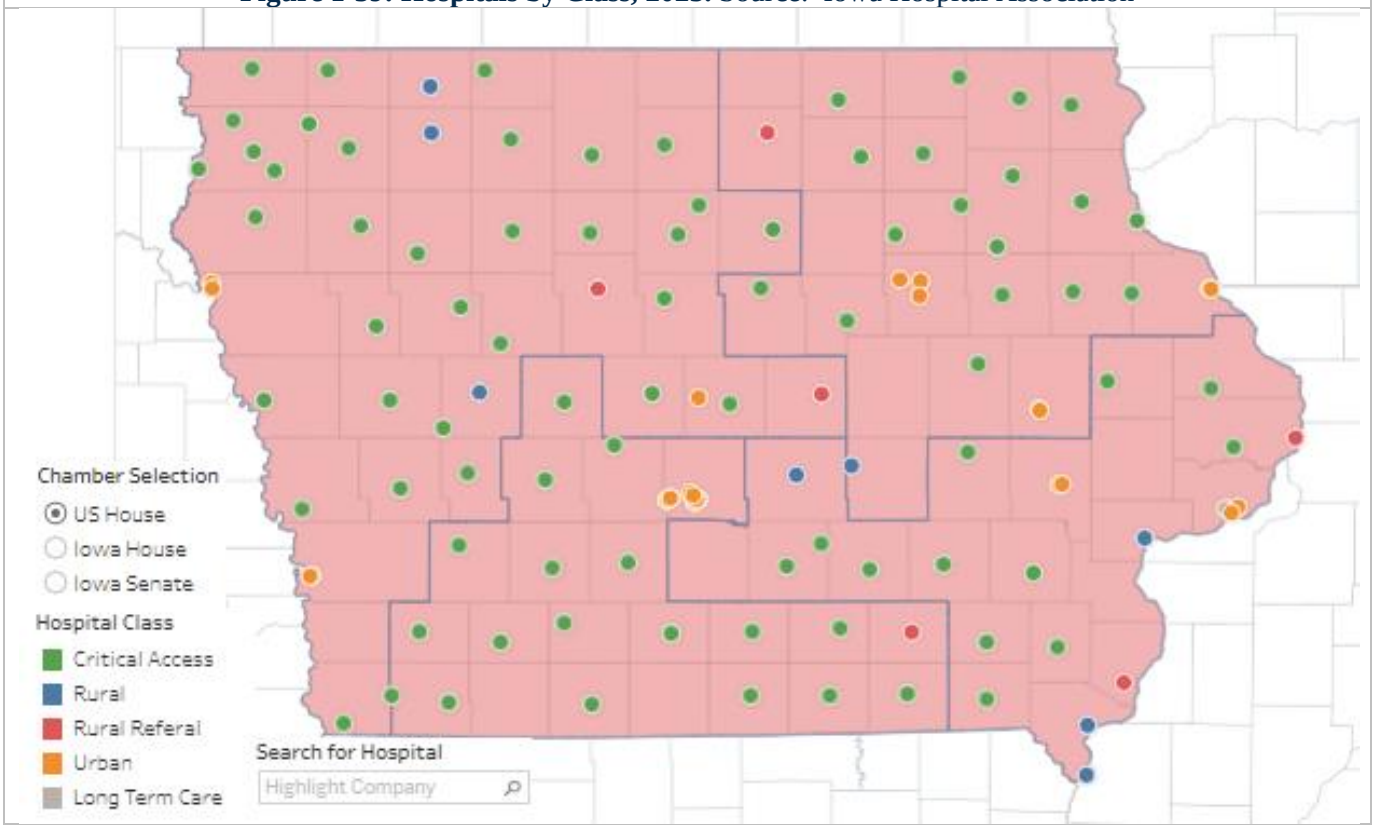
services and benefits to its authorized users such as voice, data, security, high-speed Internet and consulting services.

In addition to the mentioned communications systems, Iowa has 113 Public Safety Answering Points (PSAP) that are the first line of response to a 911 call. Each county has at least one PSAP. ICN is partnering with Iowa Homeland Security and Emergency Management (HSEMD) to use FirstNet, which was built with AT&T as the backup connection for Iowa-based PSAP's providing 911 services to Iowans. ICN has deployed FirstNet LTE connections to locations, harnessing the robust capacities of FirstNet and enabling emergency dispatchers to share critical information about the scene of an incident to first responders in a highly secure manner. In 2017, HSEMD began an initiative to help the 113 PSAPs share equipment across centers. Currently, The PSAPs remote equipment is connected to the State's host equipment through the Iowa Communications Network.

J. Medical and Hospitals

According to the Iowa Hospital Association Iowa has 117 hospitals (2023). There are numerous other regulated medical and health care facilities across the state, including long-term care facilities, hospices, end-stage renal disease units, rural health clinics, and child-placing agencies. In addition to the community hospitals, federal and/or long-term hospitals are present in Iowa, including two veteran hospitals, two State psychiatric facilities, and one alcoholism/other chemical dependency treatment facility.

Figure 1-39: Hospitals by Class, 2023. Source: Iowa Hospital Association



The Emergency Medical Service (EMS) system is a continuum encompassing prevention, out-of-hospital, hospital, and rehabilitation phases of care. The Iowa Department of Public Health is the lead agency responsible for the EMS. EMS does not exist in isolation. It is integrated with other services and systems

intended to maintain and enhance community health and will remain the public's emergency medical safety net. The EMS system must maintain a high state of readiness in order to fulfill its mission. As a component of the health care delivery system, EMS serves as the safety net for all ages, diseases, and segments of the population. EMS serves to promote the health status of Iowans through the efforts of prevention, acute care, and rehabilitation of the ill or injured.

Emergency medical services have not been a required essential county service since 1981 when the federal government shifted its financial responsibility for EMS to the states. The services relied heavily on volunteers with 75% being entirely volunteer-based. However, in 2021, the Iowa Legislature passed a law allowing counties to ask their voters to increase income and/or property taxes to support EMS as an essential service.

Key facts about the Iowa EMS system:

- Weekday staffing continues to be the most difficult challenge for volunteer ambulance service programs.
- Advancing technology and increasing national standards for training and certification are increasing the standard of patient care but often are cost prohibitive.
- Volunteer numbers are decreasing, the population is declining, and aging in rural Iowa is on the rise.
- There is an increasing volume of non-emergency and long-distance transfers.
- Volunteerism alone is no longer able to sustain a full-time ambulance service in every community.

1.4.6. Economy

Iowa is known throughout the world as America's heartland, the source of an abundant supply of top-quality agricultural and manufactured goods. The natural wealth of Iowa's soil, cutting-edge technology, world-class educational system, and quality workforce have allowed Iowa to yield a diversified economy. The Iowa work ethic has resulted in a well-deserved reputation for productivity. While proud of this characteristic, high productivity is responsible for economic shifts that continue to challenge versatility.

Productivity on the farm generated development of our manufacturing sector.

Figure 1-40: Top 5 Industries by Gross Domestic Product (2021). Source: Iowa State University, Center for Industrial Research and Service

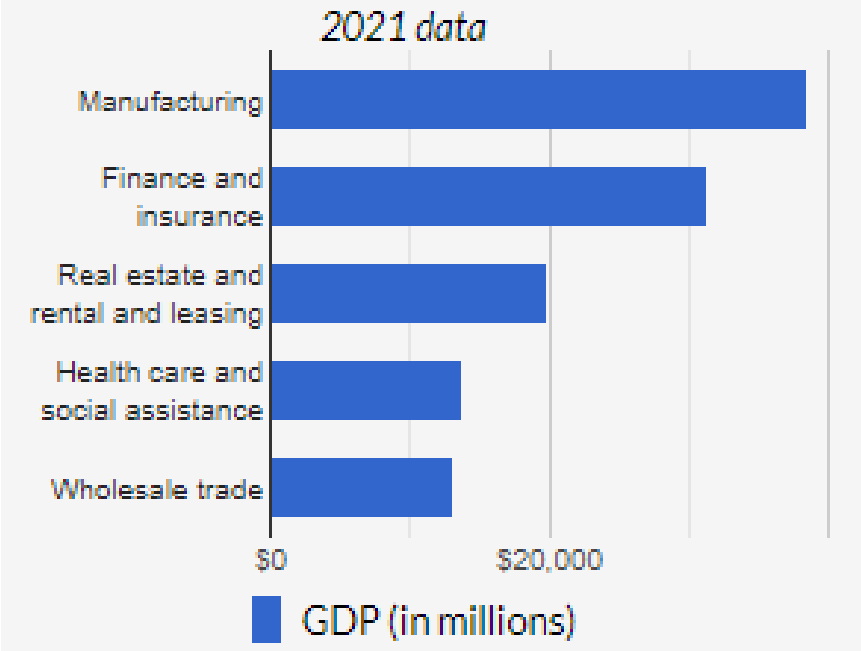
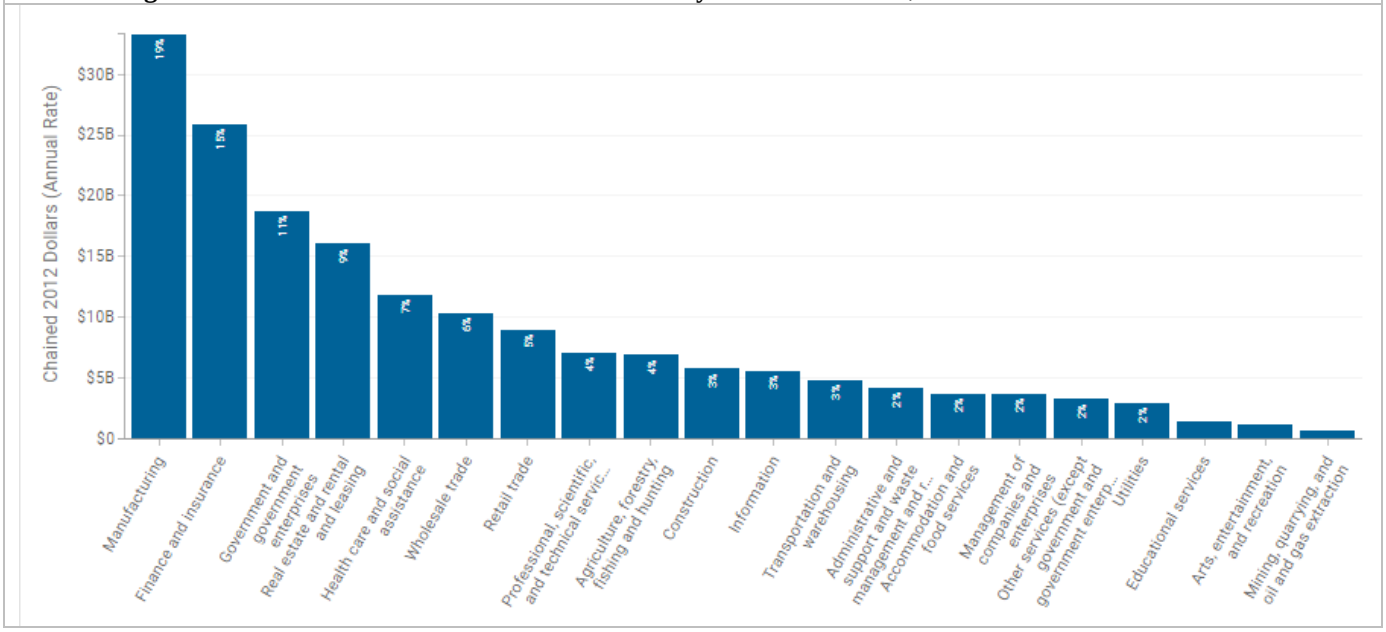


Figure: 1-41: Iowa Real Gross Domestic Product by Industrial Sector, 2022. Source: Iowa Data Center



Productivity in manufacturing, combined with sophisticated technology, has revealed a strong financial sector. Iowa has seen employment growth in the home offices of its many insurance and financial service companies in an industry that has experienced cutbacks in other states. Analysts consider the people of Iowa particularly suited to strong performance in this sector. The agricultural economy of Iowa transitioned to a diversified economy of green-energy production, biotechnology, information technology, financial services, processing and manufacturing.

1.4.7. Labor Force

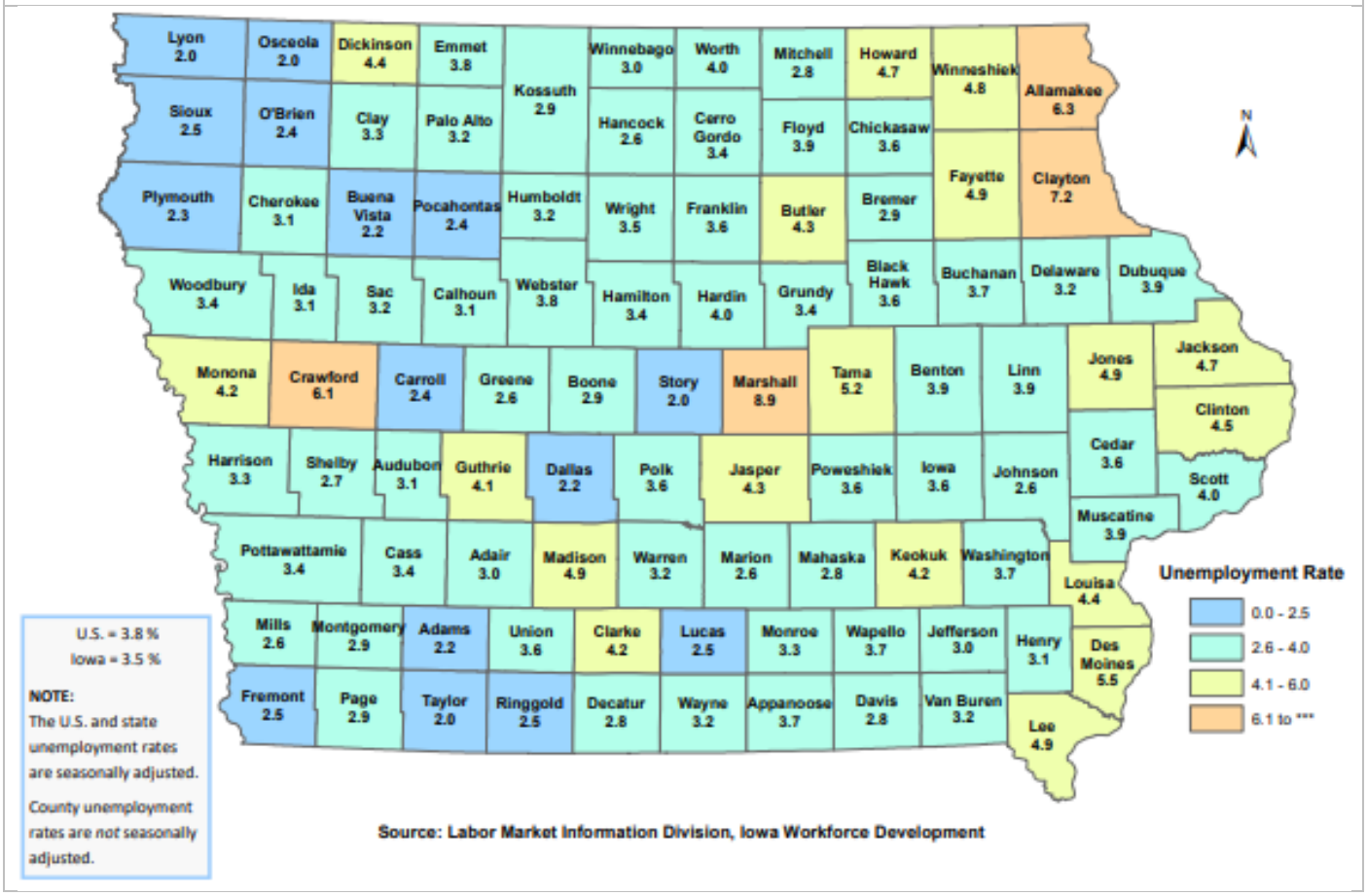
As of February 2022, Iowa's labor force included 1,700,900 workers with an unemployment rate of 3.8 percent. Farm-related employment accounted for 7.1 percent of the labor force with 92.9 percent working in nonfarm employment. The trade, transportation, and utilities section represents the highest employment levels with 20.2 percent of the nonfarm total, followed by government with 16.3 percent and education and health with 14.4 percent. Unemployment rates across Iowa are shown in the adjoining map (for most recent figures go to Iowa Economic Development Authority).

Figure 1-42: Annual Average Labor Force Data, Dec. 2022. Source: Iowa Data Center, US Bureau of Labor Statistics	
Labor force	1,709,700
Unemployed	53,200
Rate (%) Unemployed	3.1%

Figure 1-43: Employment Statistics by Industry, Farm and Non-Farm (Persons age 16 and up), Dec. 2022. Source: Iowa Data Center, US Bureau of Labor Statistics	
Farm-Related Labor Force	122,200 (7.1%)
Non-Farm Related Labor Force	1,587,500 (92.9)

Figure 1-44: Employment Statistics by Non-Farm Industries, Seasonally Adjusted(Persons age 16 and up), Dec. 2022. Source: Iowa Data Center, US Bureau of Labor Statistics	
Trade, Transportation & Utilities	313,900 (20.2%)
Government	206,300 (16.3%)
Education & Health	229,900 (14.4%)
Manufacturing	227,400 (13.8%)
Retail Trade	178,300 (11.5%)
Professional & Business Services	140,900 (8.9%)
Leisure and Hospitality	148,000 (8.9%)
Finance	109,800 (6.8%)
Construction	79,500 (4.5%)
Other Services	56,700 (3.8%)
Information	18,700 (1.6%)
Wholesale Trade	66,400 (0.1%)
Total Non-farm	**1,587,500 (92.7%)**

Figure 1-45: Unemployment Rates by County, February 2022.



1.4.8. Income

Between 2017 and 2021, the median income for Iowa households increased from $65,429 to $69,021. Even though less than 10 percent of Iowa's population derives its personal income directly from agriculture, indirectly agriculture-generated dollars have spawned vigorous growth in other economic sectors.

Figure 1-46: Iowa Household and Per Capita Income, Historical Data
(Source: US Department of Commerce, Bureau of Economic Analysis)

Year	2017	2015	2011	2007	2003	2000	1995	1989
Median Household	$65,429	$54,736	$49,427	$47,324	$42,278	$40,443	$33,436	$26,169
Per Capita	$34,817	$28,628	$25,667	$34,916	$28,608	$26,558	$20,929	$17,389

1.4.9. Productivity

Iowa's agricultural profile is strong and the state's strength in the industrial sector is often overlooked. The percentage of the Iowa workforce employed in manufacturing is holding quite steady within the nonfarm job market. Machinery exports represent the highest dollar value of factory exports, followed by food and beverages, chemicals, fabricated metals, and computers and electronics, as shown in the adjoining chart.

Historically, Iowa manufacturing has focused on heavy machinery, food processing, electronics, and chemicals. Taking advantage of Iowa's fine reputation for agricultural products, food processors enjoy ready access to raw materials and an excellent workforce. Manufacturers of rubber and plastic products, machinery, electronics, and pharmaceuticals all note the Iowa work ethic as a positive factor in their location here.

Figure 1-47: Top Five Manufacturing Industries by Gross Domestic Product.
Source: US Bureau of Economic Analysis

Machinery	35.9%
Food & Beverages	32.3%
Chemicals	17.8%
Fabricated Materials	8.0%
Computers & Electronics	7.1%

The value of Iowa's farm exports by commodity is highlighted by the state's ranking in U.S. agricultural exports of total animal products. California has remained the top export earning State since 2000, with Iowa, Illinois, Minnesota, Nebraska and Texas near the top of the list at any given year. The largest exporters of animal products in recent years have been Iowa (pork), California (dairy), and Nebraska (beef). The top three exporters of plant products have consistently been California, Illinois, and Iowa. Iowa and Illinois are the top exporters of soybeans, corn, and feeds.

Figure 1-48: Value of Iowa Farm Exports by Commodity (in millions of dollars and national production ranking), 2021. Source: U.S. Department of Agriculture							
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021/ ranking**
Soybeans	2,459.2	3,240.0	2,750.7	2,174.6	2,363.0	3,284.1	3,704.9 / 2nd
Corn	1,414.3	1,790.8	1,590.7	2,072.7	1,365.7	1,585.6	**3,081.7 / 1st**
Pork	1,932.3	2,039.9	2,188.9	2,337.2	2,466.4	2,558.0	**2,723.0 / 1st**
Feeds &Fodders	1,522.1	1,353.9	1,234.3	1,247.1	1,262.0	1,361.8	**1,655.7 / 1st**
Beef &Veal	356.2	376.9	444.0	506.4	491.9	448.9	**591.6 / 5th**
Hides & Skins	284.6	239.4	240.2	193.9	140.1	99.9	**156.4 / 1st**
Livestock & Products	2,926.8	2,952.1	3,256.2	3,444.1	3,486.2	3,522.8	**3,969.7 / 1st**
Poultry Products	184.6	137.1	196.1	220.6	185.5	191.3	**227.4 / 3rd**
Dairy Products	122.4	113.1	132.2	134.7	149.3	166.8	**189.1 / 12th**