ILLINOIS NATURAL HISTORY SURVEY
PRAIRIE RESEARCH INSTITUTE

Revision and Update of the Illinois Wildlife Action Plan's Streams Campaign: Final Report

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Final Report

Project Title:
Revision and Update of the Illinois Wildlife Action Plan's Streams Campaign.

Project Number: T-97-R-001

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Goals/ Objectives: (**1)** Develop a narrative describing the status of the Streams Campaign containing background, current conditions, and desired conditions; (**2)** Develop a narrative for the Streams Campaign containing a description of selecting and prioritizing focal themes; (**3)** Develop a narrative for the Streams Campaign containing Action Items to address priorities and data deficiencies within focal themes; (**4)** Complete a final report that includes a revision of the Streams Campaign of the Illinois Wildlife Action Plan.

Project Title:

Revision and Update of the Illinois Wildlife Action Plan's Streams Campaign.

Narrative:

We used new and existing information to revise and update the Streams Campaign of the Illinois Wildlife Action Plan (IWAP). The draft produced is organized around six focal themes and contains newly articulated goals developed with the assistance of the Streams Campaign Steering Committee. The draft includes sections describing the current status of aquatic habitats, stressors and threats to wildlife and habitats, focal species (selected to act as ecological indicators for effectiveness monitoring), focal areas, and conservation actions. We have also conducted a broad scale priority watershed analysis that identifies areas for protection and enhancement based on their biological richness and relative anthropogenic disturbance. Finally, we have identified potential performance measures for each of the Streams Campaign Implementation Goals.

Job 1. Review existing IWAP and consolidate information on aquatic habitats and SGNC associated with the Streams Campaign.

We reviewed all information associated with aquatic habitats and species that were part of the Illinois Comprehensive Wildlife Conservation Plan & Strategy (CWCP; State of Illinois 2005) and consolidated this information for use in the revision of the Streams Campaign. Due to the nature of the revised Campaigns as Implementation Guides much of the specific information concerning Natural Divisions was not specifically incorporated into the revised Campaign Chapter. Although this information is still useful for conservation planning, and remains part of the Comprehensive Plan & Strategy, it was not further refined as part of this revision.

Job 2. Review progress since IWAP implementation began in 2005 to assist with describing current conditions for aquatic habitats and SGNC.

Change in resource status was evaluated in several ways including by comparing acres of high quality aquatic resources identified in 2005 and again in 2015. Progress towards desired conditions for resources, challenges, actions and information needs were also evaluated by reviewing 10 types of activities and documenting the number of these that were conducted since implementation of the CWCP began in 2005 (Table 1). Additional information on the status of SGNC and their habitats was acquired from project reports and ongoing efforts supported by Illinois' SWG Program (e.g., T-13, T-20, T-25, T-68, T-82, T-88). This information was used to develop the Status Section of the revised Streams Campaign for the IWAP revision.

Job 3. Develop a common vision for statewide desired conditions of Aquatic Habitats and SGNC with input from Stream Campaign Steering Committee.

We developed and conducted an online survey of the Streams Campaign Steering Committee and other interested partners (Table 2). The survey had 81 responders from 43 organizations across Federal, State, and local government agencies, as well as non-

governmental organizations (Figure 1). Desired conditions for Illinois waters were generally outlined by these efforts although specific benchmarks for individual waterbodies will require additional work outside the scope of this project.

We planned and held a workshop with these partners and presented the results of the online survey and of our status assessment (Job 2). We presented a general outline of possible goals and objectives derived from the survey results and initiated the development of a common vision and specific goals for the Streams Campaign. The result of these efforts were consensus goals and objectives (listed below) that were incorporated into the draft revision of the Streams Campaign. We renamed "Campaign Objectives" to "Implementation Goals" within the draft Streams Campaign to align with their purpose of guiding work during the next 10 years. In addition, the Wildlife Action Plan Revision Team decided to use "SGCN" rather than "SGNC" in the implementation document to better align with the acronym used by neighboring states for species in greatest conservation need. We have retained the use of SGNC in this report to correspond to our project objectives except where we directly relate to the text in the draft Streams Campaign revision where SGCN has been used (e.g., Campaign Goals directly below).

Campaign Goals:

- Viable populations of each SGCN will be supported
- Habitats will be managed for appropriate structure and function, including water quality, to support SGCN
- The public will have an awareness, appreciation, and connection to SGCN and associated habitats

Campaign Objectives:

1. Illinois waters will support high biodiversity.
2. Abundance and distribution of SGCN will be increased or maintained.
3. High quality aquatic communities will be protected by conservation easement, ownership, or designation as Nature Preserves, Land & Water Reserves, or Outstanding Resource Waters.
4. Illinois waters will fully support designated uses.
5. Illinois waters will provide appropriate physical habitat, hydrologic regimes, fluvial geomorphology, and connectivity to support SGCN.
6. The public's environmental awareness, appreciation, and connection to SGCN and their associated habitats will be increased.

Job 4. Review statewide issues and update/prioritize conservation needs into focal themes for aquatic habitats and SGNC.

We reviewed recent literature associated with conservation of aquatic habitats and potential stressors to SGNC (e.g., Hall 2012, Staudinger et al. 2015, Winters et al. 2015, Heitmeyer & Mangan 2012, Wilkinson et al. 2009, Healy et al. 2015, Illinois EPA 2014, IDNR/IEPA 2006) to identify issues of conservation concern. In addition, as part of our survey of

Partners we asked them to identify the most appropriate target for stream conservation from the following categories: water quality, habitat, biodiversity, high quality areas, water supply/allocation, or recreation. Water quality, habitat, and biodiversity were consistently identified as the most appropriate targets for conservation efforts.

We also asked partners for potential Conservation Actions associated with the goals and objectives developed at our earlier workshop. Over 200 Actions were submitted for review. These were sorted based on the conservation need or objective addressed by the activity. Six themes emerged from these efforts that address (1) Monitoring & Assessment, (2) Protection & Stewardship, (3) Flow Management & Water Quality, (4) Fragmentation & Connectivity, (5) Invasive Species & Wildlife Diseases, and (6) Public Support & Action. These themes were used to provide organization and focus to the Streams Campaign revision.

Job 5. Conduct Priority Watershed Analysis: Assess current status of identified conservation areas at conserving stream SGNC and identify where gaps exist.

We used available data on presence of fish, mussels, and EPT along with a measure of watershed disturbance to conduct a priority watershed analysis for Illinois streams. Locations of fish and mussel SGNC and EPT were obtained from existing IDNR, IEPA, and INHS databases. Richness was then determined for each of these taxonomic groups for HUC8 watersheds throughout Illinois. Watershed richness was ranked statewide and within each EDU (as defined in Hinz et al. 2013, Hinz et al. 2015). We used disturbance measures developed by the National Fish Habitat Partnership (Esselman et al. 2011) and summarized the mean condition for all stream segments within each of Illinois' HUC8 watersheds using a weighted average based on watershed area of individually attributed local watersheds.

We defined four types of conservation priorities for watersheds in Illinois based on observed biodiversity (i.e., taxa richness) and connectivity. Separate prioritizations were made for fish, mussels, and EPT.

1. Biodiversity Protection Watersheds are the highest diversity reaches statewide based solely on richness measures (Figure 3a-c). We assume that currently existing conditions are sufficient to sustain the observed populations in these watersheds.

2. Biodiversity Source Protection Watersheds are defined as the highest diversity reaches among their neighboring reaches within a defined region (Figure 4a-c). Neighborhoods were defined as Ecological Drainage Units (EDUs) as previously described (Hinz et al. 2013, Hinz et al. 2015). Protection of these watersheds should be given priority since they have the potential to serve as sources areas for neighboring watersheds that are enhanced or restored.

3. Enhancement Watersheds were defined as reaches with lower biodiversity relative to other reaches within their regional neighborhood (Figure 4a-c). Local conditions in Enhancement Watersheds are assumed to be insufficient to sustain assemblages similar to neighboring biodiversity source protection watersheds. These watersheds are expected to become more similar to their higher diversity neighbors through enhancement of habitat or improving the recruitment or survival of identified species of conservation interest.

4. Restoration Watersheds are those reaches with obstructed connectivity or observed historic loss of species. Reestablishment of connectivity where it previously occurred is expected to increase local biodiversity by allowing immigration from neighboring watersheds. Reestablishment of species will directly increase biodiversity from current conditions. We did not identify Restoration Watersheds as part of this project due to time constraints as this would require a comprehensive analysis of watershed connectivity and individual species distributions.

These efforts are a good start for identifying areas that guide conservation activities. However, since many types of conservation actions can occur at any site, or stream reach, this characterization may be at too broad a scale. Continuing these efforts at a finer resolution (i.e., the reach scale) should prove to greatly improve our ability to prioritize conservation activities in Illinois streams and improve their outcomes.

Job 6. Revise list of threats, ecological indicators, and performance measures for Streams Campaign and associated habitats and SGNC.

Participants in our survey were asked what they saw as the biggest threat to stream conservation in the short term (<10 years) and in the long term (>10 years), in addition to how much action their organization has taken to address that threat in the last 10 years. Agriculture was seen as the greatest threat in the short and long term, pollution as the second greatest, and residential development, invasive species, system modifications and energy production ranked closely behind. Short and long term threats were similar with the exception of climate change which increased in rank when viewed in the long term. Surprisingly, with the exception of agricultural threats actions taken to address these threats by our partnering organizations did not correspond well with what were seen as the greatest short term or long term threats. Overall the partners that responded to the survey primarily undertook actions to address invasive species, followed by agricultural impacts and system modifications.

We compiled the results from several projects (e.g., T-68, T-82) and other information from working groups directed at updating Illinois SGNC for the IWAP revision. Threats and stressors for the Streams Campaign were also summarized from our online survey of partners. This information was used to develop the section on Stressors/Threats for the revised Streams Campaign and included information on surface waters, subterranean

waters, invasive species & wildlife diseases, and climate change.

Focal Areas

Focal Areas were included as part of the campaign revision template developed by the campaign revision team. Focal Areas were designed to be geographic locations where significant activity was expected to occur in the next 10 years that benefit Campaign Goals. For the Streams Campaign we identified four Focal Areas corresponding to biodiversity hotspots of statewide importance and areas identified in existing conservation initiatives with strong public and State support (Figure 5). Biologically Significant Stream reaches were selected as areas contributing highly to statewide biodiversity (http://www.dnr.illinois.gov/conservation/BiologicalStreamratings/Pages/default.aspx). The Cache River basin was selected based on its importance as a wetland river system, distinct fauna, and ongoing work of the Cache River Joint Venture. Illinois Department of Natural Resources Important Areas are locations owned or managed by IDNR that were identified as areas with the greatest opportunity for IDNR implementation of IWAP goals (http://www.dnr.illinois.gov/conservation/IWAP/Pages/IDNRImportantAreas.aspx). Nutrient Management Priority Areas are identified in the Illinois Nutrient Loss Reduction Strategy to focus efforts on improving water quality by reducing nutrient loading (State of Illinois 2015).

Focal Species (ecological indicators)

The IWAP campaign revision team also included Focal Species as part of the campaign revision template. Focal Species are designed to be used as ecological indicators for effectiveness monitoring of conservation actions for each Campaign. We asked the Streams Campaign Technical Committee members for suggestions of focal species for individual habitat types, stressors, and Focal Areas. Many of the suggestions were not SGCN but rather more common species, or in some cases indices, that might be used as surrogates. Species of fish were most frequently suggested as focal species followed by freshwater mussels. There were very few suggestions for other invertebrates except for specific habitats (e.g., subterranean habitats) or as part of indices (e.g., EPT richness). We aggregated these suggestions based on the stressor, habitat, or Focal Area most closely associated with the known ecological requirements and distribution of the species and sent the full list to the Technical Committee for further comment. Surrogates were selected for use when SGCN were too rare or vulnerable to monitor directly or to represent multiple SGCN with similar life histories, sensitivities to stressors, or that reside in similar habitats. We attempted to include both vertebrate (usually fish) and invertebrate (usually mussel) species in each group. We present focal species (and surrogates) for Campaign Focal Themes and Focal Areas in the draft Campaign document (Appendix I).

Performance Measures

We identified potential Outcome Performance Measures (to assess the consequences of Conservation Actions) and Output Performance Measures (to quantify activities targeted toward the Campaign) for each of the Implementation Goals of the Streams Campaign (Table 3). While these performance measures were not directly incorporated into the draft

their use is recommended to assess progress associated with the Streams Campaign.

Job 7. Review existing Campaign actions for revision and identify new actions to address priorities within focal themes and to address data deficiencies for aquatic species and habitats.

Our survey participants were asked to rank the importance of conservation actions used to address identified threats as well as their organization's interest in undertaking those actions. The four highest ranked actions were (1) land/water management, (2) land/water protection, (3) public education and awareness, and (4) law and policy. These correspond well with the four actions with the most organizational interest.

We received over 200 recommendations for Conservation Actions to be part of the Streams Campaign from our partners in conservation and research organizations. These ranged from general recommendations like expanding outreach & educational efforts, or increasing monitoring of amphibians, to detailed research plans for individual species. Many of these recommendations were similar to existing actions in the 2005 Streams Campaign. We reviewed each recommended Action and attempted to consolidate these wherever possible. Some recommendations were specifically related to activities under the jurisdiction of a state or federal agency (e.g., IEPA, USACE). Lists of recommended Actions were developed for each such agency (Appendix II).

These recommendations were used to identify Actions for the revised Streams Campaign and sent to the Streams Campaign Technical Committee for review. Suggested changes, including additions, were incorporated into the Actions Section of the draft Streams Campaign.

Job 8. Complete reporting requirements including a revision of the Streams Campaign section of the Illinois Wildlife Action Plan.

This report was completed as well as a working draft of the Streams Campaign. The draft Streams Campaign was organized using the format developed for the Campaign sections by the Wildlife Action Plan revision team. The revision team reviewed this draft and comments have been incorporated were possible. The draft was also sent to the Streams Campaign Steering Committee for review and comments have been incorporated were possible (Appendix I). Additional internal IDNR and external public review and subsequent edits will take place after the completion of this project so the final revised Streams Campaign may differ from the draft presented in Appendix I of this report.

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Table 1. Activities conducted in support of the Streams Campaign (2005-2014).

Funding/Effort Source	n related to streams campaign
State Wildlife Grants	35 studies
Wildlife Protection Fund Grants	32 studies
Nature preserve/Land and water reserve additions	88 properties
IDNR-driven stream restorations	14 projects
IDNR-driven dam removals	24 removals and passages
Endangered Species Protection Board projects	6 studies
EPA 319 projects	139 projects
DNR OMLP purchases	80 properties
FWS Partners Program stream restorations	23 projects
CRP/CREP additions in riparian enhancement practices	15,916 properties (107 in CREP)

Table 2. Contributing Partners to the Streams Campaign Revision. These individuals participated in some combination of the online survey, the workshop, review of actions, focal species, or the entire draft revision.

Partnering Organization and participant
Regional Partners
Clifftop Alliance
Carl DauBach
The Conservation Foundation
Stephen McCracken
Illinois Audubon Society
Debbie Newman
Illinois Chapter of the American Fisheries Society
Trent Thomas
Illinois Chapter of Sierra Club
Cindy Skrukrud
Jo Daviess Conservation Foundation
Jim Johannsen
National Wild Turkey Federation
John Burk
Park Lands Foundation
Angelo Capparella
Prairie Rivers Network
Elliott Brinkman
Stacy James
Shawnee Resource Conservation & Development
Tracy Boutelle-Fidler
Southwestern Illinois Metropolitan and Regional Planning Commission
Paul McNamara
The Nature Conservancy
Krista Kirkham
The Nature Institute
Patricia Brown
Trout Unlimited
Jeff Hastings
Conservation, Forest Preserve, and Park Districts
Carroll County Soil and Water Conservation District
Shay Bradbury
Champaign County Forest Preserve District
Michael Daab
Forest Preserve District of Dupage County
Jessi DeMartini
Forest Preserve District of Cook County (FPDCC)
Charles O'Leary
Jo Daviess County Soil and Water Conservation District
Mike Malon
Urbana Park District
Derek Liebert

Table 2. Continued.
Federal Partners
US Army Corps of Engineers - Rock Island District
Chuck Theiling
Ben Vandermyde
US Department of Agriculture - Natural Resource Conservation Service
Kerry Goodrich
US Fish and Wildlife Service
Donovan Henry
Gwen Kolb
Kris Lah
Jacob Randa
US Forest Service - Shawnee National Forest
Matthew Lechner
State of Illinois Partners
Illinois Department of Natural Resources
Diane Tecic
Lisa Cotner
MaryKay Solecki
IDNR - ORC - Division of Fisheries
Debbie Bruce
Jim Mick
Vic Santucci
IDNR - Office of Reality & Environmental Planning
Nathan Grider
Pat Malone
Jessica Riney
IDNR - ORC - Division of Natural Heritage
Ann Holtrop
Bob Gillespie
Mark Guetersloh
Tara Kieninger
Eric Smith
Robert Szafoni
IDNR - ORC - Division of Private Lands & Watersheds
Mike Chandler
Luke Garver
Illinois Environmental Protection Agency
Gregg Good
Matt Short
Roy Smogor
Scott Tomkins
Amy Walkenbach
Brian Willard
Illinois Nature Preserves Commission
Angella Moorehouse

Table 2. Continued

Research & Education Partners
Shedd Aquarium
Phil Willink
University of Illinois (UIUC)
UIUC - Prairie Research Institute (PRI)
PRI - Illinois Natural History Survey (INHS)
Lama BouFajreldin
Yong Cao
Andrew Casper
Kevin Cummings
Ed DeWalt
Sarah Douglass
Andrea Fritts
Mark Fritts
Jason Robinson
Allison Stadola
Chris Taylor
Jeremy Tiemann
PRI - INHS - National Great Rivers Research & Education Center
Lisa Beja
Lyndsey Ramsey
Matt Young
Other Partners
Conservation Technologies
Dave Maginel
Little River Research and Design
Amanda Nelson
Living Lands and Waters
Mike Coyne-Logan

Table 3. Potential performance measures for Streams Campaign Implementation Goals. Outcome performance measures are designed to assess the overall impact of undertaking conservation actions on Implementation Goals. Output performance measures are designed to assess how active the program is at working toward the Implementation Goals.

Streams Campaign Implementation Goal	Type	Performance Measure
	Outcome	BSS quality stream segments (total # or stream km)
Biodiversity	Outcome	Mean native taxa richness of waterbody is maintained or increases (for fish, mussels, EPT).
	Output	Number of conservation plans and recovery plans developed for aquatic SGNC (annual total)
	Output	Number of reintroduction or translocation projects for aquatic SGNC (initiated annually or currently funded)
	Outcome	Focal Species abundance (relative abundance) is maintained or increased within Focal Areas
Abundance & Distribution	Outcome	Focal Species distribution is maintained or increased within Focal Areas (Mean number of reaches [waterbodies] with recent observations; proportion of reaches evaluated)
	Output	Number of waterbodies surveyed for SGNC (annual total)
	Output	Number of vulnerability assessments conducted for SGNC (annual total)
	Outcome	Percentage of BSS reaches with protected status (based on stream length or number of reaches)
Protection of High Quality Communities	Outcome	Waterbodies under protected status (acres or stream length)
	Outcome	Percentage of aquatic SGNC with >2 populations (recent observation locations) within protected areas.
	Output	Waterbodies, stream kilometers, or total area that have received permanent protected status (e.g., Illinois Nature Preserve, annual total)
	Output	Waterbodies, stream kilometers, or total area that have received term-limited protected status (e.g., long-term easements; annual total)

Table 3. Continued

Streams Campaign Implementation Goal	Type	Performance Measure
	Outcome	Percentage of evaluated reaches meeting aquatic life designated use
Support Designated Uses	Outcome	Percentage of evaluated reaches fully supporting all designated uses
	Output	ratio of impaired waters (CWA 303(d) list) receiving Section 319 program funding to eligible impaired (Category 5) waters [based on biennial integrated report]
	Output	TMDLs or Category 4b plans completed (number per year)
	Outcome	Connected stream reaches statewide (total or mean length)
Provide Habitat for SGCN	Outcome	Major dams with functioning fish passage systems (percent)
	Outcome	Number of reaches (waterbodies) with recent observations of T&E species
	Outcome	Change in distribution and/or abundance of fragmentation & connectivity focal species (and surrogates)
	Outcome	Habitat quality measures of waterbodies are maintained or improve (QHEI, IHI, fish IBI, mussel diversity)
	Output	Habitat enhancement projects conducted annually (number, acres or stream km, funds expended)
	Outcome	Proportion of individuals donating to Wildlife Preservation Fund on IL State Income Tax returns.
Public Awareness, Appreciation, Connection	Outcome	Proportion of Public with an awareness of IESPB, INPC, or Invasive Species Programs (requires initiating surveys)
	Outcome	Proportion of public who have knowledge of and attachment to local aquatic natural areas and species (requires initiating an attachment survey)
	Output	Number of hits on Streams Campaign Web page
	Output	Number of requests for IDNR eductional information kits related to aquatic habitats or species
	Output	Outreach events held relating to aquatic habitats or species (number of events, number of participants)

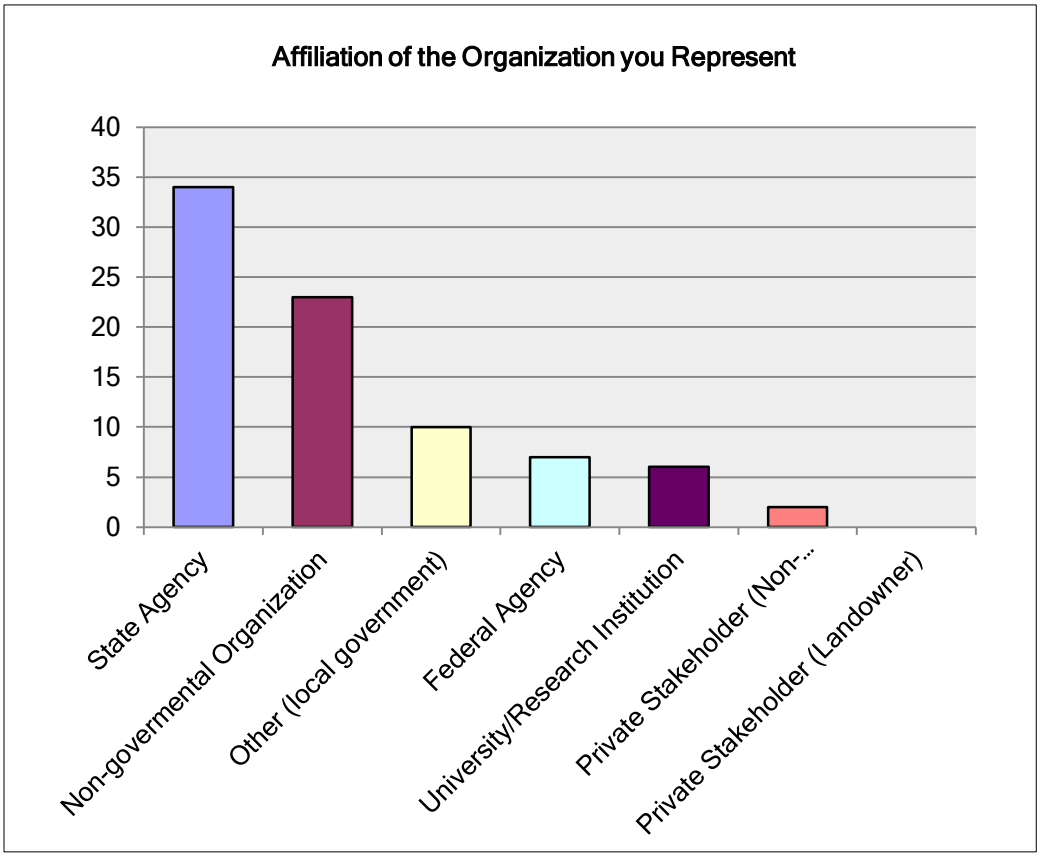

Figure 1. Observed participation in the Streams Campaign online survey.

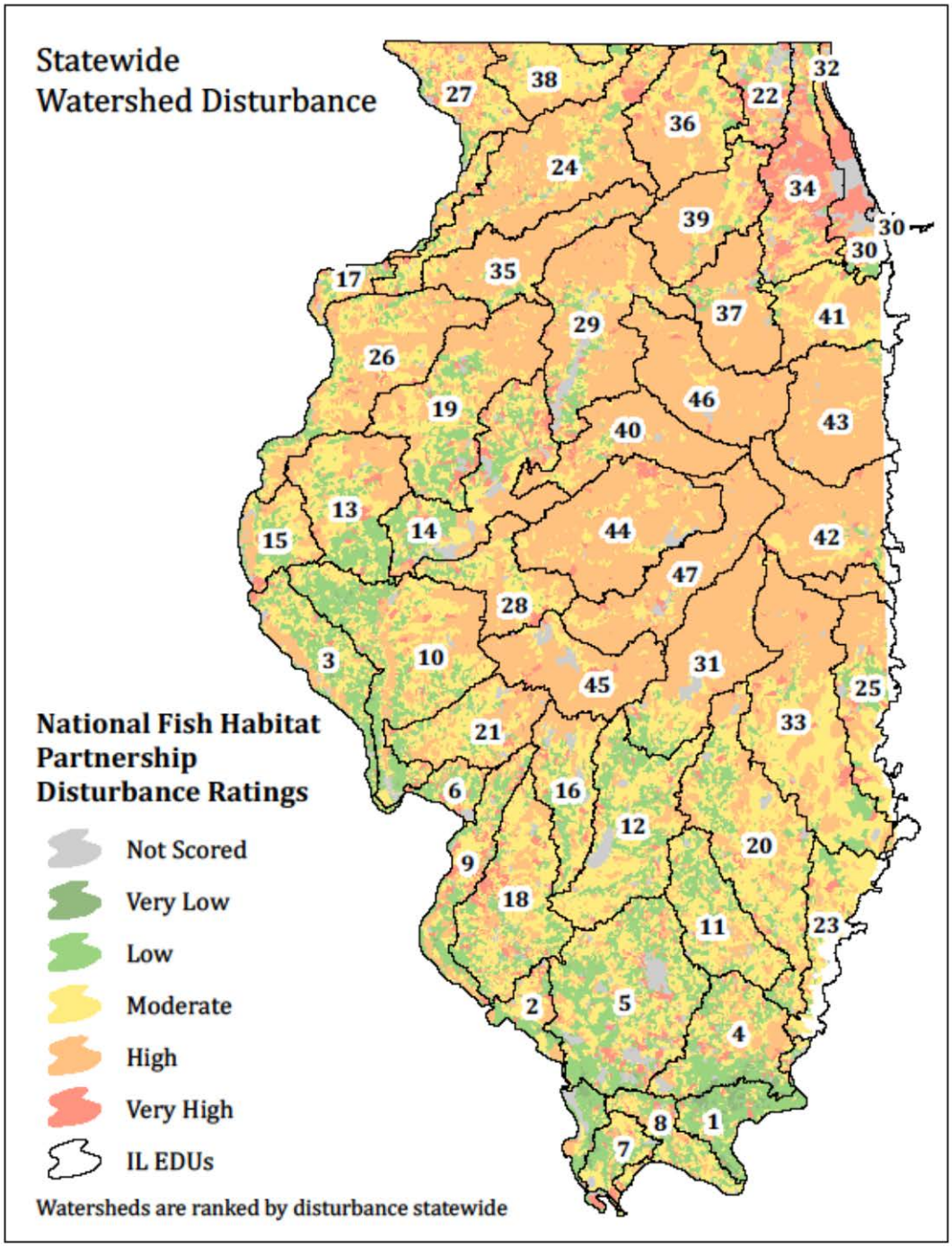

Figure 2a. Disturbance ratings for Illinois watersheds based on the National Fish Habitat Assessment (Esselman et al. 2011). Watersheds are ranked statewide based on the mean disturbance rating of stream reaches within the overall watershed boundary.

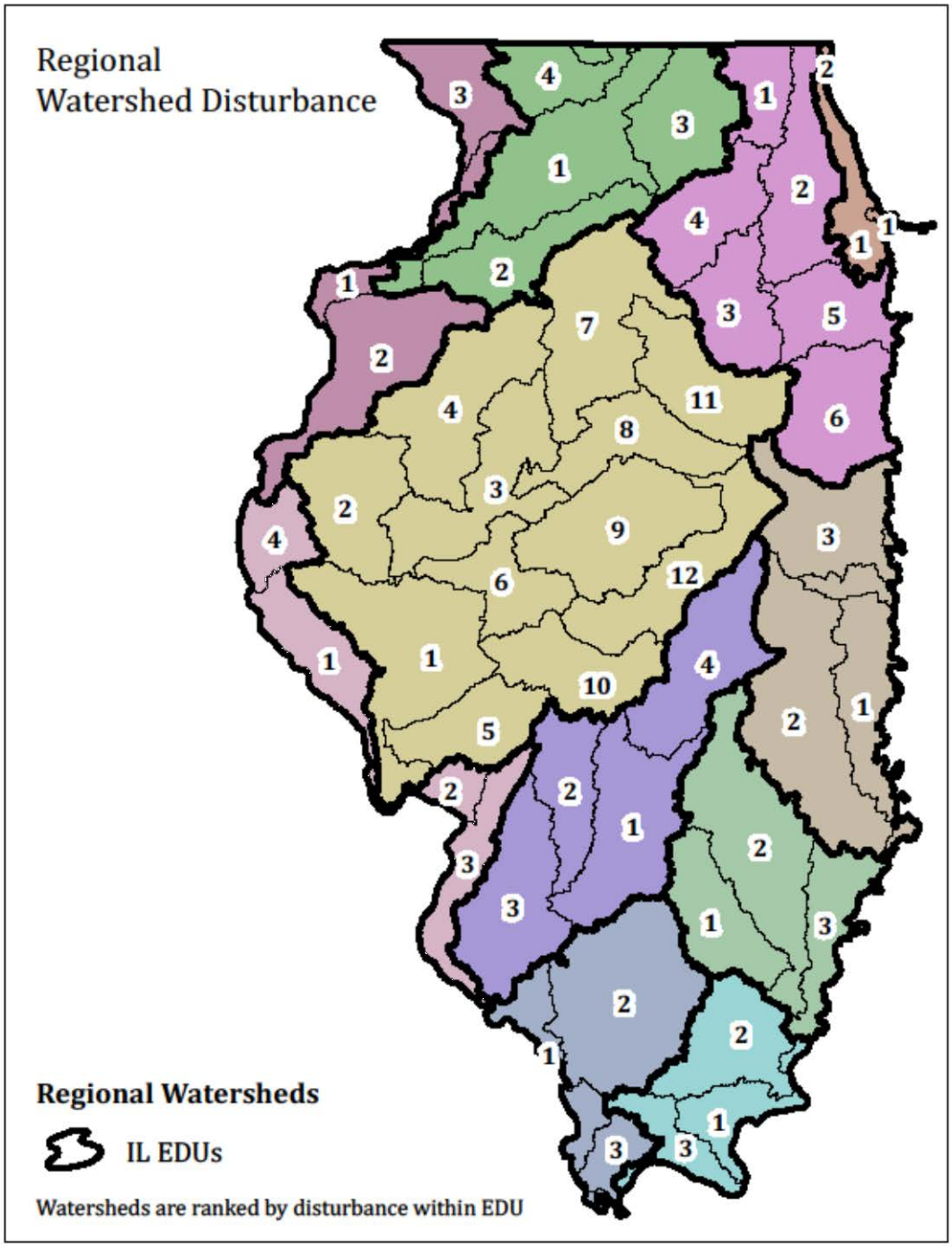

Figure 2b. Regional (EDU) Disturbance ratings for Illinois watersheds based on the National Fish Habitat Assessment (Esselman et al. 2011). Watersheds are ranked based on their relative disturbance rating within each region.

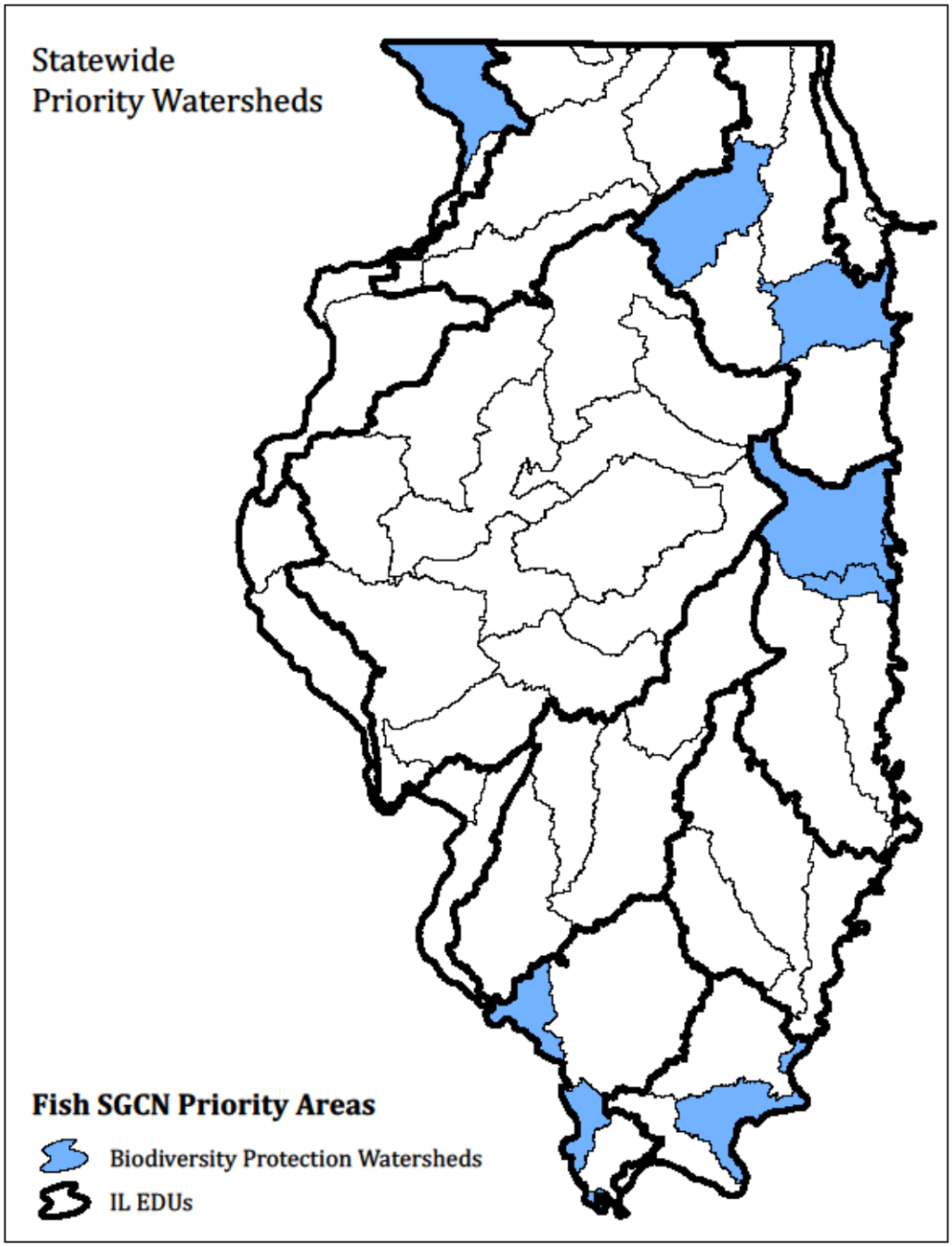

Figure 3a. Fish Biodiversity Protection Watersheds were selected based on observed statewide richness of fish SGNC. These watersheds have the highest observed richness of fish SGNC in Illinois based on currently available data.

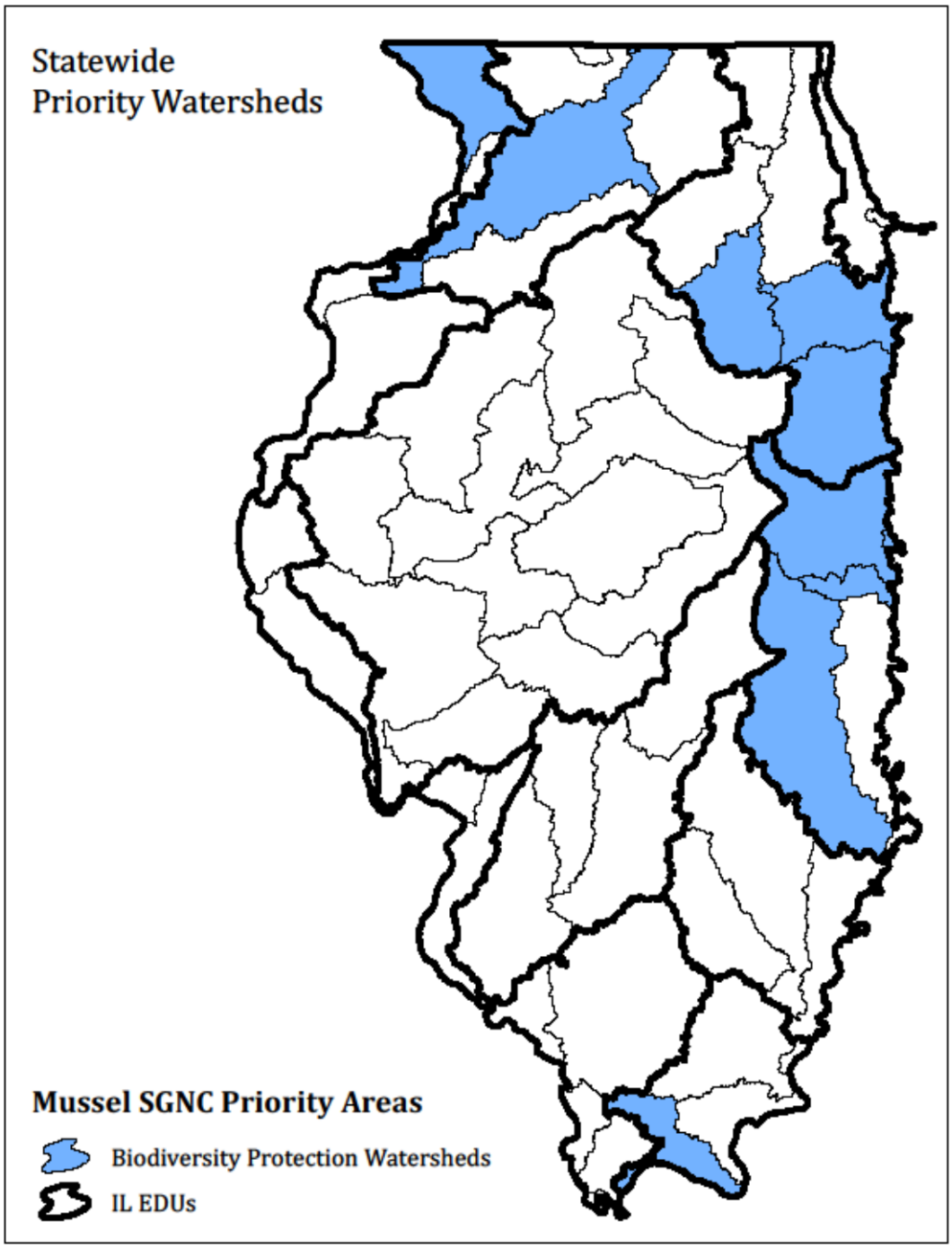

Figure 3b. Mussel Biodiversity Protection Watersheds based on observed statewide richness of mussel SGCN. These watersheds have the highest observed richness of mussel SGNC in Illinois based on currently available data.

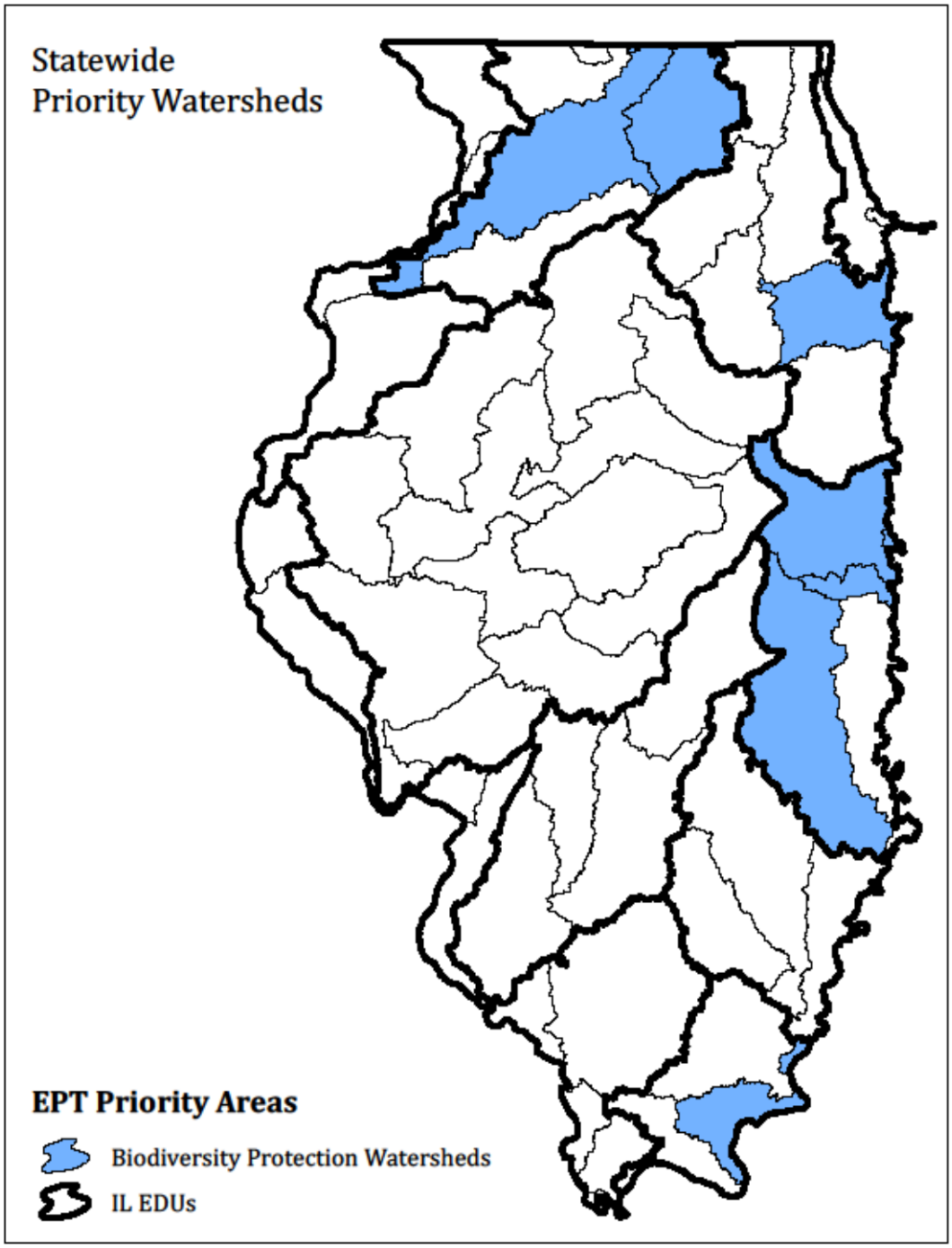

Figure 3c. EPT Biodiversity Protection Watersheds based on observed statewide richness of Ephemeroptera, Plecoptera, and Trichoptera (EPT). These watersheds have the highest observed EPT richness in Illinois based on currently available data.

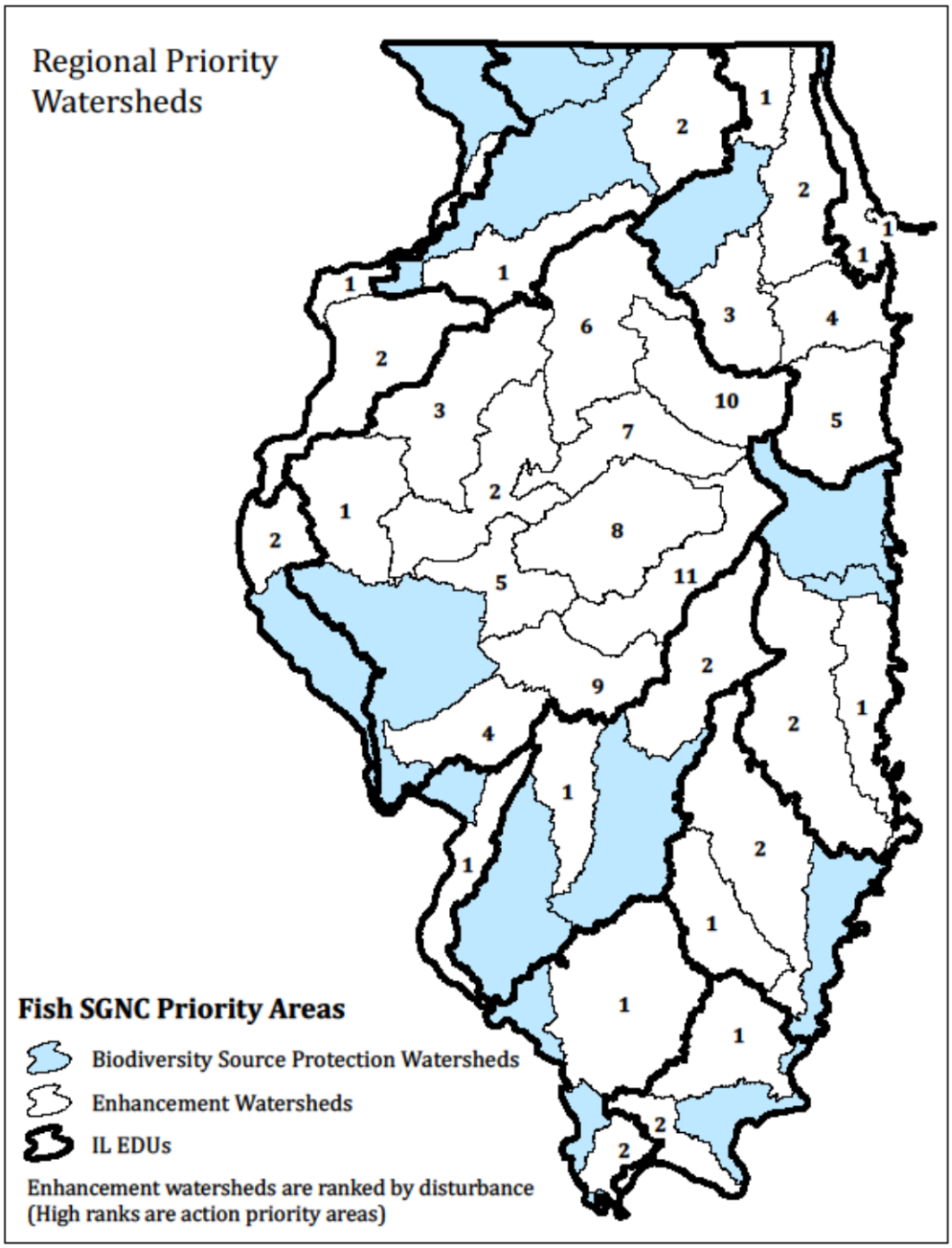

Figure 4a. Fish Biodiversity Source Protection Watersheds and Enhancement Watersheds based on regional richness (Protection Watersheds) and disturbance (Enhancement Watersheds) within each EDU.

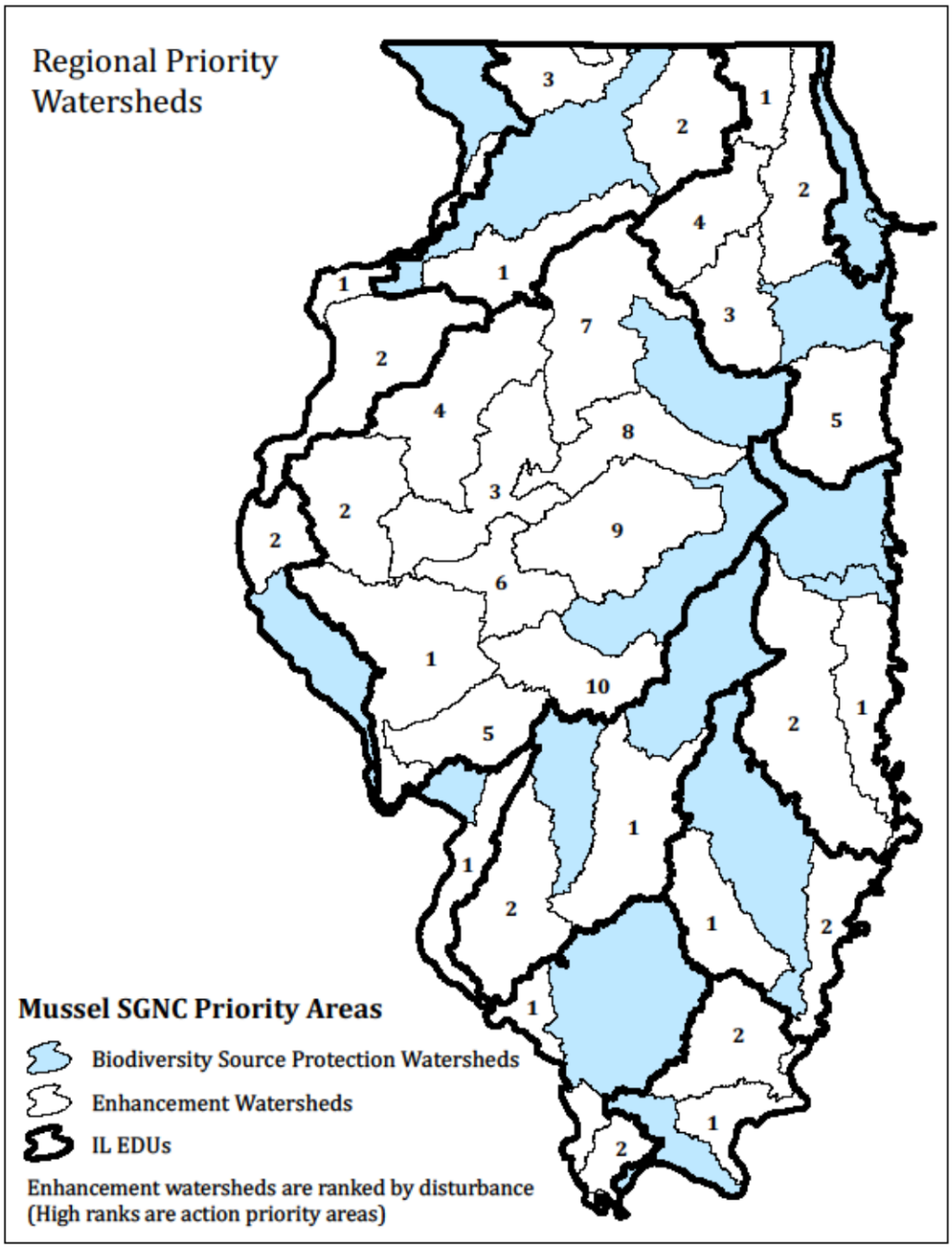

Figure 4b. Mussel Biodiversity Source Protection Watersheds and Enhancement Watersheds based on regional richness (Protection Watersheds) and disturbance (Enhancement Watersheds) within each EDU.

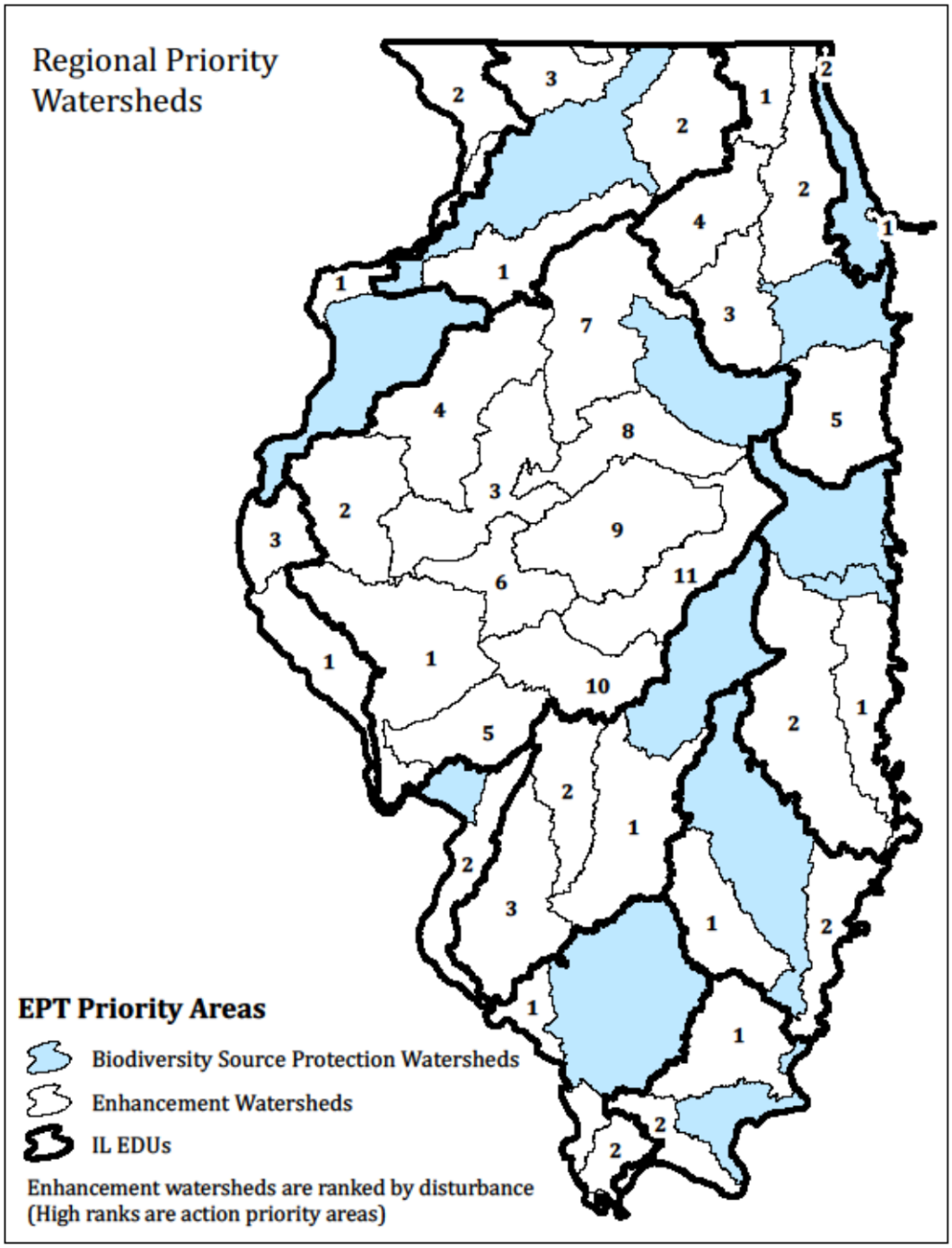

Figure 4c. EPT Biodiversity Source Protection Watersheds and Enhancement Watersheds based on regional richness (Protection Watersheds) and disturbance (Enhancement Watersheds) within each EDU.

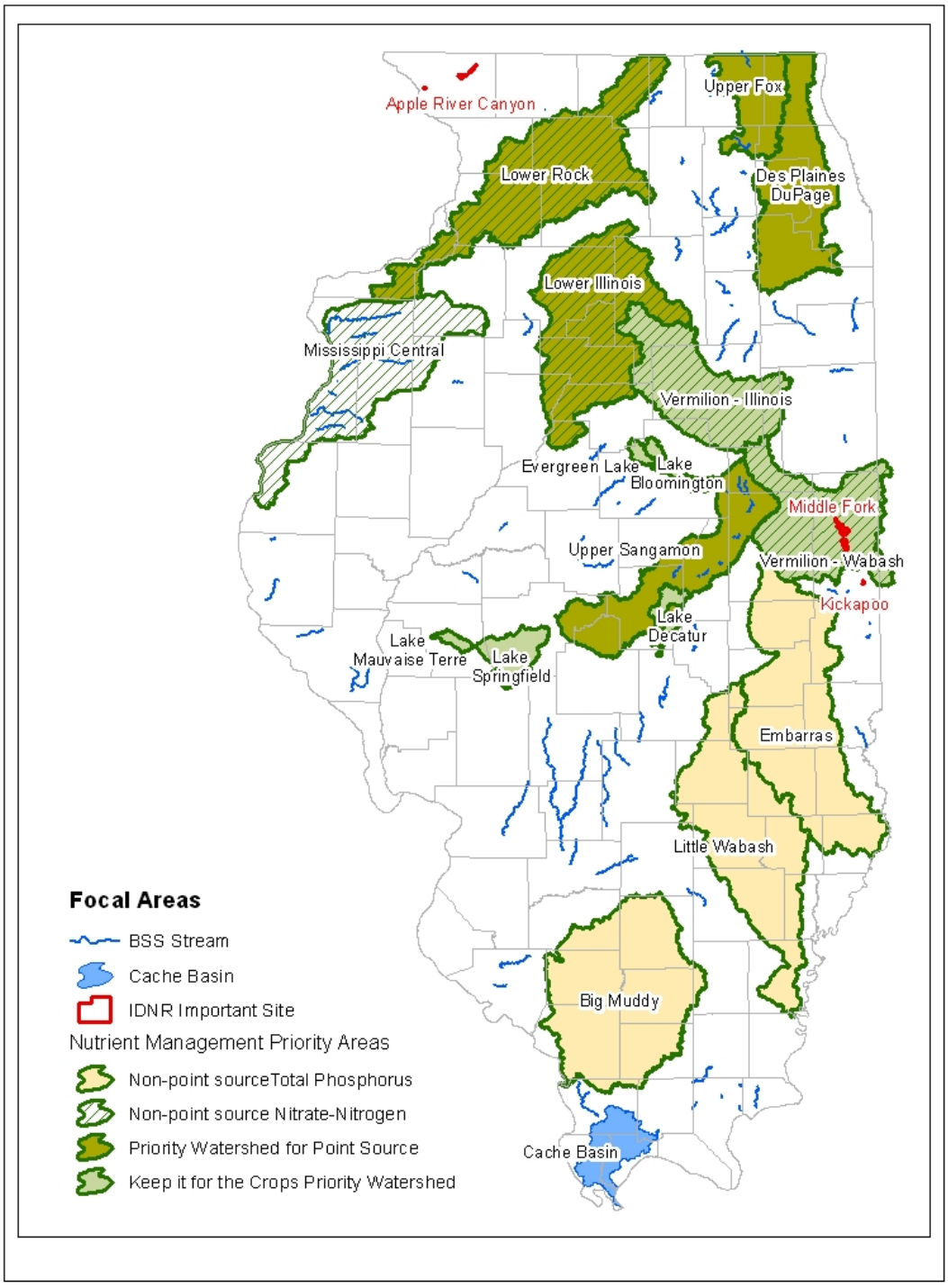

Figure 5. Streams Campaign Focal Areas have been compiled to emphasize priority areas associated with Biologically Significant Stream reaches (blue lines), initiatives to protect and enhance the Cache River Basin (blue polygon), IDNR Important Sites (red outlined), and Nutrient Management Priority Areas based on the Illinois Nutrient Loss Reduction Strategy (green outlined).

Appendix I

Draft Streams Campaign

Streams Campaign

Description

The Illinois landscape is dissected by stream and river channels and underlain with subsurface water. Three major rivers border the State of Illinois and are responsible for much of its characteristic shape. Other major freshwater habitats include bogs, fens, glacial lakes, ponds, reservoirs, spring seeps, swamps, and reservoirs. These vast aquatic resources provide vital ecosystem services to the citizens of Illinois and critical habitat for the other species that rely upon them. The Illinois Wildlife Action Plan addresses these habitats in several Campaigns including the Lake Michigan and Coastal Area Campaign, the Streams Campaign, and the Wetlands Campaign. The Streams Campaign focuses on maintaining robust communities of native wildlife and improving the capacity of lands and waterbodies to support populations of aquatic Species in Greatest Conservation Need (SGCN) through restoration, enhancement, and protection.

Portions of Illinois are included in six Fish Habitat Partnerships (http://fishhabitat.org/partnerships) and four Landscape Conservation Cooperatives (http://lccnetwork.org/find-an-lcc). Common goals for these regional efforts include the protection of healthy waters, restoration of natural flows, reconnection of fragmented stream habitats, and the improvement of water quality by reducing sediment and nutrient loading. The Streams Campaign supports these goals and strives to have local efforts in Illinois contribute to regional conservation.

The Streams Campaign is organized around six basic themes that provide continuity and focus to Conservation Actions identified as priorities for effective aquatic conservation in Illinois. These themes broadly organize activities necessary to address critical stressors and evaluate the effectiveness of conservation actions on aquatic species and their habitats. Campaign Themes include Monitoring & Assessment, Protection & Stewardship, Flow Management & Water Quality, Fragmentation & Connectivity, Invasive Species & Wildlife Diseases, and Public Support & Action.

Goals

Our Vision is for Illinois' waters to support viable populations of all aquatic species native to the state. Goals were developed to assist with obtaining this vision through consensus of the Streams Campaign Steering Committee that consists of IDNR staff and statewide conservation partners.

Campaign Goals:

- Viable populations of each SGCN will be supported

- Habitats will be managed for appropriate structure and function, including water quality, to support SGCN
- The public will have an awareness, appreciation, and connection to SGCN and associated habitats

Implementation Goals:

1. Illinois waters will support high biodiversity.
2. Abundance and distribution of SGCN will be increased or maintained.
3. High quality aquatic communities will be protected by conservation easement, public ownership, or designation as Illinois Nature Preserves, Land & Water Reserves, or Outstanding Resource Waters.
4. Illinois waters will fully support designated uses.
5. Illinois waters will provide appropriate physical habitat, hydrologic regimes, fluvial geomorphology, and connectivity to support SGCN.
6. The public's environmental awareness, appreciation, and connection to SGCN and their associated habitats will be increased.

Status as of 2015

Illinois contains over 119,000 miles of streams and rivers and 318,000 acres of lake and ponds (exclusive of Lake Michigan and the large border rivers) that provide ecosystem services throughout the state including supporting SGCN. Over 200 species of fish, 80 species of mussels, and 70 species of freshwater snails are known to have resided in Illinois waters along with numerous crayfish, frogs, salamanders, snakes, turtles, waterfowl, and hundreds of species of aquatic insects. Based on 2011 monitoring data aquatic life use was fully supported in 60.8% of stream miles and 92.2% of standing waters that were assessed in Illinois. Major potential sources of impairment for streams include atmospheric deposition of toxics, agriculture, channelization, municipal point sources, urban runoff, surface mining, and flow regulation. Potential sources of impairment for lakes are similar to those of streams but also include littoral area modifications, animal feeding operations, contaminated sediments, and on-site water treatment systems (IEPA 2014a).

Conservation of aquatic habitats and associated species continues to be a priority in Illinois. At least ten major funding and effort sources drove activities supporting Streams Campaign goals between 2005 and 2015 (Table 1). Thirty-five projects were funded with Illinois State Wildlife Grants (SWG) with twenty-three of these directly targeting SGCN. Thirty-two additional projects were sponsored by the Wildlife Preservation Fund (WPF) consisting primarily of biological surveys and evaluations of management actions. The Endangered Species Protection Board also sponsored six studies addressing the distribution and abundance of SGCN since 2005.

Monitoring & Assessment

The IDNR and IEPA conduct surface water and groundwater monitoring throughout the state with the assistance of numerous partners (e.g., USGS, USDA Forest Service, INHS). These efforts are

aimed at assessments of aquatic life, designated use attainment, identification of impaired waters, trends in water quality, and evaluating the effectiveness of water-management programs (IEPA 2014b). Examples of additional efforts include those conducted by the Long Term Resource Monitoring Program (LTRMP; http://www.umesc.usgs.gov/ltrmp.html); the Long Term Illinois, Mississippi, Ohio, and Wabash River Fish Population Monitoring Program (LTEF, http://wwx.inhs.illinois.edu/fieldstations/irbs/research/ltef-website/); monitoring by staff of Illinois Forest Preserve Districts (e.g., Forest Preserves of Cook County (http://fpdcc.com/), Lake County Forest Preserves (http://www.lcfpd.org/)); investigations by watershed groups and those of Citizen Scientists through RiverWatch (http://www.ngrrec.org/riverwatch/). The recovery plan for the Illinois Cave Amphipod (*Gammarus acherondytes*) established surveys that were completed in 2007, 2011, and 2014 in cave systems where they were known to have occurred in the past. Although the Illinois cave amphipod was not found at two previous locations ten new populations were discovered resulting in fourteen known populations (Lewis and Lewis 2014).

Three separate initiatives were undertaken to assess the conservation status of SGCN in support of the Streams Campaign largely using data from these monitoring programs. All species of fish (Metzke et al. 2012) and mussels (Douglass & Stodola 2014) known from Illinois and 563 invertebrate taxa (Hinz & Zahniser 2015) were independently assessed for possible listing as SGCN using IWAP criteria. Updated status and statewide distribution maps for each of these species were completed using data compiled during these initiatives.

Bol et al. (2007) developed a multi-taxa rating system to categorize the integrity and diversity of aquatic biota and identify stream reaches with biological significance. This update and revision of the Biological Stream Characterization (BSC; Hite and Bertrand 1989, Bertrand et al. 1996) and the Biologically Significant Streams classification (Page et al. 1992) was identified as a priority in the 2005 IWAP. Over 1000 stream segments were rated in Bol et al. (2007) with 13% characterized as Class A for diversity and 9% as Class A for biotic integrity. One hundred twenty-two stream segments (9% of all stream segments rated) were identified as biologically significant (Figure 1) (http://www.dnr.illinois.gov/conservation/BiologicalStreamratings/Pages/default.aspx). Despite the magnitude of this effort less than 1% of stream segments in Illinois were able to be rated due to a lack of biological information from the vast majority of segments.

Protection & Stewardship

Illinois contains over 120 state protected areas including state parks, wildlife areas, and state forests many of which are adjacent to, or contain, bodies of water. Additional protection of land and water resources occurs through dedication as an Illinois Nature Preserve, registration as an Illinois Land and Water Reserve, or through the establishment of conservation easements (e.g., CRP/CREP). Forest Preserve Districts, County Conservation Districts, and Municipalities also protect and manage many aquatic resources under their jurisdictions. Illinois Land trusts and other nongovernmental organizations also actively protect and manage important aquatic habitats (e.g., The Wetlands Initiative [http://www.wetlands-initiative.org/what-we-do.html], The Nature Conservancy [http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/illinois/placesweprotect/index.htm]). Federal protected areas include the Shawnee National Forest, Midewin National

Tallgrass Prairie, and several National Wildlife Refuges (e.g., Chautauqua National Wildlife Refuge, Cypress Creek National Wildlife Refuge, Hackmatack National Wildlife Refuge, Meredosia National Wildlife Refuge). Stewardship activities conducted on these areas support SGCN statewide.

The mission of the Illinois Endangered Species Protection Board is to protect native plants and animals which are in danger of being lost from the wild. The Board maintains and periodically reviews the Illinois List, conducts research and surveys, and develops recovery plans in coordination with IDNR. Illinois currently lists as either endangered or threatened dozens of species associated with freshwaters including 35 fish, 26 mussels, 9 crustaceans, 5 salamanders, 5 turtles, 2 stoneflies and 2 dragonflies.

Protection of important aquatic habitats continues to occur in Illinois, supporting SGCN. Aquatic features were in, or adjacent to, eighty-eight Nature Preserves and Land & Water Reserves totaling 8,345 hectares that have been dedicated since 2005. Seventeen of these are within 0.5km of a SGCN record. The IDNR Owned, Managed, Leased and Purchased (OMLP) database identifies 80 properties that IDNR has added since 2005 including ten within 0.5km of an aquatic SGCN record. Since 2005, the Conservation Reserve Program has added, or renewed easements on 24,694 hectares of agricultural land in Illinois (15,916 properties of which 107 are also in the Conservation Reserve Enhancement Program) under the filter strip (CP21) or riparian buffer (CP22) practices. Two hundred twenty-eight of these easements were within 0.5km of a SGCN record of an aquatic species.

Protection efforts have also targeted some subterranean habitats. In 2014, the Illinois Nature Preserves Commission dedicated the Paul Wightman Subterranean Nature Preserve, a 535 acre site that surrounds the IDNR Fogelpole Cave Nature Preserve and includes a significant portion of the groundwater recharge area of the Fogelpole Cave system. Fogelpole Cave is one of the largest and least disturbed cave systems in Illinois and includes several miles of underground streams.

Stream enhancement activities have improved habitats for SGCN throughout the state. The Illinois Department of Natural Resources (IDNR) has participated in thirteen stream restorations since 2005 including five within 0.5km of an aquatic SGCN. The US Fish and Wildlife Service's Partners for Fish and Wildlife Program has completed 23 stream restorations in Illinois since 2005. Five of these projects occurred within 0.5km of an aquatic SGCN.

Conservation efforts associated with subterranean aquatic habitats and their specialized fauna are also underway in Illinois. Efforts to delineate groundwater recharge areas associated with known locations of Illinois Cave Amphipod have been supported by the Illinois Wildlife Preservation Fund. A vulnerability assessment identifying potential threats to this species and their habitats is currently underway with funding through a State Wildlife Grant.

Flow Management & Water Quality

Water resources are intensively used throughout Illinois for agriculture, domestic and industrial supply, navigation, and recreation. Activities supporting these uses have included the development of agricultural drainage networks, flood control dams and levees, water withdrawal and storage

systems, water treatment and distribution systems, cooling water reservoirs, and recreational lakes. Engineering activities directed at agricultural drainage, flood control, navigation, and wastewater processing have greatly improved the quality of life for the residents of Illinois. However, these agricultural and urban development activities have also dramatically transformed how water moves across the landscape along with the quantity and makeup of the materials this water carries. Few, if any, watersheds in Illinois are free from the influence of these activities.

The USACE operates two large reservoirs on the Kaskaskia River (Lake Shelbyville and Carlyle Lake), one large reservoir on the Big Muddy River (Rend Lake) and the Illinois Waterway that includes a series of eight locks designed to provide navigation between the Mississippi River and the Great Lakes. Flows are managed for flood control, navigation, water supply, and recreational uses. Water control structures are also managed at many lakes, ponds, reservoirs, and wetlands for the benefit of recreation, water supply, or local flood control, often with little consideration for downstream environmental impacts.

The Illinois Nutrient Loss Reduction Strategy (State of Illinois 2015a; http://www.epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy/index) is a partnership program that seeks to reduce nitrogen and phosphorus loading to streams by encouraging implementation of best management practices in targeted watersheds. The goal of the Strategy is to improve water quality within Illinois and reduce nutrient loading to the Mississippi River. Eighteen watersheds (Figure 1) have been prioritized for Strategy implementation, and each watershed has a reduction goal for nitrate-nitrogen and for phosphorus. Under the IEPA 319 Grant Program, 139 projects to reduce non-point source pollution were initiated in the past 10 years (Table 1). Twenty-four of these projects are within 0.5km of a SGCN record.

The Illinois Mud to Parks Program (http://www.dnr.illinois.gov/conservation/m2p/Pages/default.aspx) provides funds for reuse of sediment dredged from rivers and lakes. More than fifteen agencies, institutions and private companies have contributed funds, effort or research for the Mud to Parks Program. Projects within this program have improved aquatic habitats by removing sediments from the Illinois River (and backwater lakes), the Fox River and Lake Michigan for reuse as topsoil, landfill caps and strip-mine reclamation material.

Fragmentation & Connectivity

Much of the infrastructure that supports water resource use in Illinois can also isolate local sections of the river channel from upstream or downstream reaches or from the adjacent floodplain. Longitudinal fragmentation can occur from dams, perched or poorly maintained culverts, or seasonal drying of some stream segments. Highly maintained channels and an expansive levee system can alleviate many of the problems associated with flooding but also restrict streams, and associated species, from their floodplains.

Dam modifications and removals in Illinois are designed to support biodiversity, provide appropriate habitat, and to improve environmental awareness and public safety. The Illinois Dam

Removal Initiative (http://www3.illinois.gov/PressReleases/ShowPressRelease.cfm?SubjectID=2&RecNum=10665) was started in 2012 and designed to remove or modify 12 dams on the Des Plaines and Chicago Rivers in Cook County. Since 2005 IDNR has approved permits for thirty-five dam removals of which nine have occurred within 0.5km of an aquatic SGCN.

Invasive Species & Wildlife Diseases

Aquatic Nuisance Species (ANS) include non-native viruses, algae, plants, mollusks, fish or other organisms that cause harm when introduced into aquatic ecosystems. ANS impact systems by altering habitats, shifting trophic dynamics, or by causing direct mortality of native species. Illinois-Indiana Sea Grant has developed an extensive outreach program to prevent ANS from spreading between waterways. Developed in partnership with the IDNR the "Be a Hero – Transport Zero" campaign encourages application of three simple steps to equipment (remove, drain, and dry) used in Illinois waterways to assist in the fight against invasive species (http://www.iiseagrant.org/ais/transportzero.php).

Asian Carp have expanded their distribution since 2005 in some parts of the Upper Mississippi and Ohio River Basins. Efforts to restrict this spread in Illinois waters increased dramatically with the start of the Asian Carp Program in 2009 that focused on restricting access to the Great Lakes through the Chicago Area Waterway System (CAWS). The development of the Asian Carp Control Strategy Framework in 2010 established a goal of creating a systematic multi-tiered defense against Asian Carp (http://www.asiancarp.us/). Activities are now focused on directly preventing Asian Carp dispersal toward the Great Lakes with an extensive monitoring program, evaluation and improvements of the USACE electric dispersal barriers in the Chicago Sanitary and Ship Canal (CSSC), and an active research component that includes application of additional technologies as barriers to movement (e.g., waterguns, CO_2). In 2014, the Illinois Department of Natural Resources formed an Invasive Species Unit to prevent illegal movement of Asian Carp by fish transportation companies, commercial fisherman, or bait dealers who may sell or transport live fish. These efforts appear to be effectively preventing the establishment of new breeding populations of Asian Carp although continued vigilance is required.

Public Support & Action

Illinois contains a vibrant and active community focused on freshwater conservation that includes NGOs (e.g., Prairie Rivers Network, Sierra Club, The Nature Conservancy), Federal Agencies (e.g., USFWS, USACE, USDA, USGS), State Agencies (e.g., IDNR, IDOA, IDOT, IEPA), Conservation Partnerships (e.g., Chicago Wilderness (http://www.chicagowilderness.org/), Fox River Ecosystem Partnership (http://www.foxriverecosystem.org)), National Fish Habitat Partnerships, Landscape Conservation Cooperatives), and private citizens. A critical role provided by this community is the support of outreach and educational services to the people of Illinois. Twenty percent of the 139 projects initiated in the past 10 years under the IEPA 319 Grant Program have included an educational component addressing environmental awareness of non-point source pollution. Other examples of ongoing activities include the Illinois Master Naturalists program

(http://web.extension.illinois.edu/mn/) designed to engage citizens in environmental stewardship by providing science-based education, the RiverWatch volunteer stream monitoring program for Citizen Scientists, and IDNR sponsored fishing clinics that occur throughout the state and introduce young people to aquatic conservation.

Stresses and Threats to Wildlife and Habitat

Agriculture, Pollution, Residential & Commercial Development, and Invasive Species were the top four ranked threats identified in a survey of Illinois conservation partners. With the exception of some Invasive Species these are primarily threats that cause stress by modifying the characteristics of the aquatic habitat from altered rates of flow and/or associated loads (e.g., sediment, nutrients).

Climate Change

Freshwater habitats and species are consistently rated as highly vulnerable to climate change (e.g., Staudinger et al. 2015, Walk et al. 2011). Expected changes include increases in water temperature, altered hydrology brought about by differences in the timing and intensity of precipitation events, and higher rates of erosion and delivery of sediment and chemical loads (Hall 2012). Climate change is expected to interact with hydrology, water chemistry, and biological interactions in complex ways and is considered a "threat multiplier" that will increase the magnitude of other stressors (CNA Corporation 2007). The implications of an altered climate should be considered as part of the challenge to implementation of each of the Campaign Themes.

Walk et al. (2011) conducted 584 climate change vulnerability assessments for 162 SGCN in Natural Divisions and Watersheds of Illinois using NatureServe's Climate Change Vulnerability Index (CCVI; Young et al. 2011). High proportions of mollusk and fish SGCN were rated as Extremely Vulnerable or Highly Vulnerable to climate change. In most cases crustaceans in streams and cave systems were also rated as Moderately Vulnerable or Highly Vulnerable. These assessments identified greater exposure, a limited ability to disperse, and increased sensitivity to thermal change (for coolwater species) as the primary factors associated with climate vulnerability for these species.

Monitoring & Assessment

The sheer magnitude of effort required to adequately monitor the conservation status of aquatic SGCN is immense. Over 180 SGCN are associated with freshwater habitats including amphibians, fish, snakes, turtles, and many invertebrates (e.g., crustaceans, mussels, insects). Current monitoring efforts are primarily designed to assess fisheries or water quality objectives rather than the conservation status of individual species populations. Therefore, existing programs as they are currently executed may not be sufficient to assess the status of all aquatic SGCN.

Protection & Stewardship

The Illinois landscape is over 90 percent privately owned with most of this actively managed for agriculture or other high intensity use. For aquatic systems that integrate water, and associated materials, from throughout their watersheds this can result in systemic problems that cannot be solved by local stewardship activities where protected lands occur. These twin challenges of small public landholdings and high intensity landuse require comprehensive watershed planning, coordination between public and private land managers, and cooperation toward a shared vision of land stewardship for conservation goals to be achieved.

Flow Management & Water Quality

Major stressors associated with agricultural, residential, and commercially developed landscapes include changes in the timing and magnitude of storm flows and associated loads, fragmentation and loss of lateral connectivity with the floodplain, and altered thermal regimes (State of Illinois 2015b). Unnaturally high levels of nutrients, sediment, and some unregulated substances may also stress our aquatic biota. Groundwater and other subterranean waters are subject to similar threats as surface waters since these habitat types are physically linked by the movement of water within the landscape. Subterranean waters are especially vulnerable to groundwater withdrawals and contamination from sediment or chemical loading in areas of groundwater recharge and near cave entrances.

Fragmentation & Connectivity

A major stressor associated with developed landscapes is fragmentation of habitats and loss of connectivity between populations. Fragmentation can restrict SGCN from habitats required by their life histories (e.g., fish spawning in floodplains) and prevent movements of individuals into adjacent areas that supplement existing populations. This lack of connectivity increases the vulnerability of populations to extirpation and limits the establishment of new ones. Subterranean habitats and headwater streams are especially vulnerable to fragmentation as they have few physical connections to similar habitats and often host specialized organisms with limited dispersal capacity.

Invasive Species & Wildlife Diseases

(http://www.dnr.illinois.gov/conservation/IWAP/Pages/InvasiveSpecies.aspx)

Native species can be stressed by invasive species through predation, competition, or habitat alteration. Wildlife disease can further weaken already stressed individuals or in some cases cause direct mortality. Asian Carp are a major concern in the Upper Mississippi River and Ohio River basins due to the potential for direct competition for food (plankton) used by larval and juvenile stages of native fish and by certain invertebrate species.

The following Invasive Species and Wildlife Diseases are of primary concern for the Streams Campaign:

- **Asian Carp** (Bighead Carp (*Hypophthalmichthys nobilis*), Black Carp (*Mylopharyngodon piceus)*, Grass Carp (*Ctenopharyngodon idella)*, Silver Carp (*Hypophthalmichthys molitrix*)) and **Common Carp** (*Cyprinus carpio)*
- **Gobies** (Round Goby (*Neogobius melanostomus*) and Tubenose Goby (*Proterorhinus marmoratus*))
- **Dreissenid mussels** (Zebra Mussel (*Dreissena polymorpha*) and Quagga Mussel (*Dreissena rostriformis bugensis*))
- **Chinese Mystery Snail** (*Cipangopaludina chinensis*) and **Faucet Snail** (*Bithynia tentaculata*)
- **Rusty Crayfish** (*Orconectes rusticus*)
- **Purple Loosestrife** (*Lythrum salicaria*), **Eurasian Milfoil** (*Myriophyllum spicatum*), and other listed injurious aquatic weeds (http://www.ilga.gov/commission/jcar/admincode/017/017008050000200R.html)
- **VHS** (Viral Hemorrhagic Septicemia)
- Potential threats also include **Didymo** (*Didymosphenia geminata*) and **New Zealand Mudsnail** (*Potamopyrgus antipodarum*)

Public Support & Action

Most watersheds in Illinois cross many jurisdictional and ownership boundaries and are used for multiple purposes (e.g., agriculture, recreation, water supply). Since aquatic species are supported by the ecological functioning of their watersheds, public support is required for effective conservation planning and action. Without citizens who are informed, connected, and empowered conservation actions that support SGCN or their habitats will not be prioritized over other activities.

Focal Species

Focal Species are SGCN selected for use in monitoring and assessment of the effectiveness of conservation actions associated with particular habitats or stressors. Surrogates are selected for use when SGCN are too rare or vulnerable to monitor or study directly and to represent multiple SGCN with similar life histories, sensitivities to stressors, or that reside in similar habitats. In some cases we selected indices, or groups of species, as surrogates to represent the condition of the waterbody where range restrictions limit the selection of a single species. Our approach for the Streams Campaign was to select several species and surrogates that span the range of aquatic habitats occurring statewide and that are appropriate for monitoring and assessment of the effectiveness of Conservation Actions. Focal species (or surrogates) were also targeted for Campaign Themes and Campaign Focal Areas.

Climate Change

While all SGCN may respond to changes in water temperature or altered hydrology those with restricted distributions, limited dispersal capacity, and thermal preferences near the edge of current conditions are expected to be more vulnerable to changes in climate.

Focal Species: American Brook Lamprey (*Lethenteron appendix*), Brook Stickleback (*Culaea inconstans*), Mottled Sculpin (*Cottus bairdii*), Banded Sculpin (*Cottus carolinae*); *Surrogates*: Ephemeroptera, Plecoptera, Trichoptera (EPT), Plain Pocketbook (*Lampsilis cardium*), Pimpleback (*Amphinaias pustulosa*).

Monitoring & Assessment

Natural variability in physical conditions between Illinois waterbodies requires selection of Focal Species and surrogates for several broad habitat types in addition to several applicable statewide.

Statewide Focal Species: Smallmouth Bass (*Micropterus dolomieu*), Spotted Bass (*Micropterus punctulatus*), Highfin Carpsucker (*Carpiodes velifer*), Creek Heelsplitter (*Lasmigona compressa*), Pistolgrip (*Tritogonia verrucosa*). *Surrogates:* EPT; Fish Index of Biotic Integrity (IBI), freshwater mussel diversity.

Headwater Streams & Springs Habitats: Southern Redbelly Dace (*Chrosomus erythrogaster*), Spring Cavefish (*Forbesichthys agassizii*); *Surrogates*: EPT

Wadeable and Non-wadeable Stream Habitats: Smallmouth Bass, Spotted Bass, Highfin Carpsucker; *Surrogates*: Redhorses (*Moxostoma spp.)*, EPT, fish IBI, freshwater mussel diversity

*Large Rivers and Backwater Habitats***:** Sturgeon [Shovelnose Sturgeon (*Scaphirhynchus platorynchus*), Lake Sturgeon (*Acipenser fulvescens*), Pallid Sturgeon (*Scaphirhynchus albus*)], North American Paddlefish (*Polyodon spathul*a), Bluntnose Darter (*Etheostoma chlorosoma*), Smooth Softshell Turtle (*Apalone mutica*); *Surrogates*: Gars (Alligator Gar (*Attactosteus spatula*), Shortnose Gar (*Lepisosteus platostomus*), Longnose Gar (*Lepisosteus osseus*), Spotted Gar (*Lepisosteus oculatus*)), Pimpleback.

Lakes and Pond Habitats: Yellow Perch (*Perca flavescens*), Iowa Darter (*Etheostoma exile*), Least Darter (*Etheostoma microperca*), Brown Bullhead (*Ameiurus nebulosus*); *Surrogates*: Odonata

Subterranean Habitats: Spring Cavefish (*Forbesichthys agassizii*), Illinois Cave Amphipod (*Gammarus acherondytes*), Hine's Emerald Dragonfly (*Somatochlora hineana*). *Surrogates*: Species associated with the subterranean system under study.

Protection & Stewardship

Conservation Actions occur across the range of freshwater habitats in Illinois and have the potential to impact each SGCN through protection and management of their habitat. Stewardship activities undertaken to benefit individual species, or groups of species, should use the response(s) of these species as an assessment tool.

Focal Species: *targeted SGCN,* Endangered & Threatened species; *Surrogates*: fish IBI, mussel diversity.

Flow Management & Water Quality

Highly developed landscapes are often associated with rapidly alternating high and low flow conditions, sedimentation, and spikes in pollutant loads. Species requiring clear gravel substrates are expected to be sensitive to these flow conditions. Focal species associated with altered water quality based on sensitivity to low dissolved oxygen (sensitive fish and mussels) or elevated ammonia levels (sensitive mussels) have also been selected for Nutrient Management Priority Areas (see Table 2).

Focal Species: Highfin Carpsucker (*Carpiodes velifer*), Gravel Chub (*Erimystax x-punctatus*).

Fragmentation & Connectivity

Species which make spawning migrations, use floodplains during part of their life history, or are relatively immobile are all sensitive to fragmentation of habitats in different ways.

Focal Species: Sturgeon [Shovelnose Sturgeon (*Scaphirhynchus platorynchus*), Lake Sturgeon (*Acipenser fulvescens*), Pallid Sturgeon (*Scaphirhynchus albus*)], North American Paddlefish (*Polyodon spathul*a); *Surrogates*: Redhorses (*Moxostoma* spp.), Rosyface Shiner (*Notropis rubellus*), Spotted Gar (*Lepisosteus oculatus*).

Invasive Species & Wildlife Diseases

Minimizing the impact of Aquatic Nuisance Species (ANS) on SGCN requires tracking their presence, reducing their numbers, and preventing their spread to new areas.

Focal Species: none selected; *Surrogates*: fish IBI, mussel diversity.

Focal Areas

Streams Campaign Focal Areas have been selected to indicate geographical locations where significant activity is expected to occur that benefits Campaign Goals (Figure 1). Focal Areas correspond with aquatic biodiversity hotspots of statewide importance and areas identified in existing conservation initiatives with strong public and State support. Focal species and surrogates were selected for Focal Areas corresponding with known stressors and SGCN or Surrogates in these areas.

Biologically Significant Stream Reaches
(http://www.dnr.illinois.gov/conservation/BiologicalStreamratings/Pages/default.aspx)

Illinois' Biologically Significant Stream (BSS) ratings (Page et al. 1992) were designed to expand the Biological Stream Characterization (BSC; Hite & Bertrand 1989, Bertrand et al. 1996) by identifying stream reaches with high species richness or very rare species. These products, and their subsequent revisions, have formed the backbone of stream conservation planning in Illinois for over 25 years. Since the most recent revisions (Bol et al. 2007, State of Illinois 2008) many hundreds of additional fish, macroinvertebrate (http://www.epa.illinois.gov/topics/water-quality/watershed-management/resource-assessments/index), and especially mussel samples (http://wwx.inhs.illinois.edu/collections/mollusk/swg/) have been collected throughout Illinois.

Focal species: BSS reaches were identified as segments with high ecological integrity or biological diversity in multiple taxonomic groups (e.g., Fish, Mussels, EPT, Crayfish). Conservation efforts should focus on maintaining the qualifying features of each reach.

Cache River

Despite over a century of widespread hydrological alteration and land clearing the Cache River continues to flow through rich wetlands that hold some of the highest quality natural communities in the State of Illinois. The area is listed as a wetland of international importance by the Ramsar Convention and contains the northernmost cypress/tupelo swamp in the USA. The Cache River Joint Venture was formed in 1991 with a goal of protecting and restoring this important wetland river system by restoring habitat, reducing sediment loading, and restoring base flow to the lower basin.

Focal species: Species associated with backwater habitats or requiring continuous flows were prioritized within the Cache River (Banded Pygmy Sunfish (*Elassoma zonatum*), Banded Sculpin (*Cottus carolinae*), Pugnose Minnow (*Opsopoeodus emiliae*), Little Spectaclecase (*Villosa lienosa*); *Surrogates*: EPT.)

IDNR Important Areas
(http://www.dnr.illinois.gov/conservation/IWAP/Pages/IDNRImportantAreas.aspx)

Areas with the greatest opportunity for implementation of IWAP goals and actions were identified by the Office of Resource Conservation and the Office of Land Management for properties that are owned and managed by IDNR. Apple River Canyon State Park and the Vermilion River at Middle Fork State Fish & Wildlife Area and at Kickapoo State Recreation Area were identified for the Streams Campaign.

Focal species: Species that were intolerant of sediment and other pollutants (Smogor 2000) were prioritized when possible for Apple River Canyon State Park (Carmine Shiner (*Notropis*

percobromus), Ozark Minnow (*Notropis nubilus*), Smallmouth Bass (*Micropterus dolomieu*)) and the Vermilion River (Bigeye Chub (*Hybopsis amblops*), Bluebreast Darter (*Etheostoma camurum*), Wavy-rayed Lampmussel (*Lampsilis fasciola*)).

Nutrient Management Priority Areas (http://www.epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/index)

The Illinois Nutrient Loss Reduction Strategy (State of Illinois 2015a) builds on existing efforts and identifies priority watersheds for nutrient loss reduction through regulatory and voluntary efforts to reduce loads from wastewater treatment and runoff from urban and agricultural landscapes (Figure 1).

Focal species: Species that are intolerant to low dissolved oxygen concentrations (IDNR & IEPA 2006) and/or high ammonia concentrations (USEPA 2013) were prioritized for these areas when possible (see Table 2).

Actions

The Actions included within this Campaign section are provided to help guide the next 10 years of implementation. While other Actions may be needed and larger Goals could be set, the Campaign prioritizes the Actions contained in this section as realistic, achievable and most needed within the next 10 years to best aid in meeting the overarching goals of the Wildlife Action Plan to: (1) Establish desired number and distribution of viable populations for each SGCN, (2) Manage habitats through promoting natural processes, desired structure, and disturbance regimes for the benefit of native species, and (3) Develop resiliency and connectedness into habitats so species can adjust to landscape and environmental changes.

Implementation Actions (numbers following actions refer to the Implementation Goal(s) they address)

Monitoring & Assessment:

Need: *The conservation status of SGCN, and their habitats, changes over time in response to conservation actions as well as with new and existing stressors. Monitoring is necessary to track status and assess trends associated with current conditions and management activities.*
Outcomes: *Conservation status and trends will be regularly updated and appropriate for use in adaptive management of aquatic SGCN and their habitats.*

- Continue statewide comprehensive monitoring & assessment programs focused on the conservation status of aquatic SGCN. (1,2,5)

- Examine the efficiency of existing biological monitoring in Illinois to assess the conservation status of SGCN and modify or expand monitoring efforts where needed. (1,2,4,5)
- Conduct targeted surveys for SGCN and watch-listed species statewide, especially in undersampled habitat types, protected areas, and Campaign Focal Areas. (1,2,5)
- Conduct status and vulnerability assessments of native species. (1,2)
- Conduct vulnerability assessments of protected habitats (e.g., Nature Preserves) (1,2,3,5)
- Develop efficient and effective assessment methods for SGCN that are difficult to collect using standard survey methods and approaches. (1,2,5)
- Develop biodiversity benchmarks for aquatic habitats situated in the developed landscapes (urban and agricultural) of Illinois (1,2,4,5)

o Initiate a sentinel monitoring program for a broad range of habitat conditions & taxa to improve trend analysis and assessment (1,2,5)
  - Expand annual monitoring of water temperature, water quality, and other habitat measures in aquatic systems statewide. (1,2,4,5)
  - Expand annual monitoring of biological assemblages in aquatic habitats statewide. (1,2,4,5)

o Encourage or require implementation and effectiveness monitoring in work plans on Public Lands or within projects supported by State funds. (1,2,5)

o Evaluate the success of, and potential barriers to, recruitment (reproduction) of SGCN. (1,2,5)

Protection & Stewardship:

Need: *Rare habitats often support SGCN and can be especially vulnerable to disturbances associated with adjacent areas. Maintaining these habitats may require additional protection or management activities to support viable populations of SGCN. Prioritization of vulnerable habitats associated with SGCN will allow for more efficient and effective use of limited conservation resources.*
Outcomes: *Priority habitats will be protected and managed effectively improving the viability of SGCN populations.*

o Identify and prioritize areas associated with SGCN for protection, enhancement, and restoration. (1,2,3,5)
  - Develop benchmarks for identification or designation of Illinois waters as Biologically Significant Streams, Land & Water Reserves, Nature Preserves, or Outstanding Resource Waters (1,2,3,4,5)
  - Protect, enhance, and restore aquatic habitats where priorities have been identified. (1,2,3,5)
  - Acquire land where existing SGCN populations are declining and require protection, enhancement, or restoration (1,2,3)
  - Delineate groundwater contribution areas for associated Protected Lands (e.g., Nature Preserves, Land & Water Reserves). (1,2,3,5)

- Develop BMPs and alternative strategies for deicing roads near ecologically sensitive areas. (4,5)

- Develop and begin implementation of recovery plans for state-listed aquatic species. (1,2,3,5)
  - Identify habitat requirements and limiting factors for SGCN and develop recommendations to address them where information is lacking (1,2,5)

Flow Management & Water Quality:

Need: *Unnatural flow regimes and compromised water quality are recognized stressors to aquatic biota. Minimizing these stressors by effective management of stormwater and low flows, and concurrent improvements to water quality will improve aquatic habitats for SGCN.*
Outcomes: *Improved resilience and quality of aquatic habitats will increase the viability of SGCN populations.*

- Assist with implementation of the Illinois Nutrient Loss Reduction Strategy (1,2,4,5,6)
  - Initiate efforts to require nutrient management plans for lands receiving State or Federal funds. (3,4,5)
- Explore efforts to develop environmental flows for Illinois waterbodies (1,2,4,5,6)
  - Develop strategies for naturalizing hydrologic regimes to benefit SGCN. (1,2,5)
  - Initiate efforts to establish and protect flows for ecological needs (1,2,4,5,6)
- Assess, grow, and increase the impact of buffer easement programs (1,2,3,4,5,6)
  - Focus programs on reducing sediment and nutrient inputs to aquatic systems (1,2,4,5)
  - Develop statewide guidance for establishment and management of riparian buffers on waterbodies throughout Illinois (1,2,3,4,5)
- Improve the compatibility of implementation of drainage law and other statutes with the needs of SGCN and their habitats including those of Endangered & Threatened Species. (1,2,3,4,5)
  - Review Illinois drainage law and allowable drainage and channel maintenance practices to identify changes needed to minimize impacts on SGCN. (1,2,3,4,5)
  - Review flowage easements and associated plans for their effectiveness on flood reduction and minimizing environmental impact on SGCN. (3,4,5)
  - Develop guidance consisting of a model local stormwater ordinance for use by counties and local community planning organizations that address the needs of SGCN. (1,2,4,5)
- Identify and quantify the principle stressors for SGCN in aquatic systems associated with flow modifications, water chemistry, and physical "habitat" quality and availability. (1,2,5)
  - Identify impacts of "Contaminants of Emerging Concern" (e.g., Pharmaceuticals and Personal Care Products [PPCPs], Coal-Tar Sealants) on aquatic SGCN. (1,2,5)

Fragmentation & Connectivity:

Need: *Fragmented populations are at greater risk of extirpation from stochastic events, genetic isolation, or temporal changes in habitat conditions. Artificial barriers that fragment populations by preventing dispersal and by altering local habitat can put additional stress on native populations. Reducing fragmentation of habitats will alleviate these stressors on SGCN.*
Outcomes: *Increased connectivity of aquatic habitats and increased resilience of SGCN populations.*

- Investigate the potential for aquatic species to disperse through the existing landscape (1,2,5)
- Develop a comprehensive approach for identifying barriers (e.g., dams, levees, dewatered reaches) that fragment aquatic habitats and no longer provide essential services. (1,2,5)
    - Identify BMPs and opportunities where reconnection would benefit SGCN. (1,2,5)
    - Remove or modify barriers where possible to benefit SGCN and their habitats. (1,2,5)

Invasive Species & Wildlife Diseases:

Need: *Invasive species and wildlife diseases have been identified as important stressors to both native species and their habitats. Improved identification, prevention, and control of new threats, along with management of existing threats will benefit SGCN that share habitats with Invasive Species.*
Outcomes: *Stresses associated with Invasive Species will be reduced or mitigated to the benefit of native species and their habitats.*

- Assist the Asian Carp Regional Coordinating Committee's work as described in the Asian Carp Control Strategy Framework and the Monitoring & Response Plan (ACRCC 2015a,b) (1,2,6)
- Conduct effectiveness monitoring & assessment of efforts to reduce and mitigate impacts of Invasive Species. (1,2,4,5)
- Develop and implement a sentinel monitoring program for detecting changes in distributions of known threats and identifying new aquatic invasive species or wildlife diseases in Illinois. (2,4,6)
- Investigate the cumulative impacts of landuse alteration, climate change, and invasive species on SGCN and aquatic species assemblages. (1,2,3,5)

Public Support & Action:

Need: *Conservation of SGCN will require public support and action. Awareness, appreciation, and connection to these species is a prerequisite for such support and action. Furthermore, awareness and connection to nature have a positive influence on human well-being (Russell et al. 2013).*
Outcomes: *Citizens of Illinois will be empowered to support and assist with the conservation of their natural resources including SGCN and their habitats.*

- Provide informational programing that builds awareness and appreciation of SGCN, their habitats and threats, including the water cycle, ecological flows, storm water, and current policies, practices, and laws related to aquatic SGCN (6)
- Develop and promote programing that connects people to SGCN and their habitats (6)
- Promote citizen science projects, such as RiverWatch (http://www.ngrrec.org/riverwatch/) and the Illinois Odonate Survey (http://www.illinoisodes.org/), and develop and encourage scientific collaborations that utilize data collected by these organizations (1,2,6)
- Provide information to citizens about ways they can contribute to aquatic conservation, such as water conservation, rain gardens, permeable surfaces, responsible medicine disposal, invasive species prevention, nutrient reduction, and alternative de-icing strategies (4,5,6)
- Develop and implement assessment tools to monitor awareness, appreciation, and connection to nature/SGCN across the state (6)
- Collaborate with resource managers to identify, evaluate, and/or disseminate guidance and outreach materials focused on best management practices related to stewardship and management of aquatic species (1,2,5)

Management Resources

An updated list of links to documents, recommendation, contacts, grant opportunities, and other resources for the Streams Campaign, the other campaigns, and the wildlife action plan in general are found on the Illinois Wildlife Action Plan's website at:
http://www.dnr.illinois.gov/conservation/IWAP/Pages/default.aspx#tabitem5

Table 1. Activities in support of the Wildlife Action Plan Stream Campaign and their relationship to the Implementation Goals.							
		Percent Related to Implementation Goals					
Funding and Effort Sources	**Activities Related to Streams Campaign**	**Goal 1**	**Goal 2**	**Goal 3**	**Goal 4**	**Goal 5**	**Goal 6**
State Wildlife Grants	35 projects	23%	34%	6%	0%	29%	9%
Wildlife Protection Fund Grants	32 projects	38%	31%	0%	0%	28%	6%
Endangered Species Protection Board projects	6 studies	0%	100%	0%	0%	0%	0%
EPA 319 projects	139 projects	93%	17%	0%	56%	37%	20%
Nature preserve/Land and water reserve additions	88 properties	0%	19%	100%	0%	0%	0%
DNR OMLP purchases	80 properties	0%	13%	100%	0%	0%	0%
CRP/CREP additions in riparian enhancement practices	15,916 properties (107 in CREP)	0%	1%	100%	0%	0%	0%
Dam removals	35 removals	100%	26%	0%	0%	100%	0%
IDNR-driven stream restorations	13 projects	100%	38%	0%	0%	100%	0%
FWS Partners Program stream restorations	23 projects	100%	23%	0%	0%	100%	0%

Table 2. Focal Species selected for Nutrient Management Priority Areas based on the Illinois Nutrient Management Loss Strategy. Available at http://www.epa.illinois.gov/topics/water-quality/monitoring/strategy/index	
Nutrient Management Priority Area	**Focal Species for Priority Area**
Priority Watersheds for Agricultural Non-Point Sources (Total Phosphorus)	
Big Muddy River Watershed	Spotted Bass, Spotted Gar, Pugnose Minnow
Embarras River Watershed	Steelcolor Shiner, Northern Hogsucker, Pistolgrip (*Tritogonia verrucosa*)
Little Wabash River Watershed	Steelcolor Shiner, Northern Hogsucker, Little Wabash Crayfish (*Orconectes stannardi)*
Priority Watersheds for Agricultural Non-Point Sources (Nitrate-Nitrogen)	
Lower Illinois River-Senachwine Lake Watershed	Black Redhorse, Northern Hogsucker
Lower Rock River Watershed	Fantail Darter, Northern Hogsucker, Black Sandshell
Mississippi Central Watershed	Statewide Focal Species
Vermilion-Illinois River Watershed	Fantail Darter, Northern Hogsucker, Smallmouth Bass
Vermilion-Wabash River Watershed	Steelcolor Shiner, Wavy-rayed Lampmussel (*Lampsilis fasciola*)
Priority Watersheds for Point Sources	
Upper Fox River Watershed	Northern Hogsucker, Smallmouth Bass, Ellipse
Des Plaines River/DuPage River Watershed	Northern Hogsucker, Smallmouth Bass, Ellipse
Upper Sangamon River Watershed	Fantail Darter, Steelcolor Shiner, Pistolgrip, Creek Heelsplitter (*Lasmigona compressa*)
Lower Rock River Watershed	Fantail Darter, Northern Hogsucker, Black Sandshell
Lower Illinois River-Senachwine Lake Watershed	Black Redhorse, Northern Hogsucker
Keep it for the Crop Priority Watersheds	
Evergreen Lake Watershed	Statewide Focal Species
Lake Bloomington Watershed	Ellipse (*Venustaconcha ellipsiformis*)
Lake Decatur Watershed	Steelcolor Shiner, Fantail Darter, Smallmouth Bass
Vermilion-Illinois River Watershed	Fantail Darter, Northern Hogsucker, Smallmouth Bass
Lake Mauvaise Terre Watershed	Statewide Focal Species
Lake Springfield Watershed	Statewide Focal Species
Lake Vermilion Watershed	Northern Hogsucker, Smallmouth Bass
Salt Fork Vermilion River Watershed	Steelcolor Shiner, Northern Hogsucker, Wavy-rayed Lampmussel, Rainbow (*Villosa iris*)

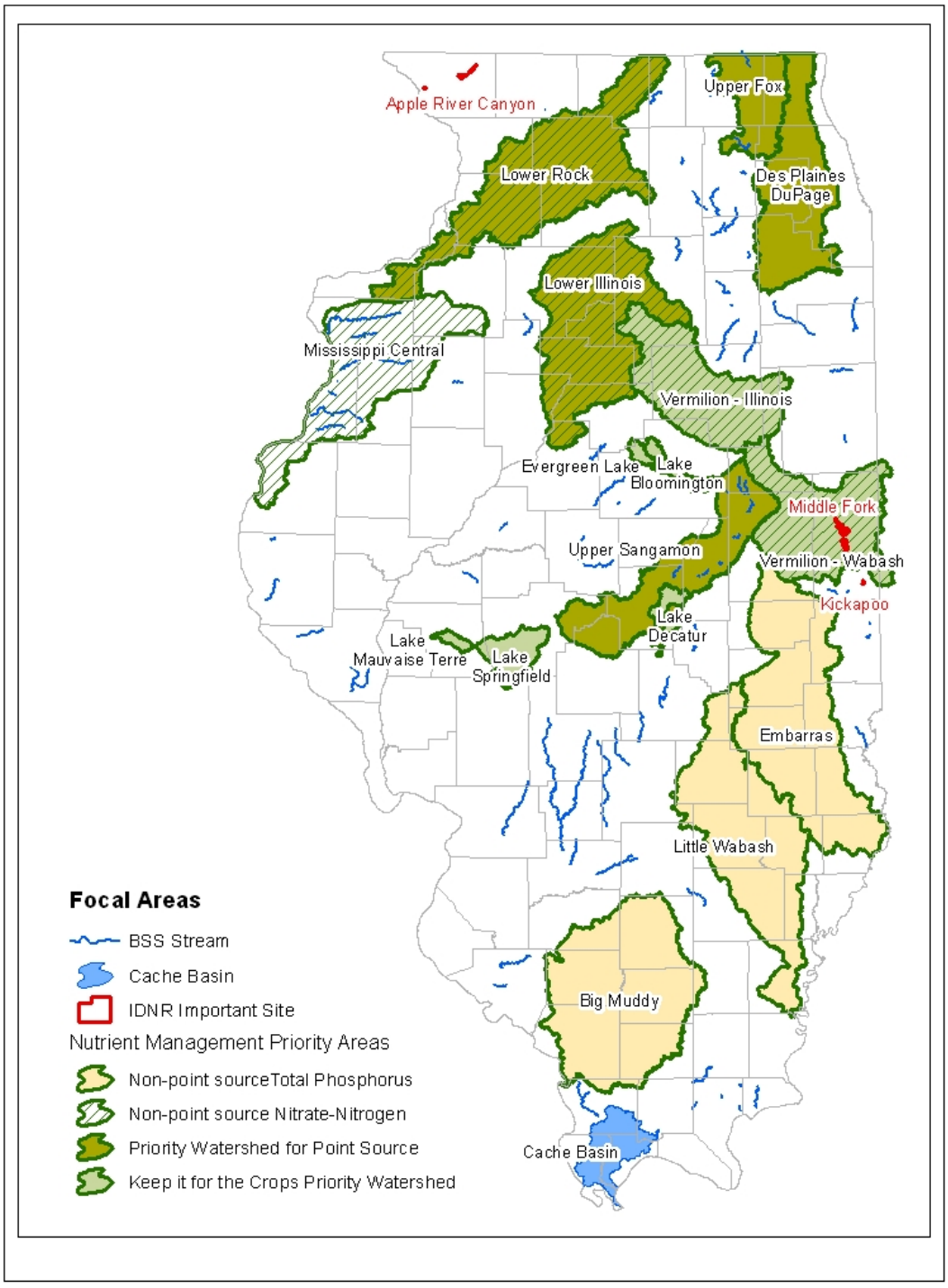

Figure 1. Streams Campaign Focal Areas have been compiled to emphasize priority areas associated with Biologically Significant Stream reaches (blue lines), initiatives to protect and enhance the Cache River Basin (blue polygon), IDNR Important Sites (red outlined), and Nutrient Management Priority Areas based on the Illinois Nutrient Loss Reduction Strategy (green outlined).

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Appendix II

Lists of Actions Identified by Partners

The lists that follow are presented for the benefit of our partnering organizations. The text presented has not been greatly edited from what was submitted by partners following our request for conservation actions to be considered for the revision of the Illinois Wildlife Action Plan. We have grouped these suggested actions based on the perceived authority of the organization listed. In some cases partners identified specific organizations for individual actions. Conservation actions may be listed as applying to more than one organization. The names of partnering organizations and individuals suggesting specific actions have not been identified to maintain their anonymity.

Separate lists are presented for the Illinois Department of Natural Resources, Illinois Environmental Protection Agency, Illinois Endangered Species Protection Board, Illinois Nature Preserves Commission, with a final list for other identified organizations. The actions presented have not been ranked and their order is arbitrary.

List of Actions for IDNR

1. Maintain a list of the species/biodiversity to be supported
2. Address known threats to populations of state and federally threatened and endangered species
3. reintroduce native species into stream habitat where decimating factors have been eliminated and natural recovery is unlikely
4. Augment targeted populations of mussel SGNC (especially Federal and State listed species)…. Stabilize or increase populations of Federally listed species (reintroductions)
5. Work with stakeholders to reduce /remove principle stressors
6. Encourage stream restoration projects as needed goals in watershed planning efforts.
7. Coordinate and support efforts to improve water quality and physical habitat in waters supporting SGNC.
8. Coordinate BMP implementations with other agencies – prioritizing to support adoption of the most effective practices in ideal locations
9. Have representation in Illinois Nutrient Loss Reduction Strategy advisory committees
10. Have a Streams Campaign and/or ORC presence on the planning committee for the Biennial Governor's Conference on the Management of the Illinois River System
11. Coordinate and support efforts to improve water quality and physical habitat in waters supporting SGNC.
12. Collaborate and cooperate with other Campaigns to identify and maximize efforts where there is overlap between goals/objectives and action items
13. Work with other agencies and organizations to agree to use the same Stream GIS layer for analysis
14. Support funding and coordinated strategy for preventing and managing invasive species
15. Review present state of flowage easements across the state. Involve ACOE, IDNR, NRCS with management of current flowage easements and planning of additional easements with the intent of improving wildlife habitat and reducing sediment and nutrient runoff (this might be a Research Project).
16. restore normal flood-pulse and hydrologic patterns
17. Seek to protect "ecological flows" as essential minimum base flows necessary to meet ecological function for the streams in question.
18. Coordinate and support efforts to manage storm flows on developed lands including agricultural lands.
19. Continue CREP and other Private Lands Program efforts within Illinois.
20. Seek financial support for riparian restoration work as a part of watershed planning activities.
21. Coordinate and support efforts to improve water quality and physical habitat in waters supporting SGNC.
22. Allow streams to periodically flood onto streamside habitats (connected floodplain lakes, 2-stage ditches, etc.)

23. Expand and coordinate efforts to naturalize flows and their associated loads in developed areas (i.e., agricultural and urban/exurban landscapes).
24. Investigate new revenue sources to fund an expanded CREP program
25. Legislation that requires riparian buffer protection statewide, without agricultural exemptions
26. Promote funding and partnerships for an NGO-driven buffer easement program
27. Require nutrient management plans for lands that receive Federal or State Funds.
28. Riparian buffer rule would go a long way towards objectives 1, 2, 3, 4, and 5. I do not believe it will be popular with farmers or other land users with large acreage, but it would certainly do #6 if controversial. [These numbers refer to the Streams Campaign Implementation Goals]
29. Seek legislation to protect minimum instream flows for ecological needs.
30. Provide funding support (like the C2000 Ecosystem Partnership Program did) to watershed groups undertaking waterway restoration efforts.
31. Extend the Middle Illinois River COA to the Mackinaw River.
32. Have a SGNC booth at Illinois State Fair
33. Develop campaigns to raise awareness about SGNC and the ecological and socioeconomic significance for protecting these species and their habitats.
34. Provide opportunities for stakeholders to engage in citizen science where they can engage in scientific research and management of SGNC and their habitats.
35. Conduct outreach to landowners in areas where SGNC are declining
36. Encourage the preservation and restoration of riparian buffers
37. Conduct regional bioblitzes (with agency biologists staffing the event and interacting with the public)
38. Secure funding for regional DNR private lands biologists whose job it is to work with private landowners to increase/preserve SGNC habitat
39. Coordinate with IWAP Campaigns where overlapping interests arise and common actions occur.
    a. Invasive Species Campaign: Asian Carp, Common Carp, Grass Carp; Purple Loosestrife, VHS, Round Goby, Tubenose Goby, Zebra Mussel, Quagga Mussel, Faucet Snail, Chinese Mystery Snail; *threats: New Zealand Mud Snail, Didymo*.
    b. Farmland & Prairie Campaign: Buffers and Agricultural Conservation Efforts
    c. Wetlands Campaign: Buffers and Agricultural Conservation Efforts, Storm water Runoff mitigation efforts
    d. Forest & Woodlands Campaign: Buffers and Agricultural Efforts, Forestry Plans
    e. Lake Michigan Campaign: Shared SGNC, Storm water mitigation efforts,
    f. Green Cities: Storm water mitigation efforts, water quality improvements, green infrastructure
40. IDNR support for Ecosystem Partnerships (most of which are/were watershed-based) to increase public awareness and engagement in aquatic SGNC and their habitats. IDNR should support this program.
41. Create and make available displays that highlight aquatic SGNC for public engagement.

42. Increase the number of schools using freshwater curriculum (Rivers Curriculum, Our Mississippi, Project WET, Holding on to the Green Zone, RiverWorks Discovery)
43. remove unnecessary dams and fit necessary dams with effective fish passage structures
44. Increase habitat connectivity through removal of defunct run-of-the-river dams and improperly designed "perched" or under-sized culverts.
45. Create migration corridors between declining populations of SGNC that are currently isolated
46. Remove low-head dams or create fish passage to re-establish ecological continuity within streams to enhance recruitment and habitat use in depauperate mussel areas. ... Re-establish ecological continuity within streams (dam removal and fish passage).
47. Connect populations of SGNC that have been fragmented by impassible barriers such as dams, wastewater treatment dilution areas, low O_2 reaches, chemical or thermal pollution, or inhospitable habitats (e.g., degraded, channelized).
48. Remove dams that no longer serve their original purpose (or some new but essential purpose).
49. Maintain and continue to fund IDNRs dam removal program, especially in order to provide state match to available Army Corps funding.
50. Develop guidance for stewardship and management activities to minimize impacts on sensitive invertebrates (or other SGNC).
51. Identify stakeholders in agricultural and urban contexts who may influence SGNC and their habitats. [remainder is part of same research initiative designed for Objective 6]:
    a. Assess stakeholders' knowledge about SGNC, their habitats, and their ecological and socioeconomic significance.
    b. Conduct empirical research for investigating stakeholders' attitudes and concerns toward SGNC and their management in order to inform management and policies.
    c. Develop campaigns to raise awareness about SGNC and the ecological and socioeconomic significance for protecting these species and their habitats.
    d. Provide opportunities for stakeholders to engage in citizen science where they can engage in scientific research and management of SGNC and their habitats.
52. Identify conservation priority areas for Protection, Enhancement, and Restoration of aquatic habitats for SGNC.
53. Review Illinois drainage law to determine if updates are necessary to address the needs of and threats to SGNC or statutorily for T&E species.
54. Develop state plan to reconnect floodplains to rivers in areas where SGNC populations would benefit
55. Identify and map suitable reference reaches for SGNC (make available as widely as possible)
56. Develop recovery plans for all aquatic threatened or endangered species (focus on fish, mussels, and other invertebrate endangered species during implementation period).

57. Determine which species have been extirpated from Illinois that might now be successfully reintroduced (and required resources to do so)
58. Assess whether biological monitoring is sufficient for determining whether species are declining/should be listed (supplement it if it is not)
59. Identify whether there is adequate habitat to maintain existing populations of SGNC
60. Designate high quality aquatic communities on the biologically significant streams list as outstanding resource waters
61. Work with land trusts and other conservation organizations to generate a list of desirable acquisition sites
62. Identify conservation opportunity areas for species recovery efforts. Develop Species Recovery Plans to include habitat enhancement efforts, reintroduction, translocation, captive propagation, and refuge development.
63. identify priority habitat to pursue purchase of or provide long term protections in the form of conservation easements
64. evaluate drainage maintenance procedures and make suggestions to avoid increased erosion and a reduction of instream habitat
65. Develop SOP for reintroductions and translocations of animals for conservation & management
66. Identify and prioritize riverine or upland parcels linked to SGCN. Look for opportunities to allow the regulated communities to assist in purchasing easements/fee simple etc.
67. Develop (for urban areas) a more scientific and realistic view of what biodiversity could be in a hardened watershed.
68. Develop detailed high resolution information for each water body (maps of fish, macros, water column chemistry habitat based on SHAP/QHEI, principle outfalls and bed control structures)
69. Develop a plan for Outstanding Resource Waters petitions and bring the first petition to the IPCB within the next 5 years.
70. Delineate groundwater contribution areas for high quality aquatic habitats associated with Nature Preserves or sensitive species.
71. Develop realistic benchmarks for Illinois waters associated with potential designations (e.g., ORW, BSS, Land & Water Reserves, Nature Preserve).
72. Conduct monitoring and field verifications on CREP easements to assess quality of conservation practices
73. Develop and implement a statewide monitoring and assessment program focused on the conservation status of aquatic SGNC.
74. Perform targeted surveys for rare species typically missed during routine monitoring efforts.
75. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
76. Many SGNC insect species are poorly known, whether basic biology or geographic distribution. Funding spatially and temporally structured inventory and/or censuses of protected areas (whether county preservation districts or state/federal land holdings) would generate more confidence in our estimates of geographic range as well as provide useful benchmarks for assessing future change
77. Expand and coordinate sentinel monitoring efforts to provide statewide baseline and trend assessments.

78. Encourage and expand effectiveness monitoring associated with all Actions associated with stream restoration, enhancement, and protection efforts.
79. Update status of distributions associated at locations of historic records
80. Conduct large scale surveys of imperiled aquatic insects within COAs including T&E EPTO species and those that merit an S1 rating. Key areas to focus on are ravine streams, seeps, large sand rivers, coldwater streams, other large rivers.
81. Monitoring and potentially mitigating the impacts of climate changes on SGNC and existing conservation networks.
82. Increase the scope and biotic range of biodiversity surveys (more taxonomic groups).
83. Conduct targeted surveys for "Watch Listed" species.
84. Intensive analysis of existing data to assess the status of all species.
85. Include streams in an update of the INAI since there are likely many high quality reaches that have not been sampled.
86. Coordinate existing and targeted monitoring to support state-wide conservation status assessments of SGNC and their habitats.
87. Estimating the current distributions and population viability of SGNC
88. Call for investigations of current population status and habitat use patterns of sturgeons (Lake Sturgeon, Shovelnose Sturgeon, and Pallid Sturgeon) and Paddlefish in the Illinois River and its tributaries. New research is needed to determine whether viable populations occur in the river and, if so, to locate critical habitats for each species continued viability within the watershed.
89. Revise subregional conservation ranks for Illinois SGNC (or all aquatic species).
90. Identify a need to conduct targeted surveys to assess individual species that do not tend to be efficiently captured by routine sampling methods.
91. Assessing the effectiveness of existing conservation lands/parks/reserves for protecting SGNC.
92. Develop and implement a sentinel monitoring program for Illinois streams that includes biological, chemical, physical data to assess the conservation status of aquatic SGNC.

List of Actions for IEPA

1. Work with stakeholders to reduce /remove principle stressors
2. Encourage stream restoration projects as needed goals in watershed planning efforts.
3. Work with other agencies and organizations to agree to use the same Stream GIS layer for analysis
4. Coordinate and support efforts to manage storm flows on developed lands including agricultural lands.
5. Seek financial support for riparian restoration work as a part of watershed planning activities.
6. Coordinate and support efforts to improve water quality and physical habitat in waters supporting SGNC.
7. IEPA will issue permits that establish discharge limits for pollutants that contribute to violations of numeric and narrative water quality criteria
8. Nonpoint sources of pollution will implement pollution-reduction practices identified in TMDL implementation plans
9. Sources of impairment will be addressed in 303d-listed streams
10. General permits will be assessed for collective impacts in watersheds impaired by pollutants likely discharged by permittees
11. Legislation that allows or requires counties to develop and adopt stormwater ordinances that include agricultural lands.
12. Work with IEPA and the regulated community to bring additional stressors identified in the State Integrated Report into the regulatory framework.
13. NPDES permits in IL are increasingly aligned with the 303 (d) list which is underpinned by a biological assessment. Making the link between aquatic life and permit conditions clear to regulated communities means they can focus more holistically on improving water way conditions as opposed to only managing their stormwater/waste water effluent.
14. Legislation that requires riparian buffer protection statewide, without agricultural exemptions
15. Promote funding and partnerships for an NGO-driven buffer easement program
16. Riparian buffer rule would go a long way towards objectives 1, 2, 3, 4, and 5. I do not believe it will be popular with farmers or other land users with large acreage, but it would certainly do #6 if controversial. [These numbers refer to the Streams Campaign Implementation Goals]
17. Support and get involved in watershed planning activities.
18. Connect populations of SGNC that have been fragmented by impassible barriers such as dams, wastewater treatment dilution areas, low O_2 reaches, chemical or thermal pollution, or inhospitable habitats (e.g., degraded, channelized).
19. Develop (for urban areas) a more scientific and realistic view of what biodiversity could be in a hardened watershed.
20. Develop detailed high resolution information for each water body (maps of fish, macros, water column chemistry habitat based on SHAP/QHEI, principle outfalls and bed control structures)
21. Develop a plan for Outstanding Resource Waters petitions and bring the first petition to the IPCB within the next 5 years.

22. Develop realistic benchmarks for Illinois waters associated with potential designations (e.g., ORW, BSS, Land & Water Reserves, Nature Preserve).
23. Expand and coordinate sentinel monitoring efforts to provide statewide baseline and trend assessments.
24. Encourage and expand effectiveness monitoring associated with all Actions associated with stream restoration, enhancement, and protection efforts.
25. Increase the scope and biotic range of biodiversity surveys (more taxonomic groups).

List of Actions for Illinois Endangered Species Protection Board

1. Work with other agencies and organizations to agree to use the same Stream GIS layer for analysis
2. Address known threats to populations of state and federally threatened and endangered species
3. Develop recovery plans for all aquatic threatened or endangered species.
4. Determine which species have been extirpated from Illinois that might now be successfully reintroduced (and required resources to do so)
5. Assess whether biological monitoring is sufficient for determining whether species are declining/should be listed (supplement it if it is not)
6. Identify whether there is adequate habitat to maintain existing populations of SGNC
7. Identify conservation opportunity areas for species recovery efforts. Develop Species Recovery Plans to include habitat enhancement efforts, reintroduction, translocation, captive propagation, and refuge development.
8. Develop SOP for reintroductions and translocations of animals for conservation & management
9. Fill information gaps for species with unknown distribution or poorly understood taxonomic position (further sampling of very rare species and genetic research on mussels)…. Identify if observations for certain mussel species are unique to Illinois and/or recognize them as new species.
10. Develop realistic benchmarks for Illinois waters associated with potential designations (e.g., ORW, BSS, Land & Water Reserves, Nature Preserve).
11. Perform targeted surveys for rare species typically missed during routine monitoring efforts.
12. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
13. Many SGNC insect species are poorly known, whether basic biology or geographic distribution. Funding spatially and temporally structured inventory and/or censuses of protected areas (whether county preservation districts or state/federal land holdings) would generate more confidence in our estimates of geographic range as well as provide useful benchmarks for assessing future change
14. Conduct large scale surveys of imperiled aquatic insects within COAs including T&E EPTO species and those that merit an S1 rating. Key areas to focus on are ravine streams, seeps, large sand rivers, coldwater streams, other large rivers.
15. Conduct targeted surveys for “Watch Listed” species.
16. Identify a need to conduct targeted surveys to assess individual species that do not tend to be efficiently captured by routine sampling methods.
17. Revise subregional conservation ranks for Illinois SGNC (or all aquatic species).
18. Call for investigations of current population status and habitat use patterns of sturgeons (Lake Sturgeon, Shovelnose Sturgeon, and Pallid Sturgeon) and Paddlefish in the Illinois River and its tributaries. New research is needed to determine whether viable populations occur in the river and, if so, to locate critical habitats for each species continued viability within the watershed.

List of Actions for Illinois Nature Preserves Commission

1. Work with other agencies and organizations to agree to use the same Stream GIS layer for analysis
2. Work with land trusts and other conservation organizations to generate a list of desirable acquisition sites
3. identify priority habitat to pursue purchase of or provide long term protections in the form of conservation easements
4. Develop SOP for reintroductions and translocations of animals for conservation & management
5. Delineate groundwater contribution areas for high quality aquatic habitats associated with Nature Preserves or sensitive species.
6. Develop realistic benchmarks for Illinois waters associated with potential designations (e.g., ORW, BSS, Land & Water Reserves, Nature Preserve).
7. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
8. Many SGNC insect species are poorly known, whether basic biology or geographic distribution. Funding spatially and temporally structured inventory and/or censuses of protected areas (whether county preservation districts or state/federal land holdings) would generate more confidence in our estimates of geographic range as well as provide useful benchmarks for assessing future change
9. Monitoring and potentially mitigating the impacts of climate changes on SGNC and existing conservation networks.
10. Assessing the effectiveness of existing conservation lands/parks/reserves for protecting SGNC.

Lists of Actions for other Organizations

Actions for other Agencies or Departments of the State of Illinois

Actions for Illinois Department of Agriculture

1. promote precision nutrient applications
2. limit livestock access to streams
3. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
4. Legislation that requires riparian buffer protection statewide, without agricultural exemptions
5. Restore funding for SWCD through Illinois Department of Agriculture to help put conservation on the ground in agricultural areas.
6. evaluate drainage maintenance procedures and make suggestions to avoid increased erosion and a reduction of instream habitat
7. Allow streams to periodically flood onto streamside habitats (connected floodplain lakes, 2-stage ditches, etc.)
8. Review present state of flowage easements across the state. Involve ACOE, IDNR, NRCS with management of current flowage easements and planning of additional easements with the intent of improving wildlife habitat and reducing sediment and nutrient runoff (this might be a Research Project).
9. Require nutrient management plans for lands that receive Federal or State Funds.
10. Give a high ranking status to applications for USDA conservation program funding that include SGNC

Actions for Illinois Department of Transportation

1. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
2. evaluate drainage maintenance procedures and make suggestions to avoid increased erosion and a reduction of instream habitat
3. Increase habitat connectivity through removal of defunct run-of-the-river dams and improperly designed "perched" or under-sized culverts.

Actions for Illinois Pollution Control Board

1. Designate high quality aquatic communities on the biologically significant streams list as outstanding resource waters

Actions for Illinois State Board of Education

1. Increase the number of schools using freshwater curriculum (Rivers Curriculum, Our Mississippi, Project WET, Holding on to the Green Zone, RiverWorks Discovery)

Lists of Actions for other Organizations

Actions for Federal Agencies or Organization

Actions for US Fish & Wildlife Service

1. Address known threats to populations of state and federally threatened and endangered species
2. Augment targeted populations of mussel SGNC (especially Federal and State listed species)…. Stabilize or increase populations of Federally listed species (reintroductions)
3. Support funding and coordinated strategy for preventing and managing invasive species
4. remove unnecessary dams and fit necessary dams with effective fish passage structures
5. Create migration corridors between declining populations of SGNC that are currently isolated
6. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
7. Call for investigations of current population status and habitat use patterns of sturgeons (Lake Sturgeon, Shovelnose Sturgeon, and Pallid Sturgeon) and Paddlefish in the Illinois River and its tributaries. New research is needed to determine whether viable populations occur in the river and, if so, to locate critical habitats for each species continued viability within the watershed.
8. Encourage and expand effectiveness monitoring associated with all Actions associated with stream restoration, enhancement, and protection efforts.
9. Require nutrient management plans for lands that receive Federal or State Funds.
10. Increase habitat connectivity through removal of defunct run-of-the-river dams and improperly designed "perched" or under-sized culverts.
11. Remove low-head dams or create fish passage to re-establish ecological continuity within streams to enhance recruitment and habitat use in depauperate mussel areas. ... Re-establish ecological continuity within streams (dam removal and fish passage).

Actions for US Army Corp of Engineers

1. Expand and coordinate efforts to naturalize flows and their associated loads in developed areas (i.e., agricultural and urban/exurban landscapes).
2. Advance reforms to federal river management (Corps) policies and programs (e.g., Emergency Levee Repair PL 84-99) to encourage proactive, non-structural navigation management and flood risk reduction strategies.
3. Expand the Upper Mississippi River Restoration program (Corps) to increase funding and broaden restoration opportunities on the Illinois and Mississippi Rivers.
4. restore normal flood-pulse and hydrologic patterns
5. remove unnecessary dams and fit necessary dams with effective fish passage structures
6. Maintain and continue to fund IDNRs dam removal program, especially in order to provide state match to available Army Corps funding.
7. Require effectiveness monitoring and assessment of outcomes to be included with all stewardship and management activities.
8. Encourage and expand effectiveness monitoring associated with all Actions associated with stream restoration, enhancement, and protection efforts.
9. Allow streams to periodically flood onto streamside habitats (connected floodplain lakes, 2-stage ditches, etc.)
10. Review present state of flowage easements across the state. Involve ACOE, IDNR, NRCS with management of current flowage easements and planning of additional easements with the intent of improving wildlife habitat and reducing sediment and nutrient runoff (this might be a Research Project).
11. Increase habitat connectivity through removal of defunct run-of-the-river dams and improperly designed "perched" or under-sized culverts.
12. Remove low-head dams or create fish passage to re-establish ecological continuity within streams to enhance recruitment and habitat use in depauperate mussel areas. ... Re-establish ecological continuity within streams (dam removal and fish passage).