Boone River Watershed Current Conditions Report:

Plant & Animal Communities

Boone River Watershed Management Authority

November 2020

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Watershed Management Authority

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Prepared as part of the Boone River Watershed Management Plan

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INTRODUCTION AND BACKGROUND

REPORT OVERVIEW

The Boone River Watershed Management Authority (WMA) has identified eight primary resource concerns for the Boone River Watershed including; Shorelines and Riparian Areas, Plant and Animal Communities, Sediment, Nutrients, Stormwater, Public Access, Flood Resiliency, and Hazard Mitigation. This report focuses on plant and animal communities and is one of eight reports developed for each of these concerns. Information contained in this report will facilitate the identification of resource and implementation priorities that will be used in the development of the Boone River Watershed Management Plan. Additionally, data gaps that are limiting such prioritization have been identified for future consideration.

INTRODUCTION TO RESOURCE

A "community" can be defined simply as set of interacting populations while an ecosystem includes communities, the physical environment, and their relationships. While the Boone River Watershed only comprises about 1.6% of the Iowa's total land mass, it provides a diverse ecosystem that supports a multitude of plant and animal species.

Landscape in the Des Moines Lobe, and Boone River Watershed, was developed through glacial activity which over time created dynamic environments (IGS, 2020). These dynamic environments, which include kettle lakes, prairie potholes, and drainage networks, offer a diversity of aquatic and terrestrial habitat. Grass prairies also made up the early landscape in the Boone River Watershed. These prairies are a critical part of the ecosystem by providing unique habitat for host of animal species.

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 (IDNR, 2015). While prairies, woodlands, and wetlands have been greatly reduced, prairies have suffered the most destruction (IDNR, 2015). Iowa's original wildlife populations suffered a similar fate as its native habitats and plant communities. Clearing of forests, conversion of native prairies to farm fields and the draining of wetlands eliminated many species of songbirds, reptiles and amphibians (IDNR, 2015).

The protection of plant and animal communities in the Boone River also supports water quality, conservation, and flood mitigation goals.

EXISTING DATA

Several entities have conducted research in the watershed or are currently collecting data/information used to assess and/or manage fish and wildlife. Water quality management plans have been developed for four sub-watersheds; Eagle Creek, Eagle Grove, Prairie Creek, and Lyons Creek. Plans developed for these areas include an extensive amount of local resource data and information. The Iowa Wildlife Action Plan developed in 2015 by the Iowa Department of Natural Resources (IDNR) provides a wealth of information applicable to the state and the Boone River Watershed. This plan and the professionals involved in its development will be a valuable resource for developing plans and strategies to protect and improve plant and animal communities in the watershed. Due to their vast responsibilities, the IDNR has and continues to generate a wealth of data and information specific to the watershed.

Table 1 contains a list of data sources that provide a composite of information on plants and animals in the watershed. The list is not exhaustive but serves as a starting point for this subject.

Table 1: Fundamental Source for Plant and Animal Data in the Boone River Watershed

Entity	Document/Information
U.S. Fish and Wildlife Service (USFWS)	Designation of critical habitat for the Topeka shiner
Iowa Department of Natural Resources (IDNR)	Iowa's Wildlife Action Plan
Iowa Department of Natural Resources (IDNR)	Natural Areas Inventory
USDA-Natural Resources Conservation Service	Boone River Watershed 8-Digit Hydrologic Unit Profile
Iowa Department of Natural Resources (IDNR)	Fish, Macroinvertebrate, and Habitat Monitoring
Iowa Department of Natural Resources (IDNR)	Fish Consumption Safety
Iowa Department of Natural Resources (IDNR)	Ambient Water Quality Data
Iowa Cooperative Fish and Wildlife Research Unit (ICFWRU)	Topeka Shiner and Habitat in the Boone River
Ellet Hoke	Research - Identification of freshwater mussels in the Boone River.
Iowa State University & U.S. Geological Survey	Topeka shiners in restored and unrestored oxbows in Iowa and Minnesota.
The Nature Conservancy (TNC)	Conservation Action Plan (2008)

STATE OF THE RESOURCE

CURRENT CONDITIONS

For the purposes of this report, the current condition of plant and animal communities in the Boone River Watershed will be defined in a broader sense by examining variations in habitat and ecosystems across the watershed. These ecosystems pertain to prairies, forest, wetlands/ lakes, and rivers/streams. The health of these systems plays a role in determining the composition, abundance, and diversity of plants and animals they support.

THREATENED AND ENDANGERED SPECIES

Threatened and Endangered (T&E) species, or those that have become so rare they are at risk of becoming extinct, have been formally identified by the USFWS and IDNR. Data compiled by the USDA-NRCS in 2007 indicated 53 State and Federally listed species reside in the watershed (NRCS, 2008). The composition of the listed species was; 28 plants, six freshwater mussels, six insects, five birds, five fish, three species of reptiles and amphibians, and one mammal. Table 2 identifies the Federally listed T&E species in the watershed. Topeka Shiner is the only species with designated critical habitat. Critical habitat is defined as essential habitat for the conservation of threatened and endangered species, but there is no regulatory authority involved with this designation. Topeka Shiner Critical Habitat was designated in 2004. Additional discussion is found later in this report.

Table 2: Federally Listed Threatened and Endangered Species in the Watershed

Type	Common Name	Scientific Name	Status	Designated Critical Habitat in Watershed?
Mammals	Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	No
Fishes	Topeka Shiner	*Notropis topeka (=tristis)*	Endangered	Yes (Final)
Insects	Poweshiek Skipperling	*Oarisma poweshiek*	Endangered	No
Flowering Plants	Prairie Bush-clover	*Lespedeza leptostachya*	Threatened	No
	Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened	No

Source: USFWS, 2020

PRAIRIE

By the 1930s the 25 million acres of prairie in the state was reduced to less than 30,000 acres or 0.1% (IDNR, 2015). The amount of native prairie currently in the Boone River Watershed is unknown. While only 4% of the Boone River Watershed was comprised of grass in 2019, the

amount in native prairie is presumed to be only a fraction of this (USDA, 2020a). There are several public areas that target the protection of native prairies or have restored native prairies including; Iowa Wetland Management District properties, Bauer Slough WMA (Hamilton Co.), Bjorkbord Marsh (Hamilton Co.), Butler Wildlife Conservation Area (Hamilton Co.), and the Mark and Sadie Bishop Conservation Area (Hamilton Co.).

FOREST

Development in Iowa and the Boone River Watershed included clearing forests for agricultural production. Additionally, starting in the 1850s, 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 (IDNR, 2015). In 2019, 11,171 acres or 2% of the Boone River Watershed was comprised of deciduous, evergreen, or mixed forest (USDA, 2020a). This is approximately 89 acres less than reported in 2009. Several public areas in the Boone River Watershed contain forested areas. The largest area of connected forest is the riparian area that parallels the Boone River.

WETLANDS & LAKES

Glacial activity resulted in the formation of unique habitat in the form of kettle lakes, prairie potholes, and other depressions in the Boone River Watershed. The impact of farming (including drainage) on prairie-pothole wetlands of north-central and northwest Iowa took longer than for prairies but by 1970 less than 1% of Iowa's historic wetlands remained (IDNR, 2015).

In 2019, the watershed contained 13,658 acres of herbaceous and woody wetlands (USDA, 2020). This is an increase of 8,269 acres (153%) from 2009 (USDA, 2020a). While potholes and wetlands can be found on several public areas in the watershed, some areas are managed specifically for wetland protection. Those include Iowa Wetland Management District properties, Bauer Slough WMA (Hamilton Co.), Bjorkbord Marsh (Hamilton Co.), and Gordons Marsh (Hamilton Co.).

There are five public lakes in the watershed that total 1,248 acres. Three of the five lakes are natural systems. They include: Lake Cornelia (Wright County), St. Benedict Lake (Kossuth Co.), and Big Wall Lake (Wright Co.). Natural lakes tend to be shallow and turbid but highly productive systems that support diverse aquatic communities. Man-made lakes developed for recreation, specifically fishing, tend to have a greater mean depth. Deeper lakes can provide different aquatic habitat than wetlands or shallower natural lakes. Publicly owned man-made lakes in the watershed include; Briggs Woods Lake (Hamilton Co.) and Fishpond Lake (Wright Co.) (IDNR, 2020a).

RIVERS AND STREAMS

The Boone River is a 5th order stream that stretches approximately 100 miles (IDNR, 2020b). The river has been targeted for chemical and biological monitoring by governmental entities, conservation groups, and researchers. The IDNR conducts periodic fish, macroinvertebrate, and

habitat monitoring on the Boone River to provide direct measure of biological health or condition. Sampling has occurred in the stretch of river located in Mills Park which is a reference site for warmwater streams. Condition indices for the most recent survey (2017) indicate the fish community is in excellent condition while macroinvertebrate and habitat are in good condition (IDNR, 2020b) (Table 3).

Table 3: Conditions in the Boone River Based on Biotic Integrity Indices

Target	Index Value for Boone River	Condition
Fish	73	Excellent
Macroinvertebrates	63	Good
Habitat	64	Good

Data Source: IDNR, 2020b

In 1998 and 1999 sampling was conducted for freshwater mussels at eight locations in the Boone River from its confluence with the Des Moines River upstream past Goldfield (Hoke, 2004). Results of this effort were compared to previous studies conducted in the 1982 and 1984/1985. This comparison "suggest a decline in the abundance of unionids [freshwater mussels] in the Boone River between the mid-1970's and the present, especially below Webster City, and based upon national trends a decline in species diversity seems likely" (Hoke, 2004). Additionally, Hoke identified certain species of mussels that were once widely distributed but have shown dramatic decreases and in some cases were not found in 1998/1999 (Table 4).

Table 4: Species of Mussels that have Shown Decline in the Boone River

Species	Common Name	Status in 1998/1999	Updated Status
Elliptio dilatata	Spike	Not found	n/a
Quadrula p. pustulosa	Pimpleback	Not found	Found in 2005, 2009, and 2015
Strophitus undulatus	Creeper	Not found	Found in 2009 and 2015
Anodontoides *ferussacianus*	Cylindrical papershell	Dramatic decrease in frequency	Found in 2015
Fusconaia flava	Wabash pigtoe	Dramatic decrease in frequency	Found in 2009 and 2015

Source: Hoke, 2004; Karen Wilke, TNC, personal communication, August 6, 2020

In 2015 a more recent IDNR freshwater mussel survey, found a significant increase in populations in the Boone River over previous surveys, including three species of mussel that are on Iowa's threatened species list. In 2015, 14 sites were sampled as part of the state-wide mussel survey, including those that had been surveyed previously. A total of 16 live species of mussels were found, and several sites had more than 10 species at each site. This would seem to indicate that conservation activities that have been ongoing in the Boone River Watershed

are having a positive impact on the freshwater mussel populations and the river itself (Kurth, 2018).

Tributaries to the Boone River are slower flowing streams and some of these streams have characteristics that are supportive of the Topeka Shiner (USFWS, 2018). Topeka shiners can be found primarily in small prairie (or former prairie) streams that are perennial and have clean gravel, rock, or sand bottoms. The U.S. Fish and Wildlife Service has designated 836 miles of streams in Iowa, Minnesota, and Nebraska as critical habitat for the Topeka shiner (USDOI, 2004). Critical habitat designates areas that contain habitat essential for the conservation of a listed species. A critical habitat designation does not set up a preserve or refuge and has no specific regulatory impact on landowners' actions on their land that do not involve federal agency funds, authorization or permits (USFWS, 2018). Areas of critical habitat have been identified in the Drainage Ditch 3 and the Eagle Creek subwatersheds, which are in Humboldt, Webster, Wright, and Hamilton Counties (Figure 1).

Oxbows are common off channel habitats that are created over time by a streams natural meandering process. Studies have shown that “restored oxbows frequently harbor significant populations of Topeka shiners in Iowa and southwest Minnesota, and the collective evidence to date suggests that restoring oxbows in this region will be an important strategy for recovery of this endangered species (Simpson, Bybel, Weber, Pierce, & Roe. 2019).

The Iowa Cooperative Fish and Wildlife Research Unit has monitored Fish assemblages and habitat conditions in two streams in the Boone River Watershed, White Fox Creek and Eagle Creek (ICFWRU, 2020). In the 2016 field season a total of 44 sites were monitored which included 27 in-stream reaches and 17 oxbows. Sampling was also conducted on 17 sites on White Fox Creek, 13 sites on Eagle Creek, 10 sites on Prairie Creek, 2 sites on Lyons Creek, and 1 site each on Buck Creek and Brewers Creek. Significant findings of this 2016 study include (ICFWRU, 2020):

- There was a total of 66,140 fish sampled that encompasses 46 different species. Over all sites, the five species there were most abundant were; fathead minnow, common shiner, black bullhead, green sunfish, and orange spotted sunfish. The most commonly occurring (# sites present/total # sites) species were green sunfish, creek chub, common shiner, white sucker, and bluntnose minnow.
- The presence of Topeka shiners was documented at 14 of the 44 sites (32%) sampled in the watershed. This includes 8 in-stream reaches and 6 oxbows. Topeka shiners were sampled at 6 Eagle Creek sites and 8 Prairie Creek sites. Topeka shiner abundance at sites where they were sampled ranged from 1-238 with a mean of 44 and median of 18 per site. Overall, 618 Topeka shiners were sampled in the watershed in 2016, making them the 15th most abundant and 22nd most commonly occurring species in the sampling. Topeka shiner presence in Prairie Creek was surprisingly consistent considering there were only two detections of Topeka shiners in this HUC 10 in two previous Iowa State University stream fish studies since 1997. Despite being the most

sampled stream, Topeka shiners were not found in White Fox Creek or any of its associated oxbows.

Fish kills have occurred in the Boone River, Eagle Creek, Lyons Creek, Little Eagle Creek, West Otter Creek, and Drainage Ditch 97. While the specific cause of the Boone River and Lyons Creek fish kills were not determined, fertilizer spills were identified as the cause of fish kills in Eagle Creek, Little Eagle Creek, West Otter Creek, and Drainage Ditch 97 (IDNR, 2020b). These fish kills resulted in impairment listings by the IDNR.

Every year, Iowa DNR biologists collect tissue samples of fish for laboratory analyses. Results of these analyses show that most fish are safe to eat even though trace amounts of chemicals may be present in fish tissue. There are no fish consumption advisories for waters in the Boone River Watershed (IDNR, 2020c).

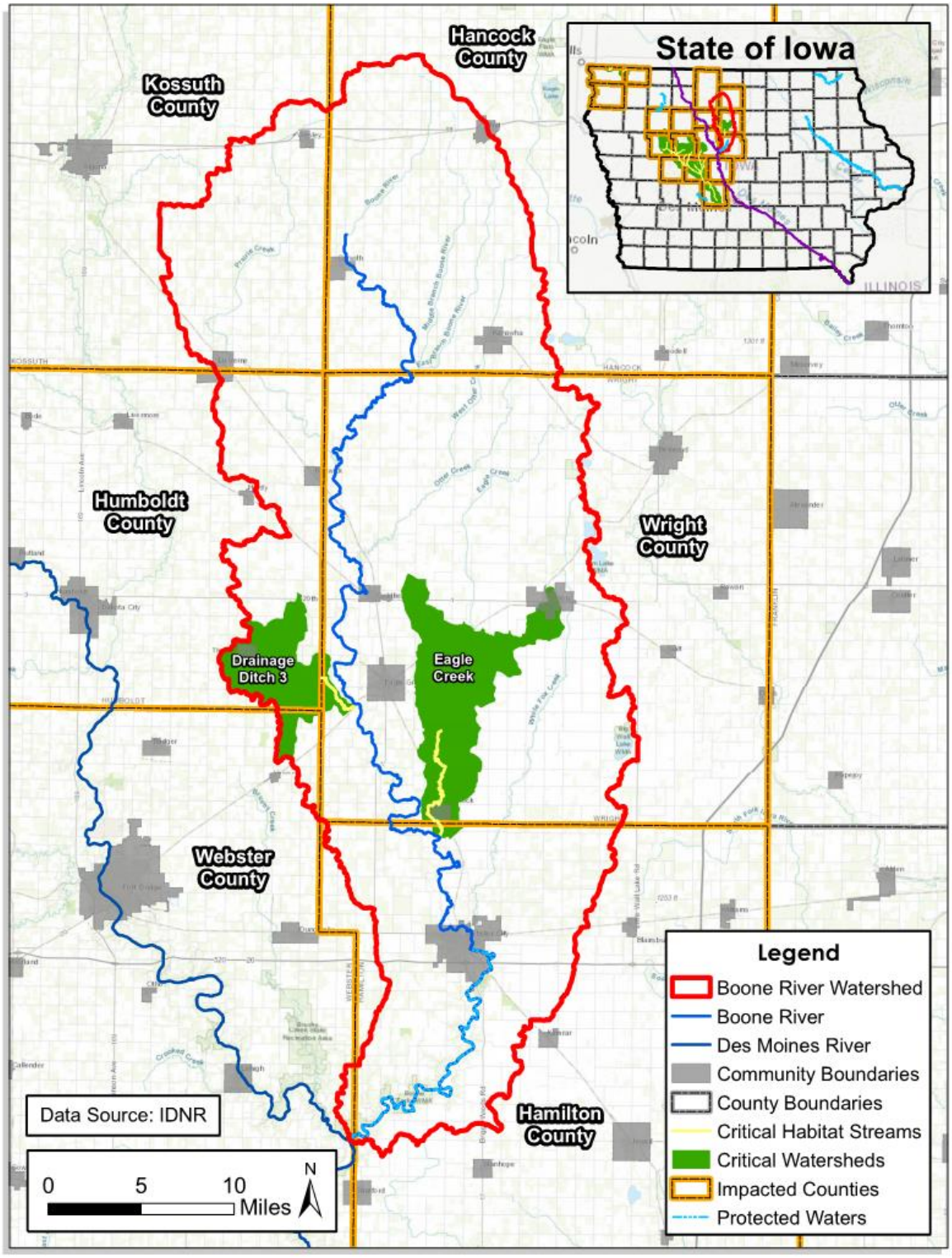


Figure 1: Critical Topeka shiner habitat in the Boone River Watershed

HISTORICAL CHANGES

As described in the previous section, landscape changes in the Boone River Watershed have changed dramatically the past 150 years. These changes include significant losses to native prairie, wetlands, and forested areas. Alterations to the landscape have resulted in the loss of slow-flowing stream habitats (USFWS, 2018). The Topeka shiner is an example of a fish that has been adversely affected by the loss of slow-flowing stream habitats. Their preferred habitats of slow current, sand and gravel substrates, and instream vegetation have become rare in areas of agricultural land use (Pflieger, 1997; Rowe, Pierce, & Wilton, 2009). Additionally, human induced fish kills and the decline in diversity and abundance of mussels, as documented by Hoke (2014), further suggests degradation of the Boone River.

CURRENT PROJECTS AND PROGRAMS

There are a vast number of programs that can be viewed as having positive benefits to plant and animal communities in the Boone River Watershed. It includes those related to land, water, and wildlife conservation and management. The primary federal agencies listed below are those that are currently involved in watershed projects or those that may be applicable to the watershed. While projects and programs that encompass monitoring, research, and education are also important, they are not included in this section.

PRIMARY FEDERAL AGENCIES AND PROGRAMS

United States Fish and Wildlife Service (USFWS)

Through the Endangered Species Program, the USFWS determines whether to add a species to the federal List of Endangered and Threatened Wildlife and Plants. The addition of the Topeka shiner to this list affords this species the full range of protections available under the Environmental Species Act. The USFWS is responsible for numerous programs related to plant and animal communities. Those that directly relate to the watershed include:

- Invasive Species Program
- Migratory Bird Program
- Fisheries Program
- Wetlands Program
- Partners for Fish and Wildlife Program
- National Wildlife Refuge System

USDA – Natural Resources Conservation Service

In 2009 the USDA-NRCS initiated the Mississippi River Basin Healthy Watersheds Initiative (MRBI) that spans across 13 states. This initiative uses several Farm Bill programs, including the Environmental Quality Incentives Program (EQIP) and the Agricultural Conservation Easement Program (ACEP), to help landowners sustain America's natural resources through voluntary conservation. The overall goals of MRBI are to improve water quality, restore wetlands

and enhance wildlife habitat while ensuring economic viability of agricultural lands (USDA, 2020b). The initiative is currently involved in watershed projects in the Prairie Creek and Eagle Creek drainages. These projects involve a multitude of partners consisting of landowners, producers, government agencies, conservation organizations, and organizations representing agricultural producers.

The implementation of some conservation measures within the Boone River Watershed will have a more direct impact in enhancing plant and animal communities. Specifically, those include practices related to riparian buffer enhancement, wetland creation, wetland enhancement, wetland restoration, wetland wildlife habitat management, streambank and shoreline protection, and stream habitat improvement and management.

PRIMARY STATE PROGRAMS & INITIATIVES

Two primary state programs/initiatives directly relate to the protection/enhancement of plant and animal communities:

- Iowa's State Wildlife Action Plans conserves wildlife and natural places. The plan assess the health of each of state's wildlife and habitats, identify the problems they face, and outline the actions that are needed to conserve them over the long term (IDNR, 2015).
- The Iowa Nutrient Reduction Strategy is a science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost-effective manner (IDNR, 2020d).

LOCAL/REGIONAL IMPLEMENTATION EFFORTS

Watershed Management Plans have been developed for four sub-watersheds in the Boone River drainage; Eagle Creek, Eagle Grove, Prairie Creek, and Lyons Creek (Table 5, Figure 2). These plans are currently being implemented in all the sub-watersheds except for Lyons Creek. The area covered by current plans is 185,313 acres or approximately 32% of the Boone River Watershed. While all the practices targeted in these plans will benefit plant and animal communities some practices provide direct and more immediate benefits. One such practice is the restoration of oxbows. Oxbow restoration has proven to provide habitat suitable for the Topeka shiner.

Table 5: Completed Watershed Management Plans in the Boone River Watershed

Watershed	Planning Area (ac)	% of the Boone River Watershed
Prairie Creek	90,000	15%
Eagle Creek	70,000	12%
Eagle Grove	14,240	3%
Lyons Creek	11,073	2%

Total Planning Area	**185,313**	**32%**

The Nature Conservancy

The Nature Conservancy assists with projects designed to protect land and water. They are currently a partner on the Boone River Watershed Nutrient Management initiative. To date, TNC and partners have completed 32 oxbow restoration projects in the watershed (BRW, 2020). Oxbows improve riparian area functions including creating fish and wildlife habit; capturing nutrients and sediments; and provide floodwater storage.

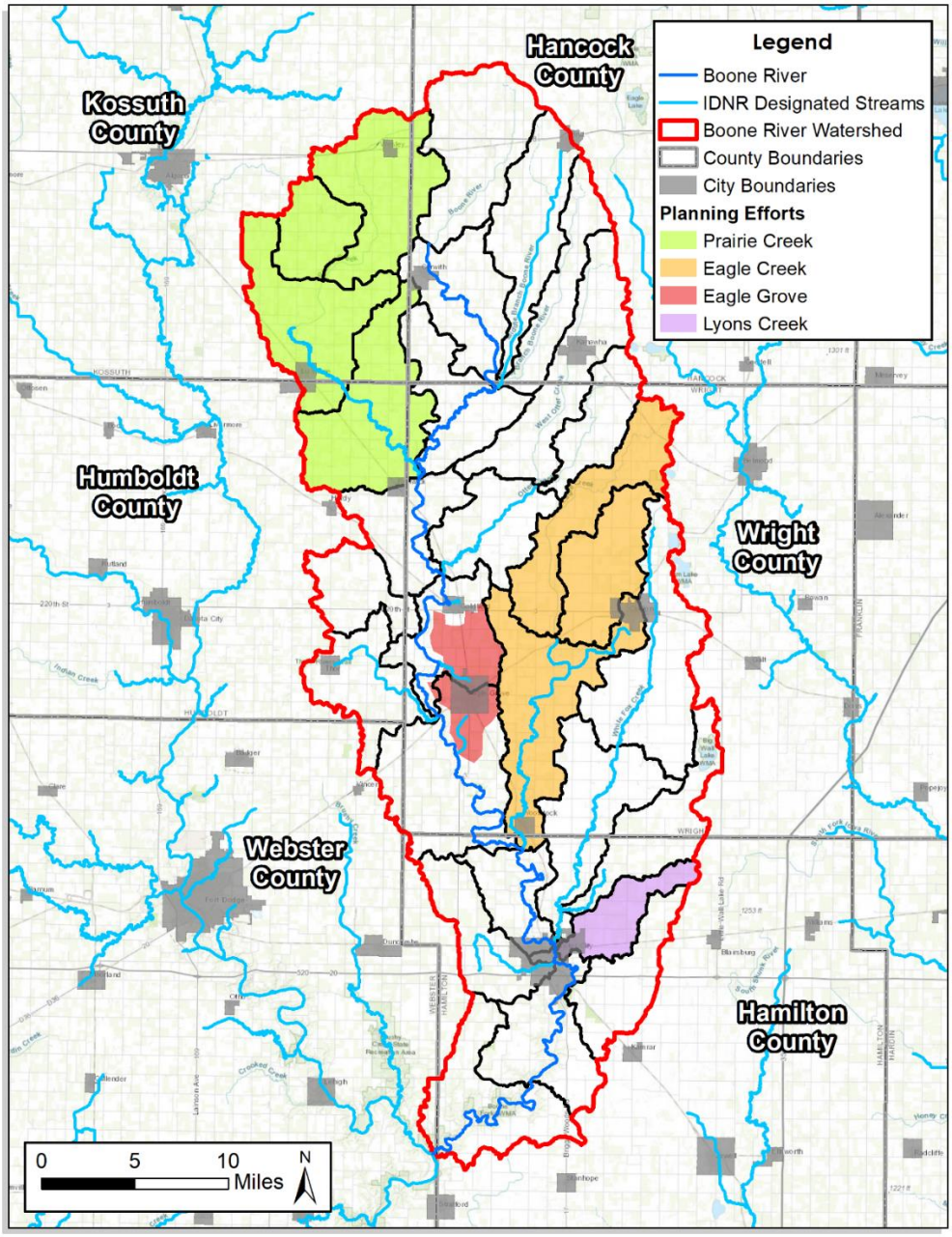


Figure 2: Areas Addressed by Current Watershed Management Plans

FUTURE TRENDS

While there have been extensive changes to the natural landscape in the Boone River Watershed, the rate of change has generally declined over the years as crop production is maximized. The onset of new partnerships, programs, initiatives, and projects targeted at natural resource protection will hopefully result in no net loss of remaining natural areas in the watershed. If the Boone River is not protected, a continued loss in the diversity and abundance of mussels is to be expected. Additionally, the degradation of critical habitat for the Topeka shiner could eliminate the presence of this species in the watershed.

RECOMMENDATIONS

The following goals have been developed for initial discussion with the WMA regarding plant and animal resources. It is anticipated that these goals may be modified for inclusion in the final Boone River Watershed Management Plan.

GOALS

The Iowa Wildlife Action Plan was developed to address the needs of the state. To the extent possible, watershed goals pertaining to plant and animal communities should support state and federal goals. USFWS goals for the protection of the Topeka shiner and its habitat in the Boone River Watershed should directly align. Goals addressed in the State Wildlife Plan are extensive and encompass all plants and animals across the Iowa landscape. To ensure watershed goals align with and support state priorities, assistance and coordination should be sought from respective professionals at the IDNR. General goals for the watershed should include:

1. Ensure the protection of the Topeka shiner and critical habitat using regulatory and non-regulatory efforts.
2. Expand the abundance and range of the Topeka shiner in the watershed.
3. Support and promote USDA programs and conservation practices throughout the watershed.
4. Along with partners, continue to initiate targeted projects in priority sub-watersheds that address water quality, soil health, habitat, wildlife, and public access.
5. Support monitoring activities that help define the physical, chemical, and biological integrity of the Boone River and its tributaries.

RESOURCE GOALS

Given local, state, and federal importance of the Topeka shiner the primary resource goal for the watershed is to increase the functional value of oxbows across the watershed.

While other T&E species are important to consider in any project, the focus on Topeka shiner is supported by the fact that critical habitat has been identified, which helps to prioritize actions, and the belief that improvements to this habitat will likely be beneficial to all fish and wildlife habitat. Additionally, given the watershed-focused nature of the Boone River Watershed Plan, there is inherently mutually supporting efforts between the Topeka shiner focused work and other watershed work.

IMPLEMENTATION

STRATEGIES

The overall framework for protecting plant and animal communities in the watershed includes both regulatory and non-regulatory efforts. Regulatory efforts such as development and building restrictions should be periodically reviewed by cities and counties to assure the adequate level of protection is being provided to sensitive or critical areas within the Boone River Watershed. Specifically, those areas designated as critical habitat for the Topeka shiner.

Non-regulatory efforts to protect plant and animal communities on private lands involve the voluntary adoption of management practices. All management practices promoted through USDA programs are beneficial to the environment by improving soil health and wildlife habitat, reducing erosion, and reducing bacteria, nutrient, and chemical runoff.

The voluntary adoption of management practices can be achieved on a targeted or non-targeted basis. Non-targeted implementation of management practices across the Boone River Watershed can be accomplished through existing USDA programs such as EQIP. These programs provide all landowners, both in and outside of priority areas, access to technical and financial assistance.

Targeted implementation of management practices can be accomplished through “projects” focused in a priority area, which is generally a smaller drainage. This would be a continuation of projects that are currently being implemented in Eagle Creek, Eagle Grove, and Prairie Creek drainages. Targeted projects can bring additional cost-share and more implementation flexibility. In most cases, the decision by a landowner or producer to implement or adopt a “practice” is financially based.

ACTION STEPS

- On a sub-watershed scale, collect the information necessary to prioritize oxbows for restoration. To a great extent, priorities should be based on potential benefits to the Topeka shiner.
- Prioritize HUC 12 sub-drainages for targeted implementation of conservation practices or habitat restoration projects (prairies, wetlands, and timber) that will benefit plant and animal communities.
- In priority HUC 12s conduct stream inventories and riparian area assessments to better understand the current conditions of those resources, and how they impact fish and wildlife habit.

PROJECT OPPORTUNITIES

Watershed management plans have been completed in four sub-watersheds; Eagle Creek, Eagle Grove, Prairie Creek, and Lyons Creek. These four sub-watersheds total 185,313 acres or 31% of the Boone River Watershed. While all practices promoted in these plans will benefit plant and animal communities, some may provide more direct and immediate benefits. Projected needs for higher impact management measures promoted in the four sub-watersheds mentioned above were used to estimate future needs in the remaining portion of the watershed or approximately 395,873 acres (Table 6).

While the NRCS EQIP program is the primary funding avenue for these practices additional funding opportunities may be available through other programs such as; Wetland Reserve Program, General Conservation Reserve Program, Conservation Reserve Enhancement Program, Wildlife Habitat Incentives Program, and Farmable Wetland Program. The NRCS EQIP program supports multiple practices not targeted in current management plans that may provide more direct benefits to plant and animal communities (USDA-NRCS, 2020). These are summarized in Table 7, and should be considered for implementation through the Boone River Watershed Management Plan. Additional practices and updated cost estimates could be provided in the Boone River Watershed Management Plan, if necessary.

Table 6: Estimated Needs for Management Practices in the Boone River Watershed

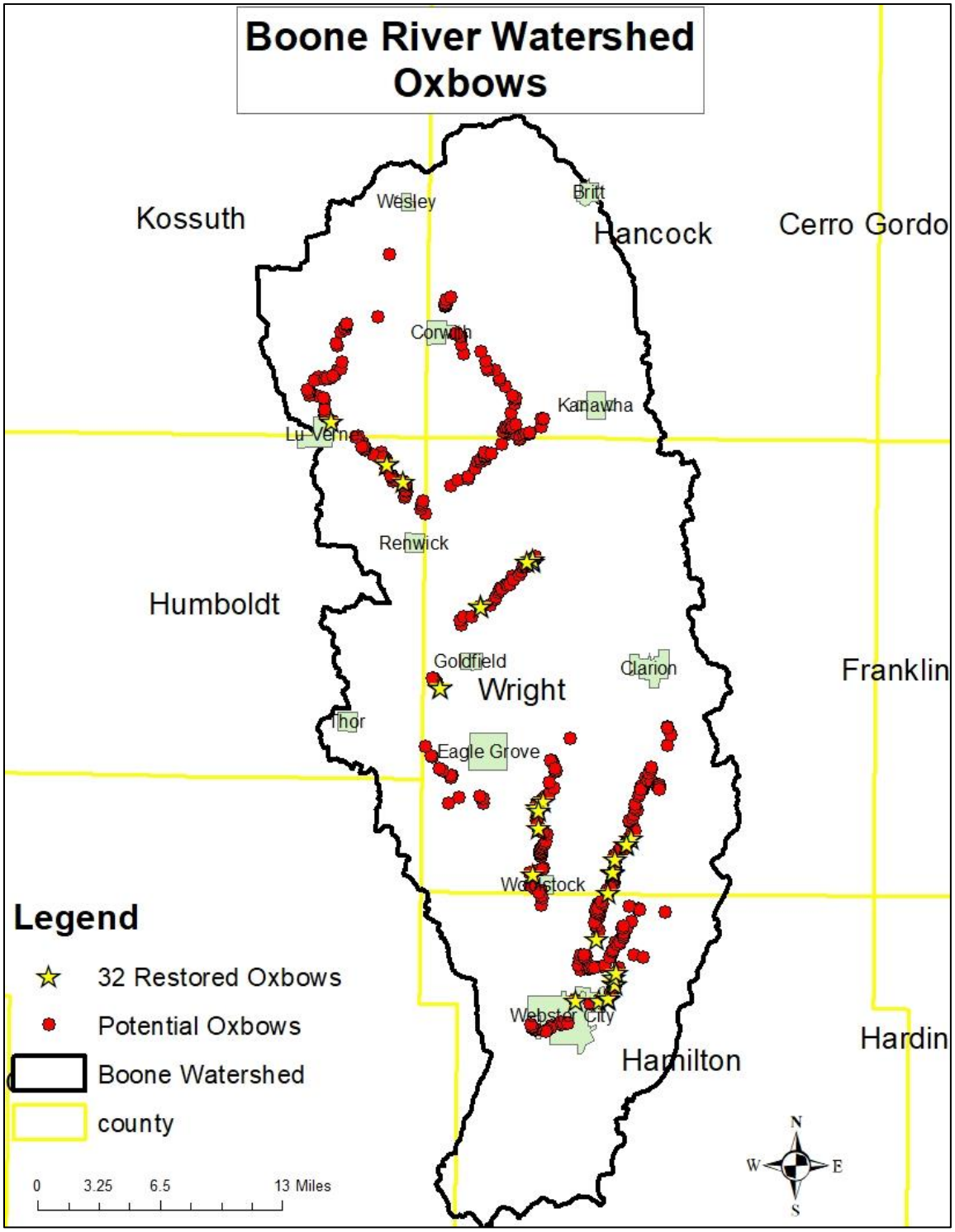
Practice and Applicable NRCS Codes	Units	Estimated Watershed Practice Needs	Expected Cost
Prairie STRIPS	Acres	3,544	$1,049,054
Buffers & Filter Strips	Acres	854	$1,131,550
Conversion of Cropland	Acres	427	$128,100
Pasture Management	Acres	320	$94,154
Saturated Buffers	Structures	203	$608,475
Wetlands	Sites	53	$20,794,006
Oxbow restorations	Sites	90	$717,360
Total Cost	**-**	**-**	**$24,522,699**

Table 7: Priority NRCS Practices for Plant and Animal Communities

Practice Code	Practice Name
396	Aquatic Organism Passage
327	Conservation Cover
656	Constructed Wetland
342	Critical Area Planting
647	Early Successional Habitat Development
666	Forest Stand Improvement
146	Pollinator Habitat Plan
378	Pond
391	Riparian Forest Buffer
390	Riparian Herbaceous Cover
580	Streambank and Shoreline Protection
395	Stream Habitat Improvement and Management
649	Structures for Wildlife
645	Upland Wildlife Habitat Management
657	Wetland Restoration
658	Wetland Creation
659	Wetland Enhancement
644	Wetland Wildlife Habitat Management

Source: USDA-NRCS, 2020

Oxbow restoration has been a success as 32 oxbows have been restored in the Boone River Watershed; however, ample opportunities exist to continue these restorations. 416 potential oxbow restoration sites have been identified (Figure 3). It should be noted that funding is available to cover 100% of the cost of restoring oxbows in the Boone River Watershed (TNC, 2020).



Source: Karen Wilke, TNC, Personal communication: 4/3/2020

Figure 3: Completed and Potential Oxbow Restoration Sites in the Watershed

EDUCATION STRATEGIES

It is imperative that all resource managers, decision makers, and general public understand the value of plant and animal communities, related issues, management tools, and costs associated with the protection and restoration resources. This can only be achieved through continuous communication, education, information transfer, and monitoring and assessment. Specific education strategies should be considered within the context of the overall goals and recommendations in the Boone River Watershed Management Plan. Therefore, the development of education strategies should be completed after watershed goals have been finalized. Education strategies should align with those provided in the Iowa Wildlife Action Plan (IDNR, 2015).

Targeted projects in sub-watershed should be developed with input from landowners, producers, and residents along with resource professionals. The process of developing targeted plans can serve as an opportunity to educate the public. Education strategies developed for current projects should be used as a starting point for new projects.

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