WABASH RIVER STRATEGIC PLAN

By Richard Skibsted

National Great Rivers Research and Education Center
Office of Lieutenant Governor Sheila Simon

2012

Table of Contents

Executive Summary

The Wabash River is the largest un-dammed river east of the Rocky Mountains and it flows 505 miles from its origin in west-central Ohio through Indiana and Illinois to a confluence with the Ohio River in Southern Illinois. It has a total land area of 53,000 square miles, 14,000 square miles are in Illinois, including from 23 counties in the Southeastern part of the State (Gammon, 1998). One of the tributaries is the Middle Fork of the Vermilion River, Illinois' only river protected under the National Wild and Scenic Rivers Act.

This watershed plan is a review of regional problems within the basin and seeks to establish some broad solutions to these problems. To identify public attitude in the region, a survey was distributed with help from the Illinois Institute for Rural Affairs. A 10% response gave an overview from both rural and urban perspectives on flooding, conservation and water use. Experts met to discuss seven topics: Business, Industry and Agriculture; Habitat; Human Resources; Hydrology; Recreation; Research and Monitoring; and Water Quality.

The survey and discussions revealed that the biggest threats to people and ecosystems in the region were agriculture, flooding and economy. Agriculture is the primary land use in the basin. Native Americans were the first to practice agriculture in the region and European descendants expanded agriculture to an astronomical scale. This led to channelization of several tributaries of the Wabash to remove water quickly from fields. The river is currently impaired with *E*. *coli*, fecal coliform, sediment and agricultural chemicals. This pollution has degraded the aquatic habitat, and sedimentation from the Wabash River is frequently problematic at its confluence with the commercial Ohio River.

Recent flooding has resulted in devastating impacts on the communities within the region. The 2008 flood caused millions of dollars in damages to urban infrastructure and agricultural lands. The recent 2011 flood also caused significant damage, and its cost is yet to be determined. This causes flood insurance rates in the region to increase, straining the regions already lagging economy.

The counties within the Wabash Basin have a much higher unemployment rate than the rest of the state and a lower mean income level. There are no big industries in the region and most of the area is rural and isolated. Champaign-Urbana is located at the northern tip of the watershed and is the largest urban area. Interstates 57 and 74 run along the northern and northwestern boarders of the watershed, but do not provide efficient travel or commerce in the area. Additionally, many of the communities do not have access to high-speed internet or cell phone reception.

Efforts to restore and highlight the region's natural resources are concentrated on the Middle Fork of the Vermilion River. Some studies and planning has been completed on the Upper Little Wabash and Embarras River, but there is very little funding and few resources available for implementation. Studies have been done on the region, but the data needs to be more readily available to the public.

The Wabash Watershed has changed significantly since European settlement. Considering the region's past management practices to the present, significant strides have been made but more can be done. A coordinated effort is needed to restore the basin's resources and economic vitality. With the establishment of the Wabash and Ohio Rivers Coordinating Council, the Office of Lt. Governor has the unique opportunity to rally partners throughout the region to protect its natural resources.

The Wabash and Ohio Rivers Coordinating Council invites the public to comment on this document at ltgov.illinois.gov.

Partners

Written by Richard Skibsted, National Great Rivers Research and Education Center and Olivia Dorothy, Office of Lt. Governor Sheila Simon.

Special thanks to

R.J. Alier, Coles County Soil and Water Conservation District
Elliot Brinkman, Prairie Rivers Network
Debbie Bruce, Illinois Department of Natural Resources
Yong Cao, Illinois Natural History Survey
Timothy Collins, Illinois Institute for Rural Affairs, Western Illinois University
W. Burke Davies, Marion County Soil and Water Conservation District
Joan Esarey, Ford County Soil and Water Conservation District
Terry Esker, Illinois Department of Natural Resources
Margaret Fertaly, Illinois Environmental Protection Agency
Kristie Ginder, Lawrence County Soil and Water Conservation District
Marla Gursh, Illinois Department of Natural Resources
Lyle Guyon, National Great Rivers Research and Education Center
Jacque Hallam, Illinois Department of Natural Resources
Stacy Helm, Jefferson County Soil and Water Conservation District
Randy Hurt, Cumberland County Soil and Water Conservation District
Fred Iutzi, Illinois Institute for Rural Affairs, Western Illinois University
Ron James, Wabash River Heritage Commission/ Banks of the Wabash
Kevin Johnson, U.S. Geological Survey
Colleen R. Kensler, Wabash County Soil and Water Conservation District
Bryon Kirwan, U.S. Department of Agriculture, Natural Resource Conservation Service
Aaron Kuehl, Pheasants Forever
Jim Nestleroad, Crawford/Clark County Soil and Water Conservation District
Tony Pals, Effingham County Soil and Water Conservation District
James Patrick, South Central Illinois Regional Planning & Development Commission
Cindy Poppenhager, Edwards County Soil and Water Conservation District
Richard Pruitt, U.S. Army Corps of Engineers
Mike Rahe, Illinois Department of Agriculture
Rae Schnapp, Wabash River Keeper/Banks of the Wabash
John Schucer, U.S. Department of Agriculture, Natural Resource Conservation Service
Steve Shults, Illinois Department of Natural Resources
Rob Simmonds, U.S. Fish and Wildlife Service
Cindy Spillman, National Wild Turkey Federation
Bruce Stikkers, Champaign County Soil and Water Conservation District
Mike Turner, U.S. Army Corps of Engineers
Josh Weger, Illinois Department of Commerce and Economic Opportunity
Jamie Wheeler, Edgar County Soil and Water Conservation District
Derra Williams, Richland County Soil and Water Conservation District
Eron Williamson, Prairie Rivers Network
Lizann Woodrow, Wayne County Soil and Water Conservation District
Gary Zwilling, U.S. Department of Agriculture, Natural Resource Conservation Service

Introduction

Watersheds have a tremendous impact on people. When they are managed properly, locals can enjoy the rich resources through recreation, plentiful clean water and abundant wildlife. If mismanaged, rivers can flood frequently damaging property, and pollution can impact drinking water supplies. The geological make up of the area and topography determine the fertility of the region and the amount of drainage that can occur. Since the Wabash sits on 50-70 feet of glacial till and loess, the soil is very fertile (Gammon, 1998). However, it has a low topography and under the glacial till is more compacted glacial deposits causing drainage in the region to be slow (IDNR, 2001). With too much run off from fields and urban development, the region can be more prone to flooding issues.

The Wabash River Strategic Plan outlines broad recommendations for the Wabash River Coordinating Council. The Plan evaluates common and overarching problems within the watershed and strives to develop achievable tactics for partners to implement. Ideally, if the identified actions are completed, the region's natural resources and economy will be significantly improved. The Plan will lead to the introduction of new programs, led and coordinated by non-government partners and the federal, state and local governments.

To develop the plan, the Office of Lt. Governor Sheila Simon partnered with National Great Rivers Research and Education Center to fund a summer intern to review the history and information available about the region. The intern reviewed watershed plans from other regions of Illinois; adjacent states and sub watersheds within the Wabash Basin were examined. Data throughout the region was organized by topic and reviewed. Topics focused on "business, industry, agriculture," "habitat," "human resources," "hydrology," "recreation," and "water quality." The Lt. Governor's Office also hosted meetings inviting stakeholders to speak to the region's economic and environmental needs. They also were invited to identify problems in the basin and develop ideas that could address those issues. This document is the product of the literary research and discussions with local experts.

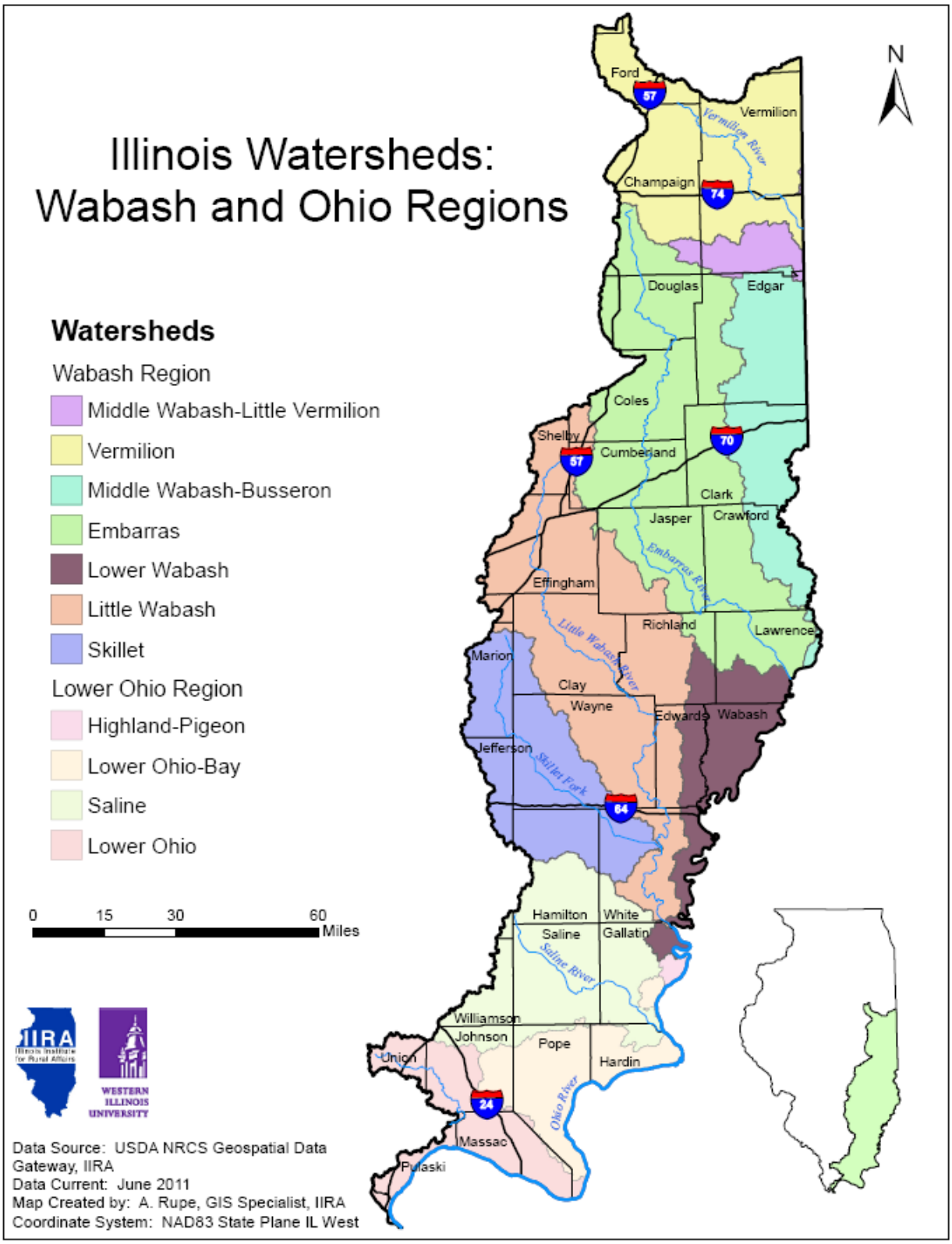
Public Survey

To identify the public views of resources in the region, a mail survey was sent to 2,500 residents throughout the Wabash Watershed, and was posted online. The survey was intended for all residents in Champaign, Clark, Clay, Coles, Crawford, Cumberland, Edgar, Edwards, Effingham, Ford, Hamilton, Jasper, Lawrence, Richland, Vermillion, Wabash, Wayne, and White Counties. Almost 250 surveys were returned, including email responses. The survey asked specific questions about respondents' views towards the watersheds resources, and how conservation and flood prevention measures should be implemented.

Most respondents were 50 to 60 years old and had a high school or bachelor's degree. Responses came equally from urban residents and rural residents. Following are some other findings based on survey responses:

- about 35% lived on a farm;
- 16% lived in the 100-year floodplain;
- 24% had recently experienced floods;
- 55% reported that ecosystem services should be used to prevent flooding (i.e. restoring wetlands and preventing floodplain development);
- 35% wanted higher/improved levees, more frequent dredging, and improved sewer systems to reduce flooding in their community; and
- 10% reported some combination of man-made and natural flood control planning.

Respondents thought that drinking and agriculture were the most valuable uses of water. Transportation was the least valuable water use. Overall, respondents valued public open space and natural resource conservation. Interestingly, a plurality of respondents (41%) was opposed to providing easements to private landowners for public recreation opportunities; but they did support easements for conservation. Of the respondents who reported their conservation farming measures, 75% stated that they either took land out of production or used conservation/no till practices.


Illinois Watersheds:
Wabash and Ohio Regions
Watersheds
Wabash Region
Middle Wabash-Little Vermilion
Vermilion
Middle Wabash-Busseron
Embarras
Lower Wabash
Little Wabash
Skillet
Lower Ohio Region
Highland-Pigeon
Lower Ohio-Bay
Saline
Lower Ohio
0 15 30 60
Miles
N
Ford
Vermilion
Champaign
Douglas
Edgar
Coles
Shelby
Cumberland
Clark
Jasper
Crawford
Effingham
Richland
Lawrence
Marion
Clay
Wayne
Edwards
Wabash
Jefferson
Hamilton
White
Saline
Gallatin
Williamson
Johnson
Pope
Hardin
Union
Massac
Pulaski
Vermilion River
Embarras River
Little Wabash River
Skillet Fork
Saline River
Ohio River
57
74
70
64
24
IIRA
WESTERN ILLINOIS UNIVERSITY
Data Source: USDA NRCS Geospatial Data Gateway, IIRA
Data Current: June 2011
Map Created by: A. Rupe, GIS Specialist, IIRA
Coordinate System: NAD83 State Plane IL West

Geological and prehistoric human history

Today's landscape has been altered over thousands of years of geological change. The pre-glacial Wabash River ran through a large valley extending from about Lafayette, IN to its mouth, and dates back to the Devonian period more than 350 million years ago. The Wabash River is a part of the Mississippi River System, and is buried in sand and gravel. The valley was covered by ice nearly to its confluence with the Ohio River during prehistoric time by the Illinois and Wisconsin glaciers, which deposited 60 or 70 feet of sand and gravel (Gammon, 1998).

It is thought that the first humans to arrive to the North American Continent came from Continental Asia over a land bridge, eventually expanding range eastward during an interglacial period. Bone tools from animals they hunted have been found throughout the region dating back from roughly 18,000 to 9,000 years ago during which time period the glaciers retreated northward (Gammon, 1998).

The region has rich soil, leading to the establishment of the first agricultural communities about 3,000 years ago. By about 300 A.D., most river valleys throughout North America, including the lower Wabash River Valley, had farming settlements. During the 1700s, the French and English expanded their trading activities. The area soon became a part of the Northwest Territory. Small communities scattered along rivers consisted of a mostly white population, but included free slaves during the 1800s. A market of surplus agricultural goods would be floated on flatboats along the Wabash River to the Ohio, then to the Mississippi and travel all the way down to New Orleans during spring flooding. Increasing amounts of settlers moved to the fertile landscape once Native hostility was resolved in 1815. Land use would forever be altered by this exponential growth which would have continuous impacts both positive and negative for years to come (Gammon, 1998).

During the 1800s and early 1900s, fish species were abundant and diverse. People in the region did not consider dams, levees, and channelization as threatening the abundant fish, wildlife and natural resources in the region (Boyce 1964). Rivers were viewed as infrastructural tools devoted to shaping the lands economic integrity, and were examined for potential mills and boats with trafficking future produce that would be produced in such a fertile landscape (Gammon, 1998).

The land was already proving its economic power and provided the region's people with prosperity (Boyce 1964). However, the extensive agricultural practices were done in an unsustainable fashion which has proved it to be detrimental to the water quality. Sediment pollution from a rapidly expanding agriculture greatly diminished fish species (Gammon, 1998). Anthropogenic influences have claimed most of the land throughout the basin for agriculture. Statewide, Illinois is covered roughly by 12% forest, of which 0.3% is high quality communities such as floodplain forest, upland forest, sand forest and flatwoods. It has been determined that in many areas of the state, 70% of underbrush shrub stems are made up of invasive species. Since the time of settlement and mechanized agricultural practices, over 90% of Illinois's wetlands have been lost due to drainage from tiling and ditches. With an increase in pollution to the rivers from agricultural, urban and industrial wastes, effects have been noticed. 48% of the states mussel species and 38% of the states native fish species are "species in greatest need of conservation."

The economic growth from the past allowed for destruction and mismanagement of the Wabash River Basin and its regional natural resources; however, this type of production has gained much notice (Boyce 1964). Conservation efforts and sustainable management practices are greatly needed in the region in order to protect its environmental and economic prosperity.

Recommendations

After meeting with key stakeholders, broad recommendations were made that will allow the Wabash and Ohio Rivers Coordinating Council to initiate programs and projects to improve the basin. Most regions within the Wabash River Watershed share common problems with regards to ecosystem and economic vitality; therefore a set of common, broad recommendations has been made that can be implemented region-wide.

The Wabash needs a plan in order to promote a better public understanding of the problems within the region that affect its residents and ecosystems. These basic recommendations made in this document can be used to secure a healthy ecosystem and economy that is vital to any region.

Business, Industry and Agricultural

Most land use within the region is devoted to agriculture, a power house for the local economies. But the region has a much higher unemployment rate then the rest of the state. The labor force in Illinois is roughly 6.5 million with approximately 500,000 unemployed, leaving a 7.1% unemployment rate. The mean income in the basin is roughly $40,000 a year vs. the rest of the state, which is $54,000 a year (2010 Census Data).

The region lacks infrastructure for communication and transportation. There is one ethanol plant in the region, three coal burning plants, one coal burning industrial plant and three active coal mines (DCEO Industry Maps). The Wabash River itself is not used for commercial traffic due to its shallow depth. Dredging has been proposed, but it is too expensive.

Goal: Promote economic development in the Wabash River Watershed.

Objective: Assist the private sector in developing business opportunities focused on agri-tourism, eco-tourism and recreation.

1. Promote farmers' markets, local foods, wineries and pumpkin patches in the region.
2. Promote Amish attractions, Lincoln sites, centennial farms, historic buildings and other heritage related tourism.
3. Identify industries in the region that may offer tourism grants and funding.
4. Develop a regional brand.
5. Identify and promote hunting and fishing tournaments.
6. Partner with regional tourism bureaus.
7. Create a Wabash River festival.
8. Expand bald eagle watching opportunities.
9. Promote & develop trails (ATV, paddling, horse riding, biking, etc.) through cooperative grant applications.
10. Use county fairs to promote other tourist attractions.
11. Develop a regional tourism plan with season specific activities & regional branding.
12. Create signage identifying local attractions, businesses & natural features
13. Promote scenic drives in the fall.

Objective: Develop and promote business opportunities and technologies that utilize river basin resources.

1. Support Resource Conservation & Development offices and other interest groups.
2. Promote ethanol industry expansion in the watershed.
3. Promote small riverfront businesses in Illinois and Indiana.
4. Educate commercial fisherman on government programs.
5. Promote river related small businesses like bait shops, fish markets, commercial fishing, etc.
6. Promote commercial fishing.
7. Support smart development of natural resources (timber).
8. Support development of a biomass industry for heat, power and advanced biofuels.
9. Develop wind and solar energy.
10. Identify farm needs to make modern resources & technologies available to support sustainability.
11. Study and identify renewable resource opportunities.

12. Use Market-Maker through U of I Extension (http://www.marketmaker.illinois.edu) to promote local foods.

Objective: Study strategic business opportunities along the river.

1. Attract industry and manufacturers.
2. Attract renewable energy retailers.
3. Streamline permitting process for new waste reuse industry (composting manure).
4. Expand recycling opportunities in the region.
5. Business management & training opportunities, expand/support needs more funding.
6. Identify abandoned coal infrastructure to develop new energy markets (wind farms, CO_2 sequestration, etc).
7. Study nutrient trading opportunities.

Objective: Involve stakeholders, landowners, business, industry and agriculture in planning for natural resources use, including water usage.

1. Promote enhanced oil recovery techniques.
2. Develop a strategy to work with remote landowners.
3. Build partnerships with Indiana.
4. Identify all stakeholder groups that represent wildlife, business, planning, agriculture and communities.
5. Create a structure to disseminate information to all groups.
6. Involve stakeholders at the sub basin level or subgroups by interest.

Objective: Restore infrastructure in the region.

1. Identify resources for road improvement.
2. Study grain facilities to support ethanol industry.
3. Identify resources that improve telecommunications and broadband in the region.
4. Improve docks and boat ramps.
5. Support river ferries/river taxies (across, up & down river).
6. Create river/wildlife pull off areas.
7. Study electrical transmission system for renewable energy development.
8. Study strategies that promote water impoundment to reduce flooding.

Objective: Study land use changes in order to develop an initiative explaining the impacts of land use decisions on natural resources

1. Identify resources that help communities, improve water treatment facilities capabilities (reducing nutrient discharge).
2. Document conservation practices.
3. Evaluate entry/withdrawal of land in conservation programs.
4. Evaluate fiscal implementations of land use changes.
5. Educate landowners on ecosystem services.
6. Improve shoreline protections

Habitat

The Wabash basin has endured land use change on an astronomical scale since European settlement. Much of the landscape has been altered for agricultural production. Wetlands have been drained, forests cleared or fragmented, aquatic habitat altered from pollution and rising temperatures (Gammon, 1998).

Illinois has lost approximately 90% of its 8.2 million acres of wetlands as a result of draining, filling, clearing, and urban development. The remaining natural wetlands now occupy about 1% of Illinois, and only 6,800 acres are graded as high quality. Statewide, 12% of Illinois is covered by forest. Less than 0.3% of this forest is high quality floodplain forest, upland forest and sand forest. Fragmented land makes up most forests in the region today, which contributes to the decline of many species of birds and animals that depend on long, continuous tracts of forest. Small fragmented parcels are more susceptible to intrusion by invasive species of plants and animals, such as garlic mustard and brown-headed cowbirds (ICWCPS).

Fortunately, not all parts of the Wabash have been affected so greatly. The floodplains of the river systems support large concentrations of migratory fowl and nesting wood ducks (IDNR 2005). Many shorebird species also use managed wetlands for migration stopover sites. Priority bird species occurring in this region include the yellow-crowned night-heron, cerulean warbler, worm-eating warbler, Louisiana Waterthrush, and eastern Bewick's wren (ICWCPS). The Little Wabash watershed alone has 17 endangered species. It is home to endangered and threatened species such as the Kirtlands snake, the timber rattlesnake, the eastern sand dater minnow, the henslow's sparrow, short eared owl, yellow crowned night heron, kin rail, the northern grape fern and blazing star just to name a few (Ecosystem Partnership).

Only 240 acres of stream and river habitat are considered high quality natural areas in Illinois (ICWPCPS). Overall, habitat within the Wabash Watershed has been degraded, negatively impacting species abundance and overall health of its aquatic, semi-aquatic and terrestrial ecosystems. Without adequate management of the basin's habitat, many of the Wabash's species could one day be extinct.

Goal: Improve habitat in the basin to revitalize the natural ecosystem.

Objective: Improve aquatic habitat in the basin.

1. Identify and pursue funding for survey work in the river and tributaries.
2. Raise awareness among leaders on the importance of survey work.
3. Recommend state appropriations for Partners for Conservation to complete work digitizing data and centralizing information.
4. Identify and pursue funding for data analysis.
5. Pursue funding to establish more stream gauges, monitoring and sampling sites.
6. Evaluate existing background data and identify gaps in information to target future surveys.

Objective: Improve riparian habitat in the basin.

1. Develop and offer incentives and cost-shares to landowners to restore riparian areas and take that land out of production.
2. Educate landowners on programs offered to restore riparian areas.
3. Work with municipal groups on urban planning to protect and restore riparian areas.

4. Identify and pursue funding for staff people to combat invasive species through public education, monitoring and prevention, and establishment of weed management groups.
5. Restore floodplains through reducing channelization.
6. Urge US Department of Agriculture to re-establish Resource Conservation and Development Councils.
7. Stabilize riparian slopes and water movement to prevent erosion.
8. Educate landowners on best management practices to prevent erosion.
9. Establish recycling programs for appliances and automobiles to prevent illegal dumping.
10. Increase penalties and enforcement for illegal dumping.
11. Create and promote river clean up events.
12. Promote native and desirable species to plant along riparian areas.
13. Establish partnerships with local groups to improve riparian habitat.
14. Pursue funding through cooperative grant applications to study riparian habitats in the region by sub-watershed.
15. Review geologic history to evaluate slopes and erosion potentials throughout basin.
16. Study how riparian areas capture agricultural runoff effectively.
17. Pursue funding to create and digitize aerial photography.

Objective: Protect existing wetlands and restore new wetlands throughout the watershed.

1. Identify the location of wetlands and converted wetlands.
2. Research plant composition of wetlands in the basin.
3. Research soil hydrology for federal and state restoration programs.
4. Educate the public on the value of wetlands.
5. Create incentives for landowners to restore wetlands.
6. Work with municipalities to protect and restore urban wetlands.
7. Provide incentives to remove tile drainage under hydric soils.
8. Research how many acres are drained and how much of the drained land was a wetland formally.
9. Conduct experiments on constructed wetlands that hold tile runoff.

Objective: Restore and protect upland forests and grasslands.

1. Pursue funding for a detailed biotic inventory.
2. Pursue funding for staff to monitor upland ecosystems.
3. Educate the public on the benefits upland forests and grasslands.
4. Identify the most threatened areas and pursue funding for foresters and grassland specialists for those areas.
5. Reach out to landowners of declining and/or degraded forests.
6. Train local organizers to prescribe burn and work with local fire districts.
7. Study how conservation programs impact the ecosystems in the region.
8. Monitor and remove invasive species.
9. Promote forest management and encourage oak regeneration.

Objective: Reduce sedimentation in the Wabash River and tributaries.

1. Expand incentive programs in the region to prevent soil erosion.
2. Create demonstration sites in the basin for best management practices.
3. Promote alternative crops and cropping systems that provide increased vegetative cover.

4. Education municipalities on land use planning that will prevent run-off.
5. Establish and support local organizations to reduce run-off.

Human Resources

Throughout the basin, the number or professional staff dedicated to natural resource protection and conservation has declined. Staff members leave the positions, frequently through retirement, and their positions are not being filled. Also, resources and support is not available to the community and local activists interested in protecting natural resources. Communication between industries and stakeholders is inefficient, and conflicts between citizens and industry remain unresolved. The Soil and Water Conservation Districts are not funded adequately at the state level. Inadequate staffing for important natural resource positions and lack of community leadership has lead to inadequate public understanding of watershed issues and public planning efforts.

Goal: Work with local stakeholders to educate the public on watershed problems.

Objective: Improve local understanding of the watershed.

1. Develop and support local watershed organizations.
2. Promote green business education in schools.

Objective: Provide technical assistance to landowners wishing to protect natural resources in the watershed and restore natural habitats.

1. Pursue funding for Soil and Water Conservation Districts.
2. Pursue funding to recruit and hire foresters.
3. Study a new design to support Soil and Water Conservation District sustainably.

Hydrology

The Wabash Watershed has been impacted heavily by flooding. Severe storms are occurring more frequently, producing widespread flooding along the Wabash River in southeastern Illinois (Final Report 2008). The 2008 flood alone caused millions of dollars in damages; federal flood insurance payments reached roughly $54 million for eight counties alone within the region: Clark, Coles, Crawford, Cumberland, Douglas, Edgar, Jasper, and Lawrence. Roughly over a million acres of farmland crops were destroyed in these eight counties. More recently, the 2011 flood, which has not yet been quantified, significantly damaged the region.

Another problem facing the basin is the accessibility of regional data. Information already published or documented, it is not yet digitized. The Illinois Groundwater Protection Act of 1987 states that all data must be made digital and usable by all state agencies. Illinois has well records dating back from the 1900s, before the Act was adopted. The Illinois State Water Survey has paper and electronic files containing 370,000 wells (ISWS 2009 ground water data). Funds are limited to support ground water services, such as the well-records program, resulting in undigitized data.

The Illinois Water Inventory Program database carries high capacity well and other various well records. This program was not terminated, but is now partially supported by state resources, which must be leveraged to obtain additional external support. There are programs that are promoting a more efficient synchronization of data availability such as BASINSOFT with digital datasets in soil, topography, land cover and precipitation to develop a set of basin characteristics. However, the number of people trained to use BASINSOFT is inadequate. Knowledge of the frequency and magnitude of flood-peak discharges is essential for water-resources planning, risk management, and project design (2008 Final Report). Stream flow gauging stations have had problems with their continuous operation in the basin do to staff cuts. Gages within this region are primarily concentrated along flood prone tributaries of the Wabash River. Insufficient funding is available to develop more gauging stations, let alone keep all of them in operation.

Water usage is divided unequally in the region; roughly 82% of all water usage goes to thermoelectric generation (ISWS 2009 ground water data). The next highest user is public supply at 10% (ISWS 2009 ground water data). Water shortages in the northern region of the Wabash Watershed. More management is needed to help prevent problems such as this from spreading throughout the region.

Goal: Improve monitoring and mapping of precipitation and stream heights and reduce flood risk throughout the region.

Objective: Create and maintain stream gage stations throughout the watershed for accurate monitoring of stream heights and flood risk.

1. Work with partnerships to coordinate and pursue funding for stream gages.
2. Aggressively pursue additional funds for gage stations through congress.

Objective: Improve and expand the use of mapping and forecasting technology within the region.

1. Expand use of inundation mapping (currently in Chicago) to the Wabash Watershed to visualize risks flooding risks for the public.
2. Improve aerial mapping in region (fly at lower elevation/more detail).
3. Continue to improve GIS mapping in region.

4. Create “coordinated stream discharge manual,” as developed in Indiana with USACE, USGS, ISWS and IDNR.
5. Ensure information is digitally accessible to the public.

Objective: Reduce flood damages in the region.

1. Coordinate with the US Army Corps of Engineers and local communities to study flood damage and develop plans to alleviate damages using Section 729, the Ohio River Ecosystem Restoration Program, and other Corps authorities.
2. Encourage communities to ensure levees meet 100 year flood requirements using FEMA flood insurance studies and USACE engineers.
3. Complete 100 year ponding studies throughout the region to evaluate internal flooding.
4. Ensure all levees in Wabash Basin have been surveyed by National Levee Database.
5. Compare levee database with actual 100 year flood levels to evaluate protection.
6. Increase area of land that is terraced throughout watershed to slow storm runoff.
7. Limit development and ensure floodplain uses are only agriculture and wildlife habitat, and ensure existing FEMA floodplain guidance policies are followed.
8. Restrict septic systems within 100 year flood plain.
9. Create levee inspection and maintenance program for non-federal levees through state revolving loans or grants.
10. Promote flood alert networks that notify residents in flood prone areas of actual flood risks using local stream gage and precipitation data.

Objective: Study and summarize conflicts of law and usage regarding water allocation in the basin and establish a conflict resolution process for the watershed.

1. Ensure proactive discussions between industries and stakeholders for planning.
2. Evaluate local pollution concerns through solicitation of comments at WORCC meetings.
3. Support local entities to provide forums to discussions regarding water allocation.
4. Support & develop local leaders to advocate for water resources.
5. Work with college workforce development programs to educate natural resource professionals.

Objective: Protect the public water supply

1. Evaluate if drinking water consortium is needed.
2. Study number of private wells.
3. Improve well-owner understanding of pollution concerns for ground water.
4. Evaluate the concern of potable water supply shortages in watershed.

Recreation

Public recreation opportunities in the Wabash Basin are few and far between because most land is in private ownership. Greenways, public lands or public water access are lacking in most counties. River trail systems have been developed in the region, but improvements are needed to connect the trails. Out of area visitors tend to follow Interstate 57 on the west side of the watershed, leaving the lands along the Wabash River underutilized (2010 Bureau of tourism). Promotion of the existing trails and recreational opportunities is needed to increase visits.

Recreation in the Wabash is mostly regional tourism; people from other communities and surrounding counties. Many historical sites are within the region, but they are not popular enough to bring in people from outside the area. Unlike on many rivers in the state, large reservoirs that provide lots of water recreational activities are absent here.

Surveys conducted by the Illinois Department of Natural Resources concluded that outdoor recreation areas are important for health and fitness, that recreation areas should serve all people, and that community recreation areas are important for quality of life and promoting economic development. The most popular recreation activity is pleasure walking. Behind that most people enjoy picnicking, observing wildlife/bird watching, swimming in a pool, using a playground, and hiking and biking on trails. Most people consider outdoor recreation areas as important for general health and fitness, and that the areas make a valuable contribution to the quality of life and economic vitality of communities (IDNR Statewide recreation survey 2008). Thus, outdoor recreational opportunities should focus around these popular areas.

Goal: Increase recreation in the Wabash River Watershed.

Objective: Increase public access to public and private land for recreational opportunities.

1. Increase river access points for canoes and kayaks in Illinois.
2. Improve police presence in rural areas to protect private land owners.
3. Develop incentives to promote access on private land.
4. Buy-out floodplains and use areas for recreation during low flows.
5. Improve public knowledge of landowner rights when they provide public access to their land.
6. Purchase more land for public recreation in the watershed.
7. Amend Illinois' Recreational Use Act to resolve liability issues.
8. Develop lotteries for only local residents to hunt certain areas.
9. Develop a comprehensive recreational needs assessment.

Objective: Develop, promote and maintain walking, biking and paddling trails in the watershed.

1. Develop rural walking, biking and paddling trails.
2. Work with Indiana to support the Wabash River Heritage Corridor.
3. Promote the Wabash River Water Trail with Indiana.
4. Develop tributary paddling trails in Illinois.
5. Develop, with Indiana and Ohio, a trail along the entire Wabash River.
6. Support local municipalities to create local trails.
7. Develop interpretive materials for trails.
8. Designate "river roads" along the Wabash and main tributaries for scenic drives.
9. Develop a Wabash River community designation.
10. Create and promote geo-caching opportunities.

11. Develop a Wabash River road rally.

Objective: Promote existing recreational opportunities and events in the watershed.

1. Increase promotion of existing eco-tourism events.
2. Identify existing recreational and public tournaments.
3. Promote free activities, such as walking trails and picnicking.
4. Promote hunting, mushroom hunting and fishing as recreation and food sources.
5. Advertise the quality of the tributaries for paddling.
6. Partner with local river groups.
7. Develop an eco-tourism "mascot" for the region.
8. Promote tourism by linking areas to historical events.
9. Work with local Pheasants Forever, Quail Forever and the National Wild Turkey Federation to promote hunting.
10. Partner with local tourism organizations.
11. Develop a Wabash River logo to use on river roads and community designations.
12. Promote awareness of the economic impacts and benefits of eco-tourism.
13. Tailor marketing efforts to rural residents.
14. Change negative public perception of natural resources (river is dirty or woods are dangerous).
15. Educate the public on local endangered species.
16. Promote Becoming an Outdoors Woman and Women in the Outdoors.
17. Expand and promote recreational opportunities for women, children and minorities.
18. Create grade school educational programs that focus on the Wabash River.
19. Encourage the expansion of opportunities at federal and State facilities.

Research and Monitoring

Compared to other watersheds in the state, data and information on the Wabash River and its tributaries is limited. The US Geological Survey monitoring is available online, and there are fewer than 20 monitoring stations in the basin, two on the main stem. Funding for monitoring stations in the region has been cut and new or updated technologies are not being implemented. The bibliography for this plan includes most of the existing information for the region.

Although a comprehensive strategic plan has not yet been fully developed for this region, its smaller subwatersheds have already implemented one of their own. Some of the watersheds that have already created a strategic management plan are the Little Wabash River Basin, Embarras River Basin, Skillet Fork Basin and Upper Salt Fork of the Vermilion Basin. Indiana has developed plans that can be used on the Illinois side, such as the Watershed Restoration Action Strategy for the Middle Wabash-Busseron Watershed, which is shared between Indiana and Illinois.

Purdue University and the University of Illinois have studies in the basin area on soil permeability, magnitudes for peak-flood discharge, recurrence intervals of large and small floods, future projections of land use change, how urban areas influence weather, large river meanders and confluences, and mapping impacts of tiling. Sustainable funding is needed in order for research to be initiated and continued.

Goal: Support and expand research within the Wabash River watershed.

Objective: Review existing data within the watershed.

1. Complete a comprehensive review of all existing data in basin.
2. Science Advisory Committee will review and make recommendations to the Lt. Governor on information gaps and research needs.

Objective: Make data more available to the public for widespread use.

1. Make data more user friendly through the Illinois Rivers Decision Support System and Illinois Council on Food and Agricultural Research.
2. Evaluate new or improve existing data clearinghouses.
3. Involve the public in monitoring decisions.
4. Develop classroom resources for the Wabash Watershed.
5. Develop partnerships with local schools to promote citizen monitoring.
6. Create classroom exchanges between upstream and downstream schools to study the impacts of upstream decisions.
7. Educate the public on research results.
8. Promote the natural resources in the region and expand public interest in research.

Objective: Expand research in the watershed.

1. Promote and improve centralized databases on all monitoring.
2. Expand water quality monitoring on streams and tributaries.
3. Identify and pursue funding sources for research.
4. Develop partnerships with Indiana and Federal Government to complete studies.
5. Expand RiverWatch in the region.
6. National Great Rivers Research and Education Center will develop and implement new citizen scientist initiatives.

Water Quality and Quantity

Throughout the Wabash Watershed, water quality has been impaired do to anthropogenic influences. Although the region's health increased tremendously from the Clean Water Act, the Wabash River main step is impaired with fecal coliform and *E. coli,* including some of its tributaries (IEPA 2006 TMDL report).

The presence of fecal coliform and *E. coli* bacteria indicates water has been contaminated with human or animal wastes, generally from the overflow of domestic sewage or nonpoint sources (ORMSS). Fecal coliform also indicates potential health risk to humans through consumption or contact with water that may have been contaminated by pathogens or disease producing bacteria or viruses.

Alarmingly, *E. coli* and fecal coliform exceed the Environmental Protection Agency's Total Maximum Daily Loads for all segments of the Wabash River within Illinois to its confluence with the Ohio River (IEPA 2006). Throughout the region, numerous concentrated feed operations exist. Animal waste loads from these operations are relevant to the tributaries or sub watersheds draining directly to the Wabash River, and 80-90% load reductions are required for all of the tributaries for *E. coli* and fecal coliform (IEPA 2006 TMDL report). Improvements in management must be made throughout the region to help reduce these harmful concentrations.

Run off carrying sedimentation loads and suspended solids have also contributed to poor water quality. Human activities such as clear cutting trees, draining wetlands, agriculture practices and urban development accelerates soil loss and runoff to waterways. Studies from Purdue University in the Wabash River have taken samples of soil in the water have shown that 68% of the weight by volume was contributed from clay, 27% silt and 5% particles. Increased sedimentation and siltation, can damage habitats for fish and other aquatic life. And sediment provides attachment sites for other pollutants such as nutrients, pesticides, heavy metals and bacteria, mostly from agriculture. Sedimentation in the Wabash River also contributes to the problems associated with the navigability in the Ohio River.

The region's river systems have large amount of nutrients from farm, industrial and urban runoff (IEPA 2006). Major sources of these nutrients entering rivers include municipal and industrial wastewater, septic systems, agricultural runoff and atmospheric deposition. These nutrients contribute to hypoxic zones in the Gulf of Mexico (Hite 1989). Heavy metal contamination in the river has resulted from various sources including coal mine drainage and industrial activity, particularly the iron and steel industry (Hite 1989). There are a few abandoned mines in the region which have leached pollutants into small segments of the Wabash tributaries.

Thermal impacts can also be considered a pollutant and by degrading habitat quality; when water temperatures rise, it may be intolerable to fish spawn (Partnership 2007)/(IEPA 2006)/(Gammon 1998). Throughout the Wabash, upper, middle, and lower, point source facilities have exceeded the in stream temperature criteria in their effluent as allowed in their permits under the CWA Section 316(a) variances. (Thermal Modifications Impairment, IEPA). It has contributed to warming portions of the Wabash, but has impacted the smaller streams more so where many fish species like to spawn (IDNR 2004). This has been a problem that has yet to be resolved within the Wabash Watershed.

Goal: Improve water quality in the Wabash River and its tributaries.

Objective: Ensure there is an adequate water supply to meet human and habitat needs.

1. Develop plans for drought years to reduce water use.
2. Coordinate planning for drought conditions to reduce water use.

3. Coordinate planning for floods to reduce damage.
4. Evaluate how tile drainage impacts water supplies.

Objective: Eliminate pollution from oil and gas wells.

1. Evaluate regulations and push for legislative and regulatory amendments that help prevent spills and leaks.
2. Develop management plans with drilling businesses to ensure adequate practices are in place to prevent spills and leaks
3. Ensure closed well sites are properly restored.
4. Evaluate worker safety regulations and push for improvements.
5. Pursue funding to restore abandoned well sites.

Objectives: Ensure groundwater is safe to drink and expand the public understanding of groundwater issues.

1. Educate well owners on water testing and pollution threats.
2. Evaluate set-back zones to determine if they need to be expanded or improve enforcement of them.
3. Study groundwater pollution in the region and develop practices to prevent it.
4. Work with municipalities to encourage better land use planning.
5. Reduce chemical fertilizer and pesticide use in the region by encouraging nutrient management plans.
6. Evaluate how tile drainage impacts water wells.
7. Identify all the recharge resources for ground water.
8. Research and identify current and future water use levels.
9. Identify and promote funding source to upgrade rural water systems.
10. Identify funding and promote proper sealing for abandoned water wells.
11. Provide more resources to educate landowners with private wells on contamination risks and safety.
12. Enforce proper maintenance of septic systems.
13. Review regulations on manure spreading and potential to contaminate drinking water.

Objective: Improve the water quality of lakes and streams.

1. Enforce septic system maintenance.
2. Reduce erosion, sedimentation and run-off.
3. Improve regulations for livestock waste.
4. Encourage municipalities to apply for grants to upgrade storm and waste water infrastructure.
5. Encourage nutrient management plans to reduce nutrient runoff.

Bibliography

Illinois Envionmental Protection Agency (2006). *Wabash River Watershed TMDL Report.* Springfield: Tetra Tech, Inc.

Boyce, R. R. (1964). *Regional Development adn the Wabash Basin.* Urbana: University of Illinois Press.

Center, B. N. (2009). *Biological Inventory of the Upper Little Wabash Ecosystem Partnship Area.* Altamont: BNC.

Cherkauer, K. A. (2011, June). The Hydrologic consequences of Environmental Change in the Wabash River Basin. West Lafayette, Indiana.

Commission, G. W. (2003). *Wabash River Trail Plan .* Springfield : IDNR.

Commission, W. R. (2006). Wabash River Water Trail Map 9. *Gibson and Posey Counties* .

Committee, P. f. (2001). *Watershed Management Plan for Turtle Creek and Little Turtle Creek.* Sullivan: PTCWC.

Committee, S. F. (2007). *Watershed Implementation Plan for the Upper Salt Fork of the Vermilion River.* IEPA.

U.S. Army Corps of Engineers (2006). *System Investment Plan/Programmatic Environmental Ipact Statement Integrated Main Report.* Huntington: US Army Corps.

David T. Soong, A. L. (2004). *Estimating Flood-Peak Discharge Magnitutes and Frequencies for Rural Streams in Illinois.* Reston: United States Geological Survey 2004-5103.

Dr. David Rohall, D. K. (2009). *2008 Illinois Outdoor Recreation Survey.* Springfield : IDNR.

Elrick, S. D. (2008). *Coal Idustry in Illinois.* ISGS, IDCEO.

ERMA. (1996). *Embarras River Basin Resource Management Plan.* USDA.

FEMA. (20010). *Flood Insurance Study for White County, Illinois.* FEMA 17193CV000A.

Gammon, J. (1998). *The Wabash River Ecosystem.* Plainfield: Cinergy Corporation.

IDEM. (2002). *Watershed Restoration Action Strategy for the Middle Wabash-Busseron Watershed.* Bloomington: Wittman Hydro Planning Associates, Inc.

IDNR. (2006). *Clark County, Illinois Trails and Greenways Vision Plan 2006.* Storrow Kinsella Associates Inc.

IDNR. (2009). *Jasper County Eagle Trails and Greenways Plan.* Springfield : IDNR.

IDNR. (2002). *Kaskaskia River Watershed.* Southwestern Illinois RC&D, INC.

IDNR. (2004). *Strategic Sub-Watershed Identification Process: Maximizing Benefits of Ecosystem Management.* Springfield : IDNR.

IDNR. (2007). *Stream Assessment Selected Tributaries of Upper Little Wabash River C-2000 ULW 008-06.* Midwest Streams, Inc.

IDNR. (2005). *The Illinois Comprehensive Wildlife Conservation Plan & Strategy Version 1.0.* Springfield: IDNR.

IL Office of Sustainablility, O. o.-C. (2008). *Aftermath of the Floods of June 2008 & Rcommendations for Long-term Economic Recovery.* IL DCEO.

Joan F. Kenny, N. L. (2005). *Estimated use of Water in the United States in 2005.* U.S. Geological Survey Circular 1344, 52 p.

John Marsh, A. M. (2008). *Trails, Trail Users and Their Managment .* Peterborough: Trent University .

Parnership, U. L. (2007). *Strategic Watershed Plan.* Glencoe: Facilitated Solutions International.

Resources, I. D. (2001). *Floodplain Management in Illinois Quick Guide.* Springfield: IDNR Office of Water Resources.

Robert L. Hite, M. R. (1989). *An Intensive Survey of the Little Wabash River Basin.* Marion: IEPA.

Rupe, A. (2011). *Illinois Watersheds: Wabash and Ohio Regions.* IIRA.

Scott P. Shasteen, M. R. (2003). *An Intensive Survey of the Little Wabash River Basin and Lower Wabash Tributaries 1996/1999 Data Summary.* Marion: Bureau of Water.

Scott P. Shasteen, R. L. (2002). *An Intensive Survey of the Skillet Fork Basin Summer 1998.* Springfield : IEPA.

Illinois State Water Survey (2011, June). *Illinois Water and Climate Summary.* Retrieved July 2012, from Illinois State Water Survey: www.isws.illinois.edu/warm

Illinois State Water Survey (2011). *Illinois Water And Climate Summary.* Champaign: ISWS.

Illinois State Water Survey (2009, May). ISWS Groundwater Database Description and Policies and Procedures Regarding Access. Illinois.

Tourism, I. B. (2010). *The Economic impact of Travel on Illinois Counties 2009.* Washingtion: U.S. Travel Association .

USDA. (2007). *2007 Census of Agriculture-County Data*. Retrieved July 2012, from www.usda.gov

USEPA. (2002). *A Home Owners Guide to Spetic Systems.* Cincinnati: USEPA.

USEPA. (1997). *Top 10 Watershed Lessons Learned.* Washington: USEPA.