THE OHIO RIVER BASIN FISH HABITAT PARTNERSHIP

STRATEGIC PLAN

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Executive Summary

The Ohio River and its basin are of national significance in both geographic scope and the fish and mussel resources contained within them. The Ohio River is the second largest river in the United States as measured by its annual discharge. The basin also contains at least 350 species of fish and more than 120 mussel species, including a number that are federally listed. Sportfishing is a major recreational activity with over 2.5 million angling hours recorded and 2.8 million fish caught within just the main-stem Ohio River during past surveys. It was with these resources in mind, that the Ohio River Basin Fish Habitat Partnership (ORBFHP) coalesced from a meeting of approximately 50 federal and state agencies, NGOs, and academic representatives interested in the aquatic habitat of the Ohio River Basin.

The ORBFHP's focus is embodied in its mission statement: *The Ohio River Basin Fish Habitat Partnership focuses protection, restoration, and enhancement efforts on priority habitat for fish and mussels in the watersheds of the Ohio River Basin for the benefit of the public.*

Over the course of four in-person planning workshops and additional video conferences in 2008-10, the partnership utilized a rigorous open source planning method known as Conservation Action Planning (CAP) to focus on a set of key targets and to develop habitat protection/restoration strategies. Conservation targets selected by the ORBFHP include:

- Headwater and small streams (watersheds < 200 sq miles) and the signature long-ear sunfish, and rainbow and orangethroat darters

- Medium rivers (watersheds 200-3,681 sq miles) and the signature fish of smallmouth and spotted bass, logperch, and tippecanoe darters

- Large and great rivers (watersheds > 3,681 sq miles) and the signature fish of sauger, paddlefish, sturgeon, and blue suckers

- Off-channel systems (e.g. oxbows, sloughs, and other secondary channels) and the signature fish of largemouth bass and pickerel

- Native aquatic vegetation

- Native mussels (fluvial dependent, non-pool species)

The key ecological attributes (needs) provided by each habitat type (based on their signature species or biotic group) was identified. Then the root causes of the top threats to each type of habitat type were determined. Based on these determinations, a set of habitat protection and restoration strategies were developed for each habitat type based on the needs of its signature biota. Threats from individual habitat types were also rolled up to assemble a list of urgent threats that affect all aquatic habitats within the Ohio River basin.

Ultimately the ORBFHP also developed a core list of specific habitat protection/restoration strategic actions with SMART objectives nested under six strategy areas that include the National Fish Habitat Action Plan Board's four interim habitat strategies. The strategies selected by the ORBFHP link well with State Wildlife Action Plans and other planning efforts in the basin. These strategy areas are:

- Identify and protect intact and healthy waters.

- Restore natural variability in river and stream flows.

- Reconnect fragmented river and stream habitat, to allow access to historic spawning, nursery, and rearing grounds.

- Reduce and maintain sedimentation, phosphorus and nitrogen runoff to river, and stream habitats to a level within 25% of the expected natural variance in these factors or above numeric State Water Quality Criteria

- Reduce other key pollutants or degrading environmental conditions (acid drainage, heavy metals, altered temperatures, or oxygen levels) in degraded priority stream habitat to a level within 25% of natural rates or above numeric Stream Water Quality criteria by 2020.

- Reduce the potential for invasive species impact through prevention and control measures at the basin-level and within priority systems.

During the planning process it was determined the ORBFHP's initial geographic scope would not include the Tennessee River and would be limited to the Ohio River Sub-basin minus its HUC-4 Cumberland watershed (to limit overlap with SARP). The partnership coordination area encompasses the entire 981 miles of the Ohio River mainstem and 143,550 square miles of its watershed including tributary streams.

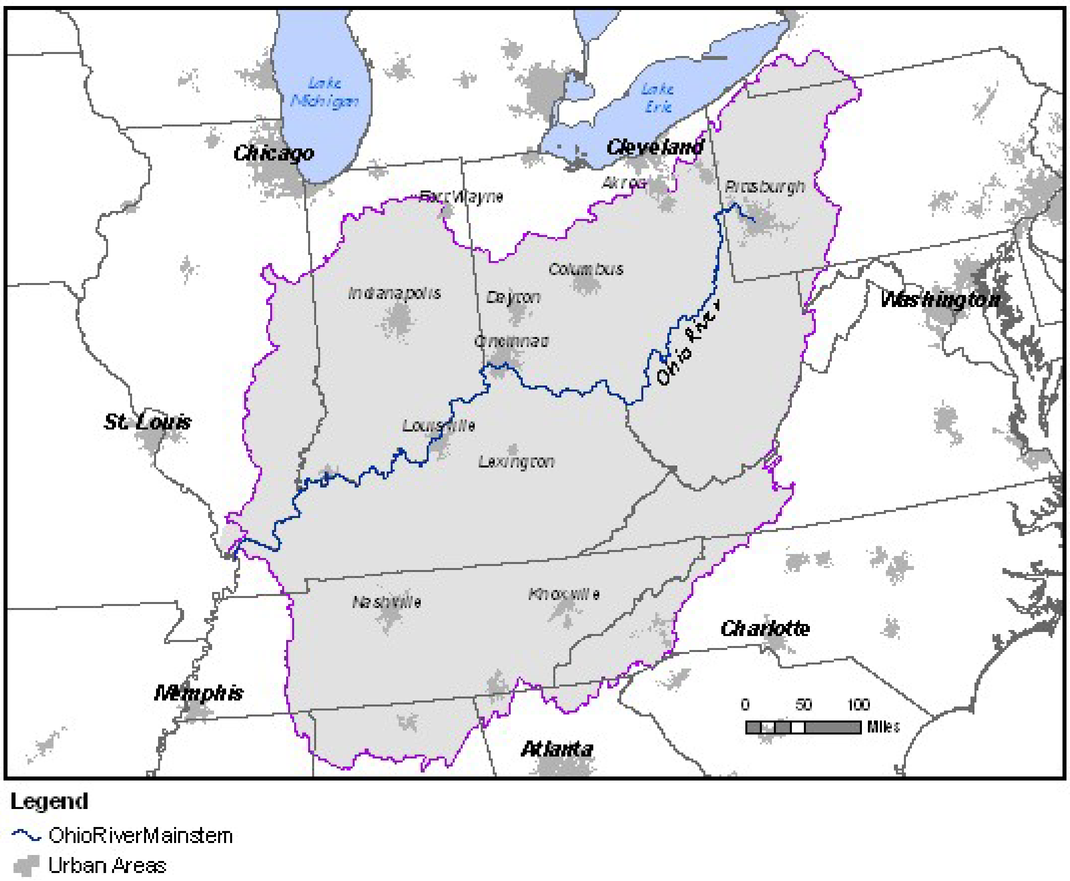
The ORBFHP and SARP collaborated on a rigorous basin-wide stream habitat assessment that was completed in 2012. This assessment along with our mission, guiding principles, and core strategic actions was used to help identify priority areas, select priority projects for funding, and to track progress on our objectives.

The partnership has identified a need to conduct sediment and nutrient loading modeling in at least the central and western portion of the basin to determine which lands are the greatest contributors to water quality stress. An analysis of floodplain connectivity and restoration potential is also needed throughout the ORBFHP area. Finally research into possible invasive species, invasion pathways, and methods of prevention are needed to prevent their introduction or spread.

Introduction

The Ohio River and its basin are of national significance in both their geographic scope and the fish and mussel resources found within them. The Ohio River is the second largest river in the United States as measured by its annual discharge (Van der Leeden et al 1990). In fact, the annual flow of the Ohio River exceeds even that of the Mississippi upstream of their confluence (USGS Water Data Report 2009) and is a reflection of its approximately 204,000 square mile drainage basin (Van der Leeden et al 1990) that includes portions of 15 states (Figure 1).

Figure 1. The Ohio River Basin (with major urban areas)



Of even more importance are the fish and other freshwater biodiversity found within the basin. The Ohio River drainage contains at least 350 species of fish ranging from endemic darters and dace in the headwaters to a suite of great river fish (e.g., paddlefish, blue sucker, lake, and shovelnose sturgeon) and more than 120 mussel species, including a number that are federally listed. These figures approach half of the freshwater fish and over a third of all mussel species found in the United States (NatureServe 2010).

Freshwater mussels as a group are among the most endangered freshwater fauna in the world and it can therefore be argued that protection and restoration of mussels and their habitat in the Ohio River Basin is not just of national significance but of global importance as well.

A number of the fish are also important sport or commercial species. An illustrative example of the Ohio River sport fishery and its economic impact can be found in the results of a 1991-92 creel survey in the West Virginia, Ohio, Kentucky, and Indiana portions of the mainstem (Schell et al 1998). At that time approximately 2.5 million angler hours of effort with a corresponding economic value of 34 million dollars were recorded. The vast productive potential of the Ohio River was evident in the 2.8 million sport fish that were caught even with the dampening effects of continuing habitat threats noted at that time.

Largemouth bass occupy the pools and oxbows of the mainstem and the lower reaches of its larger tributaries. A number of the rivers in the Ohio River Basin also contain outstanding smallmouth or spotted bass fisheries, and several mainstem tributaries to the Ohio River host a unique riverine subspecies of muskellunge (Trautman 1981; IL Nat History Survey 2005).

Portions of the Ohio River Basin contain viable populations of paddlefish that support a highly valuable commercial fishery (Henley et al 2001). Reported average annual commercial harvest was 149,764 pounds of flesh and 14,084 pounds of eggs during 1999-2000. The retail value of the 2000 egg harvest *only* was estimated to be 4.3 million dollars.

Fish and mussel habitat within the Ohio River Basin, however, is imperiled by a number of historic impacts and continuing threats including mineral extraction, row crop agriculture, and livestock grazing. It was within this context that a group of approximately 50 representatives from state and federal agencies, NGOs and universities within the Ohio River Basin, interested in fish and freshwater mussels, coalesced into the Ohio River Basin Fish Habitat Partnership (ORBFHP). The forming partnership desired to facilitate and carryout the goals of the *National Fish Habitat Action Plan* (2006) within the Ohio River Basin by developing a strategic planning framework that would:

- Protect and maintain intact and healthy ecosystems.
- Prevent further degradation of fish habitats that have been adversely affected.
- Reverse declines in the quality and quantity of aquatic habitats to improve the overall health of fish and other aquatic organisms.
- Increase the quality and quantity of fish habitats that support a broad natural diversity of fish and other aquatic species.

The subsequent sections of this document summarize the partnership's efforts to develop a strong conservation planning and operational process that complements the national effort to protect and restore fish and mussel habitat.

Mission of the ORBFHP

The first task of the forming fish habitat partnership was to craft a mission statement that reflected the common interests of the partnership members and their desire to achieve the intent of the National Fish Habitat Action Plan within the Ohio River Basin. After careful consideration the following mission statement was developed:

The Ohio River Basin Fish Habitat Partnership focuses protection, restoration, and enhancement efforts on priority habitat for fish and mussels in the watersheds of the Ohio River Basin for the benefit of the public.

Conservation Planning Process

The ORBFHP undertook a rigorous conservation planning process to determine how to focus existing and future resources for the protection and restoration of fish and mussel habitat. The partnership utilized an open source planning method utilized by a number of non-profit conservation organizations known as Conservation Action Planning or CAP (The Nature Conservancy 2005).

CAP begins by determining an appropriate project area and then selecting a subset of priority conservation targets within the area (Figure 2). Once the targets have been selected, planners determine their Key Ecological Attributes (KEAs). Key ecological attributes can also be thought of as critical needs. Current and desired future condition ratings (also known as viability analysis) are developed based on the degree to which a target's needs are met.

Figure 2. Visual Representation of the CAP Process

Understanding the needs of each target allows a determination of critical threats (key stresses) to each. Once top threats are determined an examination of underlying sources (often called a situation analysis) is undertaken. It is within the situation analysis that protection and restoration objectives and strategic actions are developed to alleviate the top sources of threats.

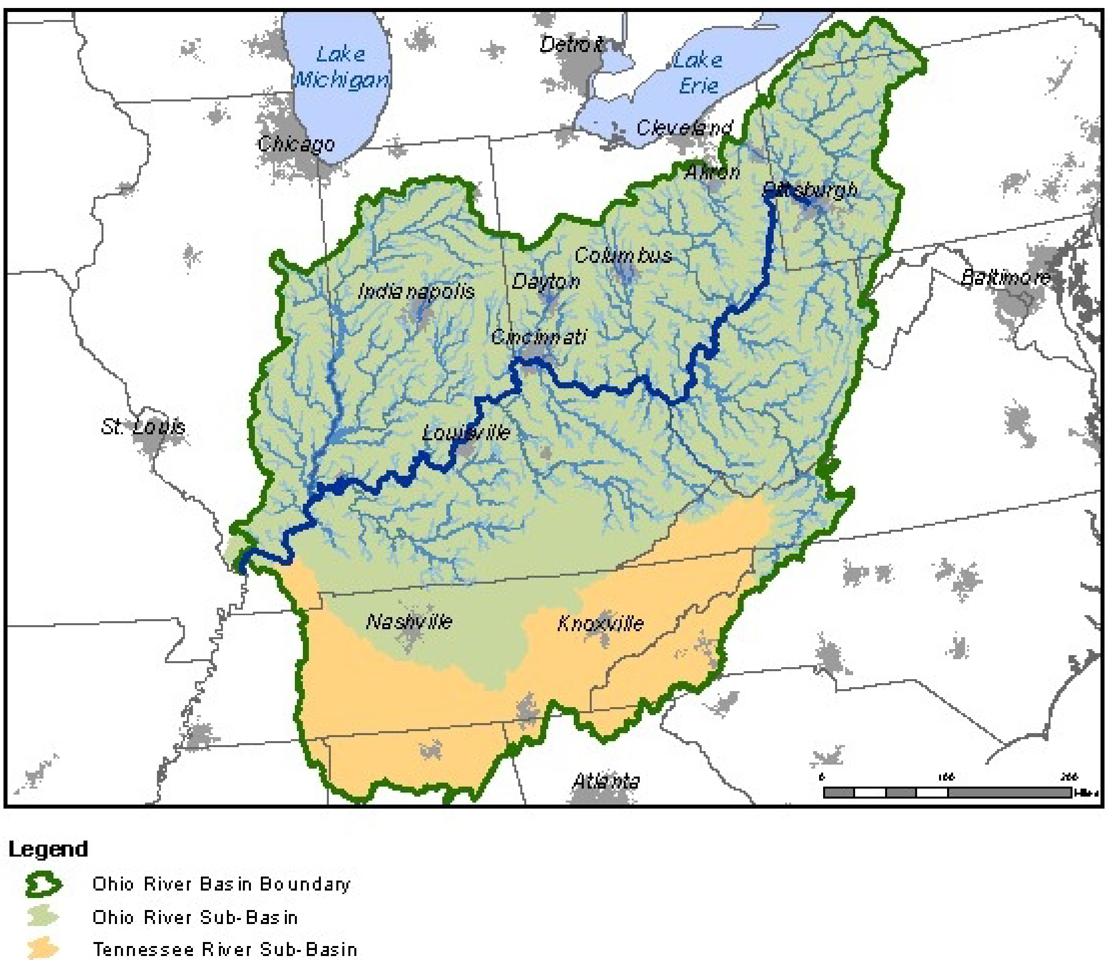
Finally measures are selected to evaluate the impacts of conservation strategies based first on strategy implementation progress and then to the degree which target KEAs are fulfilled and their status (viability) improves. In true adaptive management fashion effectiveness of selected strategies is evaluated using the selected measures and if necessary, strategies can be changed or refined accordingly.

An assembled group of core conservation experts within the partnership participated in an Ohio River Basin CAP process during four in-person workshops in 2008-10. Initial CAP planning was also refined in a series of conference calls and the outcome is presented in subsequent sections of this document.

Project Area Scope

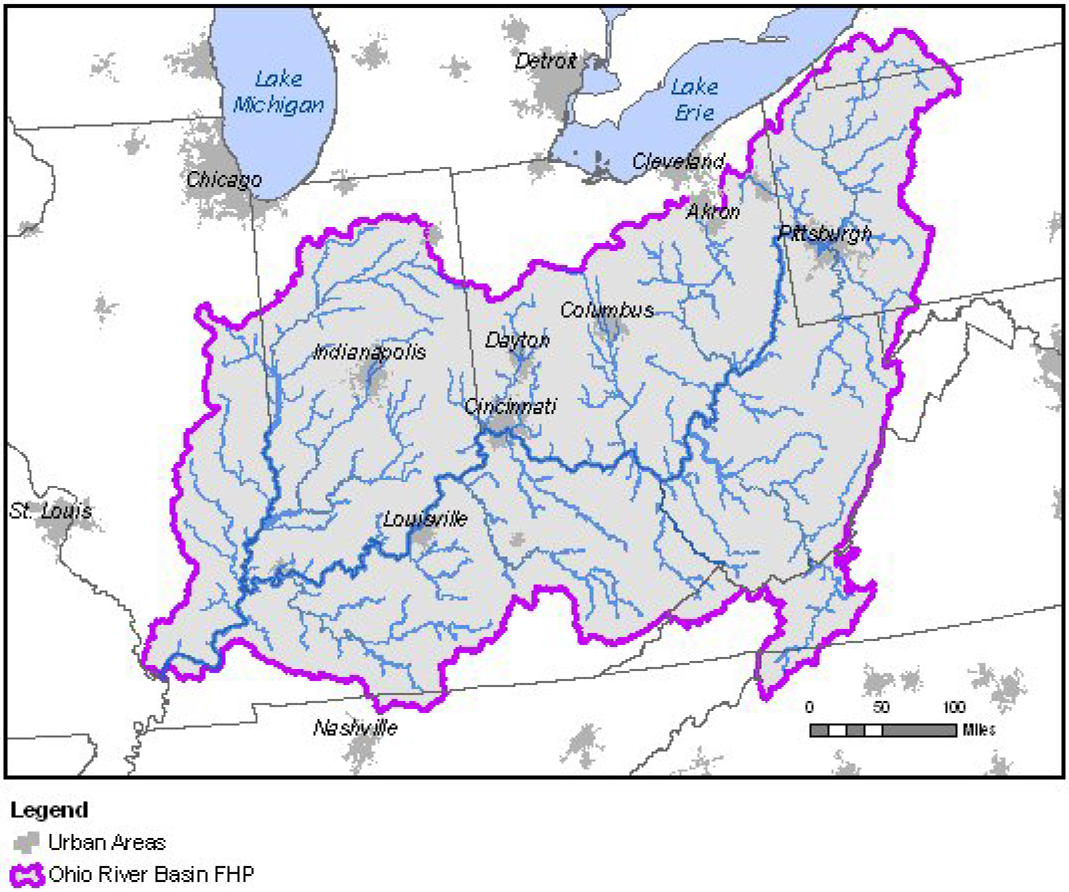
As noted earlier in the document the entire Ohio River Basin is a vast area and it also encompasses two great river basins (US Army Corps of Engineers 2009). The Ohio River and its major tributary (the Tennessee River) comprise the two sub-basin units (Figure 3) within the larger Ohio River Basin.

Figure 3. The Ohio River Basin (with sub-basin divisions)



After careful consideration, the core conservation planning team decided to limit the Ohio River Basin Fish Habitat Partnership's effective administration area to 13, HUC-4 units and the entire mainstem of the Ohio River stretching 981 miles between Pittsburgh, PA and Cairo, IL (Figure 4).

Figure 4. The Ohio River Basin Fish Habitat Partnership Geographic Boundary



The decision to initially limit the partnership's scope was based primarily on a desire to limit geographic overlap with the Southeastern Aquatic Resources Partnership (SARP) as it is that fish habitat partnership's stated intent to work in the Tennessee and Cumberland River systems. The decision to focus on the northern or Ohio River portion of the basin was also driven by a recognition that the prevalence of high dams (and resultant large impoundments) in the excluded areas creates a high degree of system fragmentation that is practically irreversible.

The ORBFHP will therefore initially operate within a geographic area corresponding to a large portion of the Ohio River Basin that extends from the southwestern corner of Maryland and western New York in the east, westward to the confluence of the Ohio River with the Mississippi in Illinois and as far south as portions of Virginia, North Carolina, and Tennessee (Figure 4). Within the bounds of this area are large portions of Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois.

The Ohio River watershed area contained within the ORBFHP encompasses approximately 143,550 square miles (Seaber et al 1987). A breakdown of HUC-4 units and principal streams within the bounds of the ORBFHP are presented in Appendix A.

Conservation Targets

During the conservation planning process, four signature groups of fish representing general habitat types, one specific rare habitat type, and a freshwater mussel group were chosen as targets that cover the diversity of aquatic habitat in the basin and the ecological needs that it provides. The signature fish (where applicable) are listed under their habitat types:

- Headwater and small streams (long-ear sunfish, rainbow and orangethroat darters)
- Medium rivers (smallmouth bass, spotted bass, logperch and tippecanoe darters)
- Large and great rivers (sauger, paddlefish, sturgeon, and blue sucker)
- Off-channel systems (largemouth bass and pickerel)
- Native aquatic and riparian vegetation
- Fluvial dependent native mussels (non-pool species)

The KEAs (usually critical habitat needs linked to important life history events) of signature fish or other biotic groupings were examined (Appendix B-G) to evaluate the current status of their associated habitat types. These lists of indicators should be viewed as a work in process that will likely be altered by an ongoing aquatic habitat modeling assessment. However, with further refinement and additions KEAS will eventually function as scorecards that track habitat improvement progress and provide a means of determining whether work in individual projects should be geared toward restoration or protection activities. In the present, indicators with incomplete rankings also determine areas where research or information mining is needed.

The general distribution of conservation targets within the ORB is presented below and includes the KEAs of each. Critical habitat threats to signature fish groups (or other biota) and sources of threats (at present to next 10 years) as determined by an assembled group of knowledgeable raters (made up of NGO, state and federal personnel) and trends within the basin are also discussed.

Headwater and Small Streams

The ORBFHP defined headwater and small streams as having watershed areas less than 200 square miles (Figure 5). This habitat type makes up the majority of stream miles within the basin.

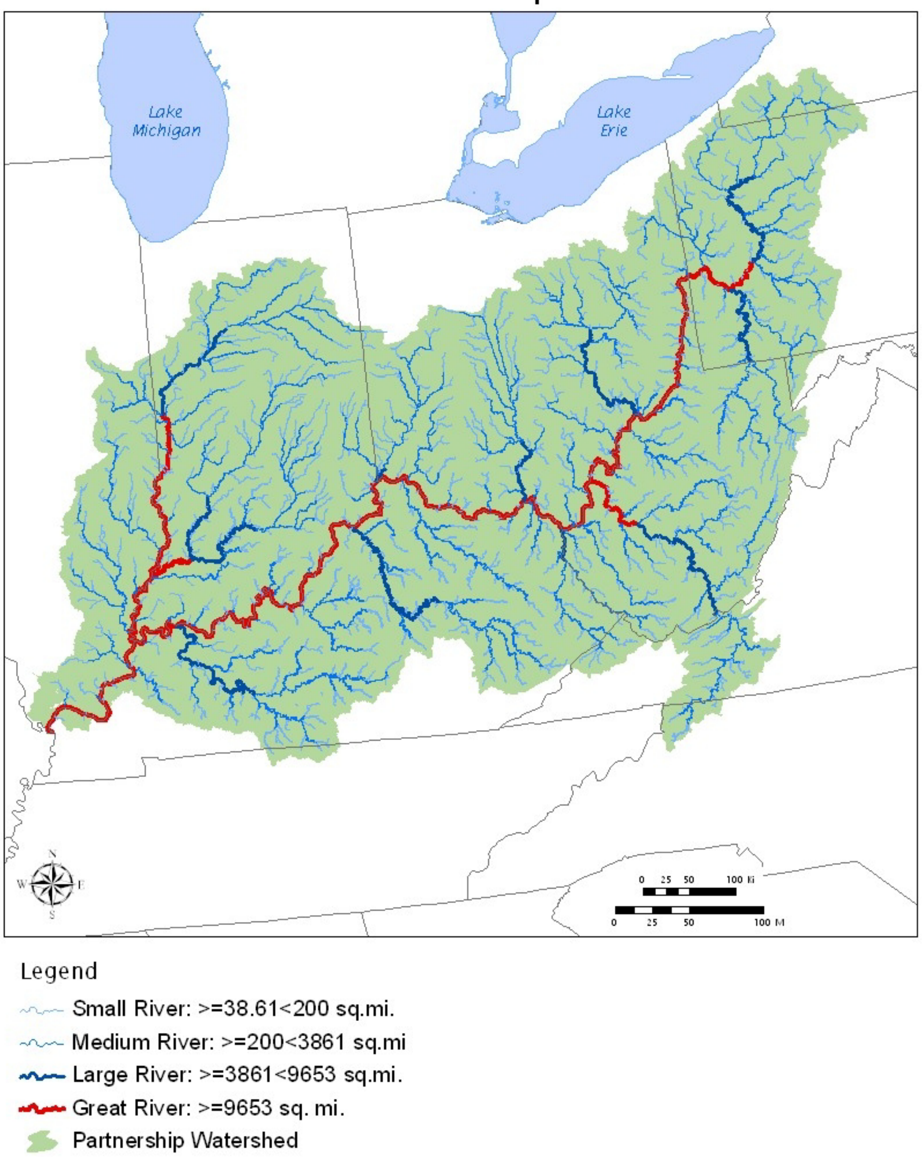
Long-ear sunfish and rainbow and orange-throat darters were chosen to represent the ecological needs provided by this habitat type. Within the basin, these signature fish are most abundant in headwater and small streams that provide the KEAs of good water quality and physical habitat (Trautman 1981). It was determined that additional KEAs of the signature fish are clean spawning substrates (usually rocks and gravel), adequate baseflow, and sufficient quantity and composition of invertebrate food sources (Appendix B).

Results of occurrence endpoint modeling from a basin-wide stream habitat assessment (Martin et al 2012) also indicate the importance of stream size and these KEAs. Among the most influential predictor factors for the presence of small stream fish are the network drainage area, network wetland land cover, mean annual air temperature, and network mean base flow index.

Conversely sedimentation from various land uses, barriers (usually road and pipeline crossings at this scale), altered channel morphology (straightening), altered hydrology, acid mine drainage, and climate change impacts (warmer water temperatures) ranked among the greatest threats to the headwater/small stream fish (Appendix H). Although relatively recent in nature, Marcellus Shale gas extraction is expanding in the eastern portion of the basin and therefore ranked highly as a headwater threat.

Again, the perception of workshop raters was well supported by endpoint modeling. Wetland land cover, density of cattle, riparian disturbance, impervious surface cover, and pasture land cover throughout the stream network were identified as the most influential anthropogenic factors affecting presence of signature small stream fish.

Figure 5. Distribution of Stream Size Classes within the ORBFHP



Medium Rivers

The ORBFHP defined medium rivers as having watershed areas between 200 and 3,861 square miles (Figure 5). As with the smaller stream class, there are numerous medium rivers within the Ohio River Basin and therefore they are not listed by name within the current document.

A group of signature fish (includes smallmouth bass, spotted bass, redhorse species, logperch, and tippecanoe darters) were chosen to represent the necessary ecological needs provided by the medium rivers habitat type. Within the basin, smallmouth bass are more widely distributed within the eastern portion of the basin than in the west and are normally found in streams with summer water temperatures consistently less than 84F (Brewer et al 2007). Spotted bass distribution is not as clearly defined as smallmouth bass, but they often fill a similar niche in streams or stream segments with warmer water temperatures. Logperch and tippecanoe darters and redhorse species are typically found in the less disturbed reaches of medium rivers throughout the basin.

It was determined that the KEAs of this group of fish (Appendix C) are clean spawning substrates (usually cobble-sized rock and gravel), good water quality, and cooler water temperatures (<84 F) for smallmouth. Other KEAs include sufficient quantity and composition of invertebrates (darters) as well as sufficient large prey items (smallmouth and spotted bass). Modeling of the probability of smallmouth bass and redhorse presence during the basin-wide habitat assessment indicates that these fish are also influenced by network drainage area, mean annual air temperature, and network land cover.

Conversely sedimentation from various land uses, dams, altered channel morphology, hydrology, and climate change impacts (warmer water temperatures) ranked among the greatest threats to the medium river fish (Appendix H). Marcellus shale extraction was also identified as an emerging threat in the eastern portion of the basin.

Important anthropogenic factors identified in the habitat modeling as influencing the presence of smallmouth bass and redhorse included sources of the threats above or important mitigating features to these threats. These factors were the network density of cattle and crop land cover, network forested cover, network density of dams, local and network impervious surface cover, and local riparian disturbance.

<u>Large and Great Rivers</u>

The ORBFHP defined large and great rivers as having watershed areas exceeding 3,861 square miles. Moving generally east to west within the partnership area these rivers are the Allegheny, Monongahela, Muskingum, Kanawha, Scioto, Big Sandy, Great Miami, Kentucky, Green, Wabash, White, and the Ohio.

A signature group of great river fish (sauger, paddlefish, sturgeon species, and blue sucker) was chosen to represent the necessary ecological needs provided by the large and great rivers habitat type. Sauger are found throughout much of the mainstem and are the most highly sought after game fish of Ohio River anglers (Schell et al 1998, West Virginia DNR 2004). Within the ORBFHP, sturgeon are most abundant in the western portion of the mainstem of the Ohio River and the lower reaches of major tributaries in this area and are virtually extirpated in the eastern portion of the basin (National Paddlefish and Sturgeon Steering Committee 1992). Paddlefish abundance follows the same trend in the northern portion of the basin (Henley et al, 2001). Blue sucker distribution is relatively unknown but abundance is thought to generally follow that of the sturgeons.

The assembled technical experts determined that the KEAs of this group of fish (Appendix D) are suitable spawning areas (shoals of rock and cobble), unimpeded movement within the system at key life history events, and rearing habitat with sufficient quantity and quality of planktonic (paddlefish), benthic macroinvertebrate (sturgeon and blue suckers), and piscivorous food sources (sauger). Occurrence modeling supports many of the KEAs outlined by raters. Among the most influential predictors of the presence of great river fish were network drainage area, local riparian disturbance, network carbonate bedrock, and minimum catchment elevation.

Conversely changes in land use, dams, sedimentation from various sources, invasive fish, and flood plain connectivity loss ranked among the greatest threats to the great river fish (Appendix H). Results of the occurrence modeling indicates that local riparian disturbance, network surface water consumption, local impervious surface cover and network pasture land cover were also very important anthropogenic factors affecting the presence of great river fish.

As a result of land use changes, and interruption of coarse substrate transport (due to tributary flood control projects) cobble or larger rock sizes are not abundant in the benthic surface of the Ohio River mainstem and lower tributary reaches. Additionally, a system of 20 mainstem navigational locks and dams disrupt movement of these highly migratory great river fish (USACE 2009).

Off-Channel Systems

Off channel systems were defined as aquatic habitat not permanently connected to primary stream channels. Examples of this type of habitat include oxbow lakes and sloughs. Off-channel systems are normally found in lower gradient flood plain areas. As a rule of thumb off-channel systems therefore are most prevalent in the floodplain of the lower reaches of larger rivers and generally increase in abundance toward the western side of the basin.

Largemouth bass and pickerel (chain and grass) were chosen to represent the necessary ecological needs provided by the off-channel habitat type. Pickerel are distributed across some of the remaining off-channel systems within the basin but largemouth bass are generally most abundant in the larger slough and oxbow areas found in the central and western portions of the basin. This type of habitat is also critical for the maturation of juvenile paddlefish.

In naturally functioning stream systems these areas connect at least every few years with the main channels of streams and larger rivers during flood events. During these connection events fish are free to move between habitat types, and the off-river habitat is renewed by the influx of nutrients and the flushing of excess sediment and vegetation. Therefore off-channel habitat serves as reproductive areas for fish such as largemouth bass, and rearing areas for young fish of several species, and later provides an influx of recreationally and commercially important fish into stream systems during periodic connections resulting from overflow events. This is particularly true of paddlefish young that need the plankton rich environment of off-channel features to grow and mature in good numbers. In overflow events, larger paddlefish move back into the river channels where they eventually spawn.

Therefore it was determined that the KEAs of this group of fish were frequent floodplain connectivity, sufficiently high water quality to prevent large diurnal oxygen swings, and little to no resource competition with invasive fish or mussels (Appendix E). In a number of cases raters indicated that an assessment is needed to determine the current status of KEAs, which points to the need to conduct an assessment of this type of habitat as whole within the partnership area.

Conversely flood control structures such as dikes/levees, flood plain development, and altered channel morphology (straightening) ranked among the greatest threats to the off-channel fish (Appendix H). In the western portion of the FHP area, sedimentation and nutrification are highly ranked threats to this habitat type.

Native Aquatic & Riparian Vegetation

Aquatic and riparian vegetation, consisting of native species known to occur within the basin, is another ORBFHP conservation target. Historical accounts of the Ohio River System indicate that native aquatic and riparian vegetation was once widely distributed (Trautman, 1981) although this habitat is now rare throughout much of the basin.

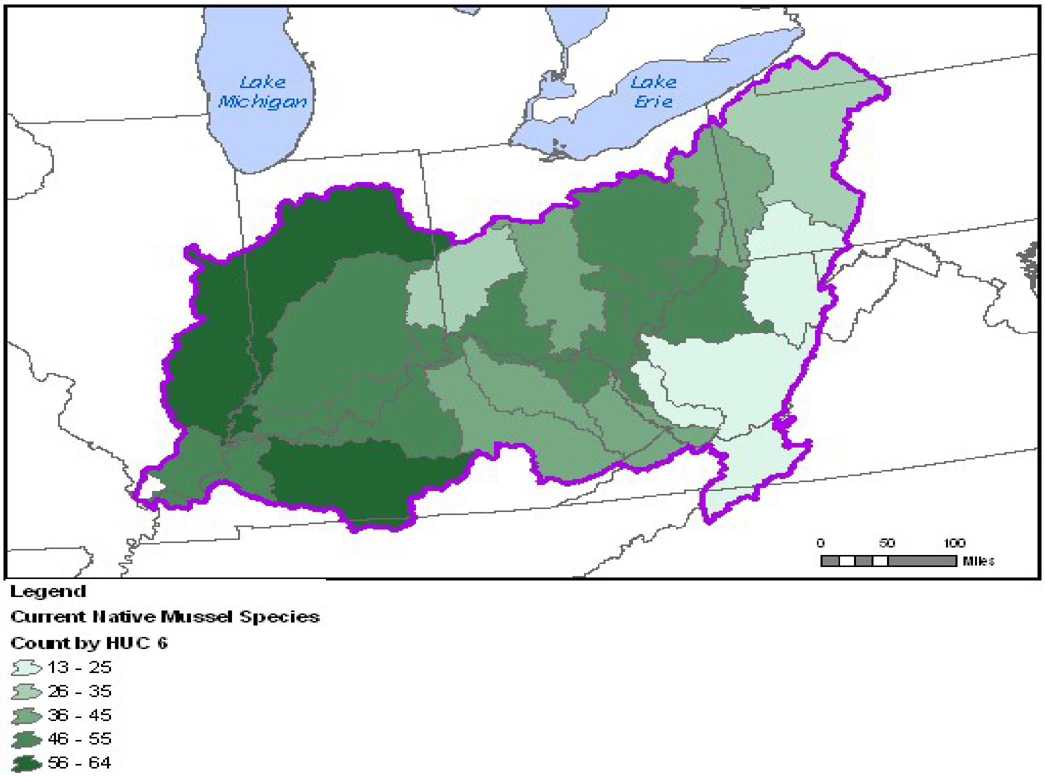
An examination of the assembled rankers' KEAs for this habitat type (Appendix F) reveals that the most important ecological needs of the native aquatic vegetation are good water clarity and/or shallow water, depositional areas of stable, coarse substrates (rock bars with interspersed fine sediment), and lack of invasive competition or direct predation (e.g. rusty crayfish). These KEAS appear to be largely unmet due to numerous high ranked threats (Appendix H), although in a number of cases raters indicated that an assessment is needed to determine the current status of KEAs. The lack of concrete knowledge would indicate the need to conduct an overall assessment of this type of habitat within the partnership area.

Increased sedimentation (as a result of past and current land-use) has greatly reduced water clarity and in some cases covered suitable substrates (US Army Corps of Engineers 2006). Additionally the series of navigational pools created within the Ohio River mainstem and the lower reaches of its major tributaries greatly reduced the amount of shallow habitat within the system. Likewise past and present dredging for navigational purposes often removes forming point bars that would create suitable areas for aquatic vegetation growth. Finally, invasive vegetation directly competes with native species in many suitable growth areas, and invading rusty crayfish consume submerged aquatic vegetation.

Fluvial Dependent Native Mussels

Fluvial dependent native mussels (do not colonize pools) were defined as a conservation target as they are present across much of the partnership area, as a group are globally endangered, and tend to be indicators of good stream habitat. Conversely, species of mussels found in pools tend to be more tolerant of habitat degradation. The ORBFHP area is a global center for mussel diversity with a number of Ohio River HUC-6 units containing upwards of 45 species (Figure 6) although individual mussel bed diversity and population density are often lower than historic levels.

Figure 6. Distribution of Mussel Diversity (by HUC-6 Units) within the Ohio River Basin FHP Area



The middle and lower Ohio River possess good mussel diversity, however, portions of the upper Ohio River remain in an extended recovery phase and currently possess lower mussel diversity from severe environmental degradation prior to 1970 (USACE 2006).

ORBFHP conservation planners determined that native mussel KEAs are good water quality (particularly DO, and pH), appropriate stream bed structure (stable and clean gravel substrates with adequate interstitial flow), and presence of suitable host fish during reproductive events (Appendix G). Occurrence modeling supports many of the KEAs outlined by raters. Among the most influential specific predictors of the presence of intolerant mussels (e.g. fluvial dependent natives) were network drainage area, network baseflow index, mean annual precipitation, network alluvium cover, and network shale bedrock.

Conversely top ranked threats to native mussels were found to be sedimentation from various land uses, barriers to host movement (often dams), altered hydrology, channelization, dredging, and non-native invasive mussels (Appendix H). Additionally the series of navigational pools created within the Ohio River mainstem and the lower reaches of its major tributaries greatly reduced the amount of riffle habitat within the system.

Results of the occurrence modeling indicates that network dam density, network surface water consumption, network forested land cover, network density of road crossings, and local impervious surface cover were also very important anthropogenic factors affecting the presence of intolerant mussels.

Basin-wide Threat Analysis and Habitat Strategy Development

The ORBFHP compiled a list of higher ranked threats based on threats that were identified for all or nearly all of the signature conservation targets representing the range of habitat types across the basin (Table 1).

Table 1. Overall Basin-wide Threats across Habitat/Conservation Targets

Threats	Rank
Class I and II Dams (>40 feet tall)	High
Class III Dams (25 -40 feet high)	High
Class IV (Lowhead) and smaller dams	High
Sediment from Mining	High
Sediment from Urban Development	High
Sediment from Silviculture	High
Sediment from Agriculture	High
Sediment from Livestock	High
Changing Climate (water temps)	High
Invasive Fish Species	High
Atmospheric Deposition	High
Sediment from Agriculture	High
Flood Control Structures	High
Acid Mine Drainage	High
Channelization	High
Culverts and Bridges	High
Channel Dredging (commercial gravel mining)	High
Impervious Surface run-off (CSO and SSO)	Medium
Invasive Plants (aquatic)	Medium
Invasive Plants (riparian)	Medium
Rusty Crayfish	Medium
Land-use Changes (not urbanization)	Medium
Land-use Changes (urbanization)	Medium
Coal Prep Plants	Medium
Endocrine Disruptors/Pharmaceuticals	Medium
Surface Mining	Medium
Oil and Gas Explor (e.g marcellus extraction)	Medium

An examination of spatial trends across the basin was then carried out in an effort to better understand the impact of historic impacts and future threats. In order to reduce duplication of effort for this analysis, each stream (or other habitat) type and their signature fish and mussels were considered holistically in the following categories:

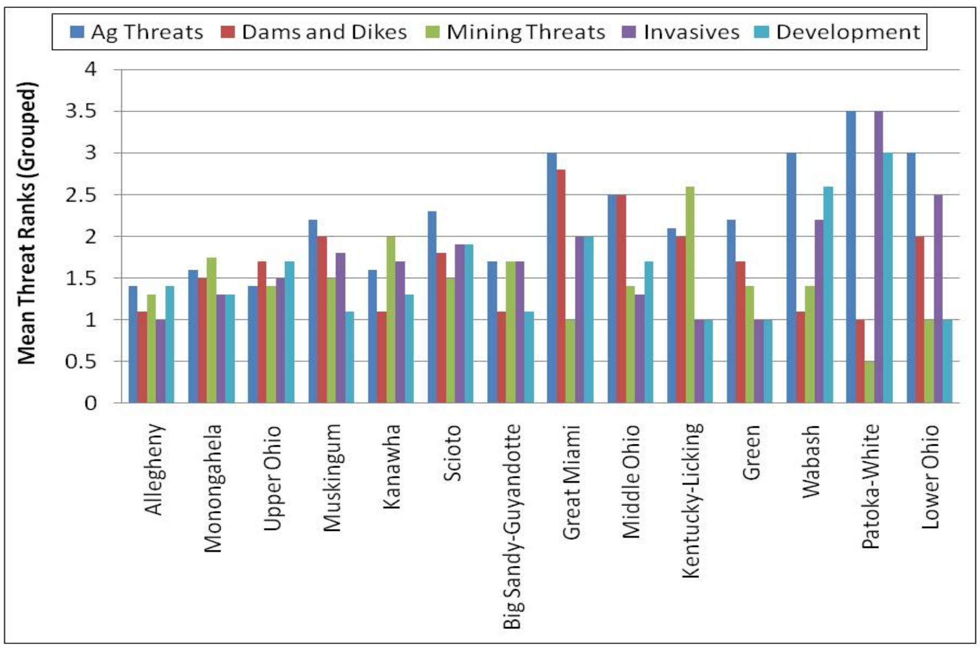
- Headwater and small streams and signature fish and mussels
- Medium rivers and signature fish and mussels
- Large rivers and signature fish and mussels

- Off channel systems and signature fish and mussels
- Native aquatic/riparian vegetation

Individual raters with knowledge of specific ORBFHP HUC-4 units rated current condition of these conservation targets and the relative severity of the highest ranked threats to these targets both from a legacy standpoint and within the next 10 years to look for trends across the basin.

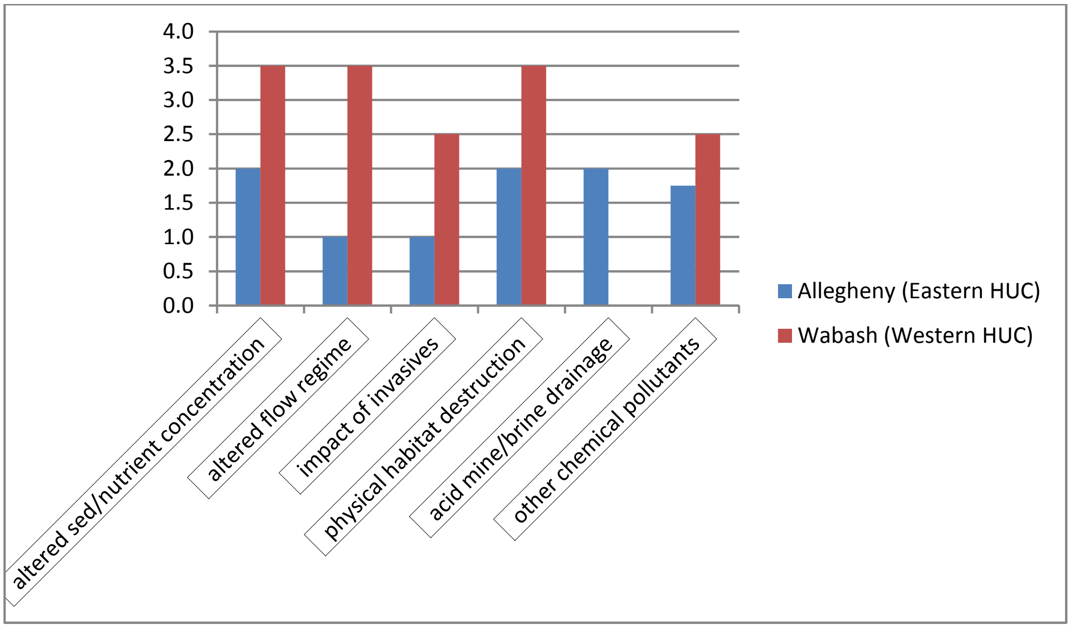
This analysis indicates that legacy coal mining impacts are greater in the eastern and southern portions of the partnership area, and the overwhelming legacy and near term threat to the targets in the west stem from agricultural impacts such as sedimentation and altered hydrology from dams and associated impacts of development (Figure 7).

Figure 7. Spatial Differences in Threat Sources Across the Ohio River Sub-basin



The contrast in threats is presented in the example of two extremes from the far eastern and western parts of the basin (Figure 8).

Figure 8. Example of Habitat Condition and Threat Differences Across the Ohio River Sub-basin



These trends also indicate that future work in the western HUCs will often involve habitat restoration strategies geared toward agricultural impact abatement (altered hydrology, sediment, and nutrients) while work in the eastern HUCs generally may involve greater emphasis on protection of higher quality areas or restoration strategies in areas with legacy impacts to abate a variety of often, relatively equal severe threats.

The current conditions of each habitat type and specific protection/restoration strategies developed for them are outlined below based on the previous threat analysis. Also presented are habitat improvement activity indicators and generalized desired biotic outcomes. In each case though, the ORBFHP will need to work with partners in the near term to develop specific desired biological outcomes based on population indicators and cooperative monitoring efforts.

Headwater and Small Streams (Incl. signature fish and mussels)

Despite the overall fair rating of the headwater/small stream fish and mussels (and necessarily their associated habitat) condition of this habitat type varies throughout the basin. In agriculturally or urban dominated areas smaller headwater streams are often ditched and straightened and do not provide suitable habitat quality to support the signature fish and mussel species. Similarly, smaller streams in areas with current or historic mining are often heavily impacted in the absence of restorative actions.

In less disturbed areas, smaller streams possess excellent populations of this habitat type's signature fish and mussels. As a result of this variability, a group of strategies were identified from situation analysis and conservation target viability indicators (Appendices B, I, & N) that were a mixture of protection and restoration activities depending on the localized condition of the target.

These strategies included the utilization of erosion control BMPs (including protection or restoration of riparian zones), opportunistic removal or replacement of obsolescent road or pipeline crossings with designs that facilitate fish passage, stream channel restoration, flood plain reconnection/restoration, and protection of watershed hydrology and water quality (particularly as related to water temperature and emerging contaminants such as endocrine disruptors).

It is important to note that ORBFHP raters found that there is often a strong link between altered hydrology and degraded water quality (Appendix I). Therefore it is often crucial to focus on the prevention or restoration of impervious surfaces and stream straightening in high quality watersheds. An opportunity often exists to install semi-permeable surfaces or reduce flood peaks with alternative water handling methods such as micro-wetland retention in place of traditional infrastructure. Prevention and/or control of riparian invasives were also identified as a protection/restoration strategy at this scale.

These strategies link well with a number of watershed-scale protection or restoration efforts by governmental agencies and NGOs. Examples include the recent work of the USDA's Natural Resources Conservation Service in Indiana and Kentucky to aggressively facilitate the implementation of agricultural BMPs within the Wabash and Green River Drainages, The Nature Conservancy's initiative to protect and restore the hydrology of Big Darby Creek, and Little Miami Incorporated's efforts to prevent floodplain development and address barriers.

Future progress indicators include sedimentation reduction (ultimately to within 10% of natural variability), an increase in the percentage of contiguous stream miles, improved physical habitat (i.e. increased QHEI scores), benthic invertebrate index scores, number of miles of stream channel restored, and number of acres of flood plain reconnected. The ultimate measure of improvement for this habitat type will be positive changes in fish community IBI (including darter richness), indicator species catch per unit effort and other sampling indicators (Appendix B) that result in an overall viability rating of good or very good.

Medium Rivers (Incl. signature fish and mussels)

Although the current status of medium river habitat (based on the condition of its fish and mussels) was rated as fair overall, a great deal of variation exists throughout the partnership area. Therefore a group of strategies were identified from situation analysis and target viability (Appendices C, J, & N) measures that were a mixture of protection and restoration strategies depending on the local condition of this habitat type.

These strategies included the utilization of best management practices (BMPs) for erosion control (including protection or restoration of riparian zones) in locations upstream of or in areas of otherwise high quality habitat, removal or replacement of obsolete dam structures with designs that incorporate fish passage during key life history stages (spawning, post-spawn dispersal, and larval drift), and design and implementation of dam reoperation flow regimes that mimic the natural hydrograph during key life history events for fish and mussels. Other potential strategies include flood plain feature reconnection/restoration, design and development (or application) of state and local regulations that minimize hydrologic alteration and dredging, and protection of water quality (including emerging contaminants such as endocrine disruptors). Finally, prevention or control of aquatic invasive species was also identified as a strategy for protection or restoration of high quality watersheds. Aspects of this strategy would include identifying environmental barriers/factors that could be protected or manipulated to provide a competitive advantage for native species.

The preliminary flow, aquatic organism passage, and flood plain connectivity strategies developed by the ORBFHP link well with existing conservation goals and objectives of the Nature Conservancy's Upper Ohio River Integrated Landscape Project, and to the Illinois State Wildlife Plan in particular. The Aquatic Invasive strategy of the ORBFHP is also complementary with the Aquatic Invasive Species prevention/control plans of several basin state conservation agencies.

Future progress indicators include reduction of sedimentation (ultimately to within 10% of natural TSS variability), percentage improvement in contiguous river mileage, improvement in benthic indices, and number of acres of flood plain connected at the two-year flood interval magnitude. The ultimate measure of habitat improvement for this habitat type will be positive changes in fish community IBI, mussel diversity, and/or signature species sampling CPUE and other indicators (Appendix C) that result in an overall good or better viability rating.

Large and Great Rivers (Incl. signature fish and mussels)
Large and great rivers habitat was rated as poor (based on the condition of its fish and mussels) with a few rare exceptions such as shovelnose sturgeon abundance near the Mississippi River. Therefore a group of strategies were identified from situation analysis and target viability (Appendices D, K, & N) measures that are almost exclusively restoration driven.

These strategies include the removal (where possible) of obsolescent structures and the physical or operational modification of current locks and dams for fish passage during key life history events. Other potential restoration strategies are the addition of spawning substrates within the tailwaters of locks and dams or the selective creation of spawning shoals in other localities with sufficient flows. Finally, reconnection/restoration of key flood plain features (such as oxbows) reduces mussel bed scouring during flood events and is particularly important for paddlefish rearing. The chosen strategies link well with the goals and objectives of other planning efforts such as the Ohio River Fish Management Team's strategic plan for paddlefish (Henley et al 2001), The National Paddlefish and Sturgeon Steering Committee (1992) Mississippi Interstate Cooperative Resource Association (MICRA), and state wildlife action plans in PA, and OH.

A single habitat protection strategy revolving around the prevention/control of Asian carp or other invasive species was identified and would include the identification and exploitation of any potential natural barriers or augmentation of environmental factors that might improve the competitive advantage of the native great river fish. While physical barriers have traditionally been viewed as control points, the ORBFHP is hopeful that exploitation of potential environmental requirements can also be used to at least slow the spread of invasive species.

As an example, the relatively large, floating eggs of Asian carp (Kolar et al 2007) likely have greater visibility and may be more efficiently predated in lower turbidity waters (e.g. Wieland and Koster 1996; Ellis and Nash 1997) than the eggs of most native great river fish such as paddlefish and sturgeon which adhere to rock and cobble substrate (Greg et al 2004) and therefore may not be as easily seen and predated. As a result of these differences, best land management practices that reduce sediment and nutrient input might actually provide multiple benefits to native great river species (stable, clean substrates, lessened diurnal dissolved oxygen swings, and increased diversity of benthic food sources) while leading to less turbid waters that could reduce Asian carp spawning success.

Future progress indicators based on the key needs of signature species include a reduction in the number of reproductive barriers for the great river fish (particularly those that are mussel hosts) and an increase in the number of current swept, rock/cobble bars. Improvements in benthic invertebrate indices, and number of acres of flood plain reconnected/flood plain features restored (Appendix D) will also be noted. The ultimate outcome of habitat improvement for this conservation target will be positive changes in the Modified Ohio River Fish Index (MORFIN) developed by ORSANCO, number of pools with multiple sturgeon species and paddlefish year classes and/or sampling CPUE for indicator species that result in an overall good or better viability rating.

Off Channel Systems (Incl. signature fish)

Less is known about the status of off-channel habitat although in the opinion of ORBFHP raters much of this habitat type has been lost or degraded and therefore the overall condition in the basin was thought to be fair at best. A planned field survey of selected off-channel habitat features across the FHP area will help access current conditions, refine viability indicators, and thereby aid in the selection of appropriate protection and restoration strategies. At the moment, the current strategies identified from viability and situation analyses (Appendices E, L, & N) are almost exclusively restoration driven.

High value strategies selected included the reconnection and/or restoration of floodplain features such as oxbows and floodplain forests. Techniques to restore connectivity at lower flood levels include the selective removal or alteration of lower value flood control structures (typically upstream dams and adjacent levees), and relocation of floodplain infrastructure to non-flood prone areas when feasible. In off-channel areas with high ecological value, it might also be appropriate to recreate/maintain connections at key lifecycle events through the creation of new hydrologic connections and/or pumping. Protection or restoration of oxbows in agricultural areas will often involve the establishment of buffer areas around the feature to prevent excessive nutrient input in between flood events.

Progress indicators include the number of acres of off-channel features reconnected, return frequency and duration of overflow events, and increases in the flood-prone width/bankfull width ratio at key localities (Appendix E). The ultimate measure of habitat improvement for this conservation target will be positive changes in the percent of signature fish harvested and/or their sampling CPUE.

Native Aquatic/Riparian Vegetation

Once abundant in the Ohio River Basin, native aquatic vegetation in particular has been greatly reduced throughout the ORBFHP areas because many of its key ecological needs are currently not met (Appendices F& M) and invasive plant species compete for the remaining available habitat and nutrients. This habitat type was therefore determined to be in poor condition throughout much of the basin.

Possible strategies to restore native aquatic vegetation include the development and implementation of dredging practices that allow for increased point bar formation, direct addition of artificially created point bars, and creation of suitable shallow water zones along the edges of larger pools through the addition of benthic substrates. Development and application of techniques to control non-native aquatic and riparian vegetation should also be used to reduce direct competition. Large-scale implementation of best management practices that reduce erosion are also extremely important to restoring aquatic vegetation as needed sunlight is able to penetrate to greater depths with increased water clarity.

Indicators of progress will include positive changes in the number of point bars formed or created, decreased turbidity, acres of shallow water habitat created, and acres of non-native aquatic vegetation controlled (Appendix F). Ultimate measures of habitat improvement success will include increased riparian and in-stream acreage with native vegetation, as well as percentage dominance and diversity of native species at monitored sites.

Development of Crosscutting Habitat Improvement/Protection Actions

The ORBFHP also developed habitat restoration and protection strategies that addressed the most detrimental (i.e. high ranked) legacy and imminent threats across all key habitat types in the basin.

The most urgent individual threats fall into 4 general threat groupings consisting of:

- Direct habitat degradation (channelization, stream bottom removal, stream valley filling, and suitable substrate starvation)
- Altered water quality (toxic pollutants, excess silt and sedimentation, altered temperature regime, and excessive nutrients)
- Altered population dynamics (limited reproduction)
- Altered hydrology (reduced channel/flood plain width, and inappropriate scour)

The larger threat groupings were utilized to further stratify all 6 of the conservation targets by good or poor condition (see Appendix O as an example). This examination revealed common, underlying causes of the gravest habitat threats across all of the key habitat types of the Ohio River Basin. These "mega" threat *sources* were targeted by the ORBFHP through the development and implementation of high leverage restoration (improving poor habitat condition due to legacy impacts) or protection (guarding against future degradation of good habitat condition) actions as laid out in the following section.

Core Habitat Improvement/Restoration Actions

The list of crosscutting habitat improvement or restoration actions developed by the ORBFHP to address Ohio River Basin mega-threat sources are nested within 4 broad habitat improvement strategies suggested by the National Fish Habitat Board. The ORBFHP added 2 additional strategies (other degrading environmental factors and aquatic invasive species prevention/control) based on the unique needs and opportunities present within the Ohio River Basin.

The core list outlined below is not meant to exclude potential habitat improvement actions tailored to individual project sites with unique threats. Potential cooperators and partnership members should also refer to scale-appropriate stream strategies developed under the headwater/small, medium, and large/great rivers categories. However, the core list is a guiding framework of pre-identified high leverage strategies that will be strongly considered when identifying potential projects for funding through the ORBFHP.

These strategy areas with corresponding strategic actions (including SMART objectives) are as follows:

Strategy 1 – Identify and protect intact and healthy waters.

1.1 Identify the key lands along priority intact and high quality stream and off-channel systems necessary to maintain the physical and ecological processes that supply the key ecological attributes of selected conservation targets by 2016.

1.2 Work with appropriate state and federal agencies, municipalities, and NGOs to protect lands identified in 1.1 along 500 miles of high priority streams and 200 acres of off-channel systems by 2025.

1.3 Identify the key hydrologic parameters needed to sustain the ecological needs of conservation targets in priority streams and off channel systems by 2016.

1.4 Work with appropriate governmental agencies, water users and NGOs to prevent significant future hydrologic alteration within 1,000 miles of high priority streams and 200 acres of off-channel systems identified in 1.3 by 2025.

1.5 Develop guidance on appropriate locations for large water withdrawals and electrical generation sites that avoid siting at critical locations within key systems by 2016.

Strategy 2- Restore natural variability in river and stream flows and water surface elevations in floodplain features (oxbows, secondary channels, etc).

2.1 Identify priority stream and off-channel systems impacted by hydrologic alteration within the Ohio River System by 2016.

2.2 Work with dam operators, municipalities, and state agencies on priority *stream systems* to develop and adopt ecologically based flow management regimes that improve the status of selected conservation targets in 1,000 stream miles by 2025.

2.3 Remove or modify (where possible) 20 dams and/or other structures that significantly alter natural stream hydrology by 2025.

2.4 Restore 500 acres of *off-channel systems* impacted by hydrologic alteration within the Ohio River System by 2025.

2.5 Improve system hydrology of 1,000 acres of key floodplain area along priority streams by restoring river connectivity to these areas by 2025.

Strategy 3 **–** Reconnect fragmented river, stream, reservoir, coastal, and off-river habitats to allow access to historic spawning, nursery and rearing grounds.

3.1 Physically remove or modify (where possible) 25 dams and other barriers that prevent aquatic organism movement by 2025.

3.2 Modify operational regimes to improve fish and aquatic organism passage through 25 locks, dams and other structures by 2025.

3.3 Reconnect 1000 acres of key floodplain and off-river spawning habitat along priority streams to allow access for signature conservation targets by 2025.

Strategy 4 **–** Reduce and maintain sedimentation, phosphorus and nitrogen runoff to river, stream, and off-river habitats at a level within 25% of the expected natural variance in these factors or above numeric State Water Quality Criteria.

4.1 Within priority stream systems, identify those areas which are key contributors to excess nutrification by 2016.

4.2 Within priority stream systems, determine the appropriate combination of land acreage identified in 4.1 and BMPs needed to reduce nutrification in 1,000 miles of streams by 2016.

4.3 Within priority stream systems, facilitate the implementation of BMPs on land acreages identified in 4.2 to reduce nutrification in 1,000 miles of streams by 2025.

Strategy 5- Reduce other key pollutants or degrading environmental conditions (acid drainage, heavy metals, altered temperatures, or oxygen levels) in 500 miles of degraded priority stream habitat to a level within 25% of natural rates or above numeric Stream Water Quality criteria by 2020.

5.1 Within priority stream systems identify key sources of pollutants or other environmentally degrading conditions.

5.2 Within priority stream systems identify and facilitate the implementation of BMPs/restoration techniques to reduce degradation from key sources.

Strategy 6- Reduce the potential for invasive species impact through prevention and control measures at the basin-level and within priority systems.

6.1 Identify and prioritize potential sources and associated invasive species by 2016.

6.2 Engage with appropriate agencies and entities to develop prevention programs/measures to stop the introduction/spread of invasive species by 2017.

6.3 Facilitate the implementation of prevention programs/measures developed in 6.2 with appropriate agencies and entities by 2020. As an example identify physical barriers or environmental conditions within priority streams that likely serve (or could serve) as barriers for invasive species and work with states to develop protection measures to preserve (or augment) these conditions.

6.4 Identify appropriate methods of controlling already present invasive species and implement in at least 100 stream miles by 2025.

Implementation of these overarching strategies and actions will address the greatest number of current and future threats and therefore improve/protect the ability of Ohio River Basin aquatic habitat to meet the ecological needs of its signature fish and mussels. The ORBFHP chose to direct much of its resources toward implementing its core strategies in what are thought to be high quality HUCs (Hydrologic Unit Codes). These early action sites were selected to provide a stable network of high quality habitat as soon as possible. Selection of these sites is outlined in the following section.

Early Action and Priority Sites

During the conservation planning process participants from across the basin were asked to assemble a list of early action sites (HUCs of varying sizes) that possessed key conservation targets and/or outstanding aquatic biodiversity and were preferably listed as state priority areas. The list of Early Action Sites included:

- Conewango Creek (NY & PA)
- Upper Allegheny River (NY & PA)
- Middle Allegheny River (PA)
- French Creek (NY/PA)
- Elk Fork River (WV)

- Upper Kanawha River (WV)
- Captina Creek (OH)
- Muskingum River (OH)
- Darby Creek (OH)
- Middle Green River (KY)
- Licking River (KY)
- East Fork White River (IN)
- Hovey Lake (IN)
- Cache River (IL)
- Lower OH Bay (KY and IL)
- Ohio River Mainstem (PA-IL)

In 2012 the previously mentioned basin-wide habitat assessment was completed. The ORBFHP joined forces with five other Midwestern fish habitat partnerships to apply for, and receive, a Multistate Conservation Grant from the Midwest Association of Fish and Wildlife Agencies. This grant enabled the FHPs to work with a contractor, Downstream Strategies (DS), to develop a general aquatic habitat assessment model that could be tailored to address the specific needs of each individual FHP. The model developed by DS integrates rigorous statistical methods with a geographic information system (GIS) interface.

The approach incorporates natural (e.g. elevation) and anthropogenic (e.g. impervious surfaces) landscape (predictor) variables constructed at the local (e.g. percent forested area in a local watershed) and network (e.g. percent cumulative upstream forested area) scales with response variables (e.g. biologically-based endpoints) in boosted regression trees (BRT) models. DS developed the statistical models and GIS interface with input from representatives of the FHPs in the form of a Science Advisory Network (SAN). Working together, DS and the SAN assembled predictor variables from national and regional datasets and gathered FHP-specific response variables.

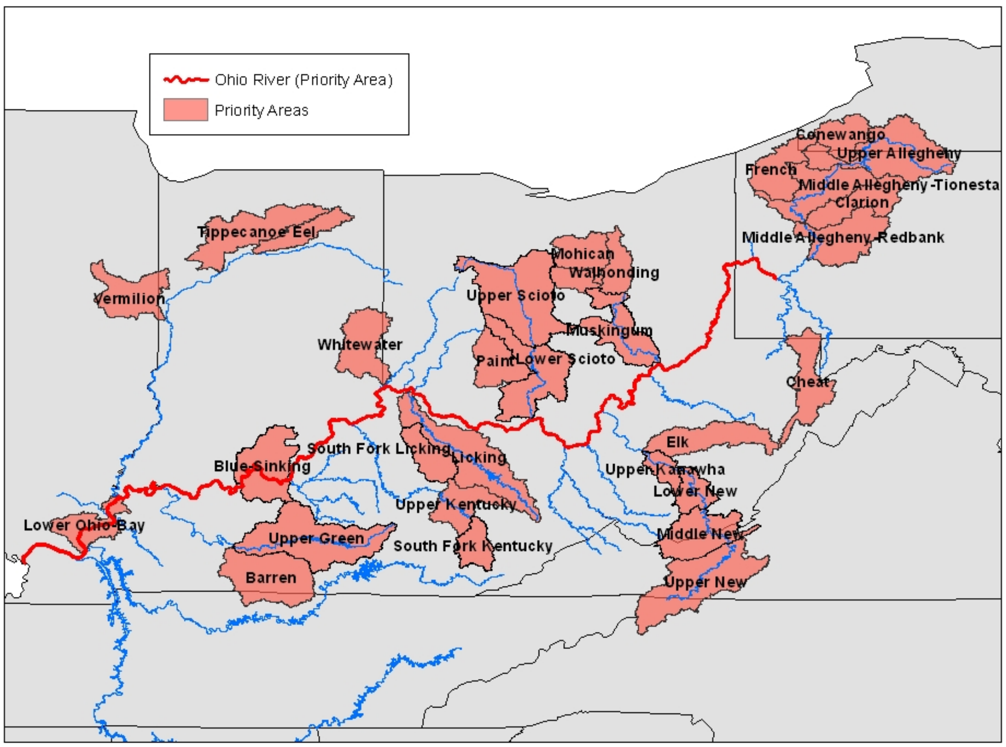
Upon input of appropriate variables, BRT model(s) produced predictions of the response variables for each watershed in the FHP as well as a ranking of important predictors. Post-modeling methods then produced indices of relative natural habitat quality (NHQI) and relative anthropogenic stress (CASI), each independent of the other, for every catchment modeled. These indices were then aggregated to large scales such as HUC 8s. Important outputs of the BRT process are functional relationships between each individual predictor variable and each response variable modeled, including non-linear relationships.

The partnership developed a process to evaluate the protection of those priority areas that are potentially facing multiple, imminent threats versus restoration activities in areas already impacted. The habitat assessment informs such a process by providing estimates of HUC protection and restoration potential.

Areas of various scales (i.e., HUC 12, HUC 8) were ranked based on several combinations of CASI and NHQI as determined by a case per case basis. For instance, areas with the highest natural habitat quality and lowest anthropogenic stress were highlighted for protection purposes. However, if restoration activities are a priority, areas with high natural habitat quality and medium to high anthropogenic stress can be selected at a later date.

These indices were then aggregated to HUC 8s. HUCs with the highest occurrence of streams with high natural habitat quality and low anthropogenic stress were designated as priority areas for protection. Adjacent HUCs containing almost as many high quality streams within the same drainage were also included as priority areas. A few additional priority areas that did not quite make the top tier were included in the western portion of the FHP. These areas scored highest within the context of the western portion of the FHP (currently more altered than many central and eastern HUCs). These Priority Sites are well distributed (Figure 9) and form the beginning of an interconnected protection/restoration network.

Figure 9. ORBFHP Priority Sites



To aid in predictions of success of various projects, resource managers within the partnership will have access to a decision support tool developed by DS. This tool is based on the functional relationships of the predictor variables with each response variable and uses a GIS interface integrated within ArcMap 9.3 to allow users to examine various scenarios of landscape improvement or decline in selected watersheds. Managers will be able to predict the effect of a 10% increase in impervious surfaces, for example, in a given area on the biological community of interest within, or downstream of, that area.

Future Information/Research Needs

In addition to a basin-wide habitat assessment, the partnership has identified an urgent need to conduct sediment and nutrient loading modeling in at least the central and western portions of the basin to determine which lands which are the greatest contributors to water quality stress. An analysis of floodplain connectivity and restoration potential is also needed throughout the basin.

Little is known about the current status of off-channel habitat in much of the basin and therefore a sampling design or modeled approach based on a random subsample is needed to be able to evaluate this habitat. Likewise, stream sampling in portions of the basin may not be of sufficient spatial distribution and frequency to determine current status and track future habitat improvement progress. A key, early task of the partnership will be the cooperative development of sampling for long-term priority sites following the ongoing habitat assessment process.

In some cases the results of the basin-wide habitat assessment, stand-alone research, or literature searches are needed to determine appropriate numerical criteria (poor, fair, good, & very good) for key ecological attributes of signature fish and mussels. Finally, research into possible invasive species, invasion pathways, and identification of potential environmental barriers is needed to prevent their introduction/spread.

Operational Planning Process

One early task of the forming partnership was to develop a set of guiding principles that embodied the consensus of its member agencies and organizations. Essentially the guiding principles reflect the ORBFHP's "values" and together are a framework for prioritizing commitment of the partnership's resources (financial and time expenditures). The ORBFHP's guiding principles are as follows:

1. **Partnership resources are focused on areas containing both regionally/nationally important fish and mussel species and where there are both angling and species diversity interests.**

2. **Watersheds are treated holistically, realizing that habitats within a watershed are interconnected and must be dealt with accordingly. Reservoirs will not be addressed in and of themselves, but rather as a part of the stream system within which they occur.**

3. **Protection of the best areas of each type of habitat is prudent, but in addition, appropriate techniques will be applied to areas where restoration of fish and mussel habitats is necessary and positive results can be reasonably expected, particularly when they result in larger contiguous areas of quality habitat.**

4. **Use of sound science and measurement of results are foundational.**

5. **Public support is crucial to generating partnership momentum, securing funding, and ultimately completing on the ground work that will be done by or through local partnerships representing a broad range of interests.**

Partnership Diversity

The ORBFHP originates from a diverse group of agencies and organizations that have a strong interest in the protection and restoration of fish, mussel, and their associated habitat ranging from the headwaters of the basin to the main stem of the Ohio River.

Among the core conservation planning team represented within the ORBFHP are members of the Ohio River Fish Management Team (comprised of representatives of the Ohio River main stem state conservation agencies), the Kentucky State Nature Preserves Commission, federal agencies (e.g., U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Geological Survey, U.S. Forest Service, U.S. Environmental Protection Agency), unique state-federal partnerships (e.g., Ohio River Valley Water Sanitation Commission), NGOs (e.g., The Nature Conservancy and The Ohio River Foundation), and academic institutions (e.g., Marshall and Ball State universities).

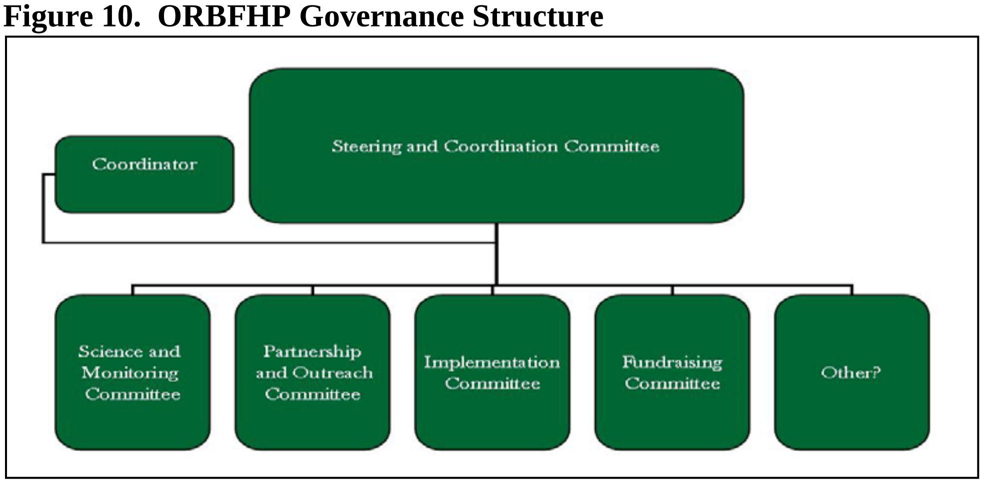
The partnership entities listed above also have unique interests and associations that strengthen the ORBFHP and provide the foundation for exceptional synergy and management effectiveness. Some of the highlights of partnership strengths and interests are listed in Appendix P.

Partnership Governance Structure

The governance structure will operate with oversight consisting of a Coordinator alongside a Steering and Coordination Committee as well as several working committees to address science and monitoring, partnership and outreach, implementation, fundraising, with possible additions as the partnership develops (Figure 10). At a minimum, the partnership will meet semi-annually, in spring to review past the past years progress and discuss future needs, and again in autumn to review recent activities, consider grant requests, and plan for the upcoming year. The autumn meeting will be an in-person gathering and the ORBFHP will meet virtually as needed at other times of the year.

Details of the long-term committees and their current functions are listed in Appendix Q. Several technical sub-committees working under the auspices of the Science and Monitoring Committee are already involved in shaping the future habitat improvement approach of the ORBFHP. In addition, the Partnership and Outreach Committee is making progress on putting the ORBFHP on the map.

Figure 10. ORBFHP Governance Structure



Fish Habitat Partnership Overlap

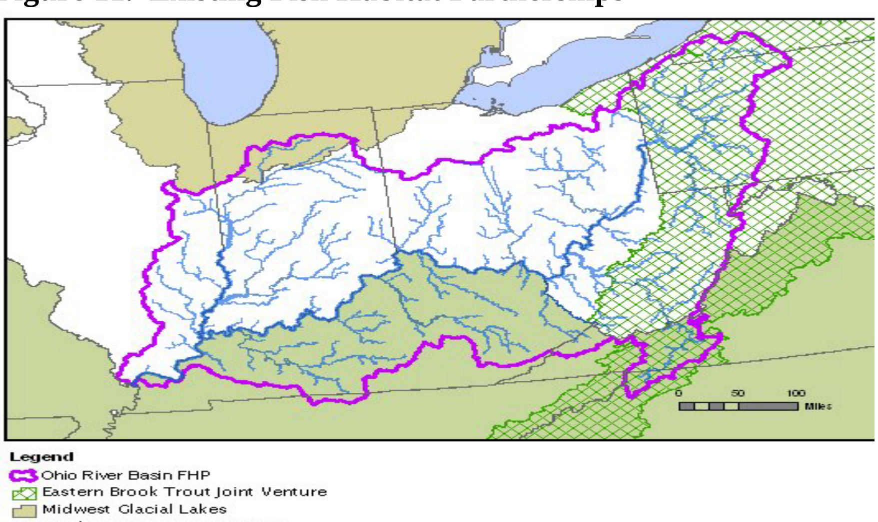
The ORBFHP area overlaps with the Eastern Brook Trout Joint Venture (EBTJV), Southeastern Aquatic Resources Partnership (SARP), Midwest Glacial Lakes FHP, and Reservoir FHP (Figure 11; Reservoir FHP is national in scope and therefore not included in figure 11). The ORBFHP has carefully considered this geographic overlap and taken steps to minimize duplication of effort accordingly, while still maintaining meaningful boundaries for our partnership. The reality of the situation is that it is impossible to simultaneously maintain meaningful boundaries and at the same time eliminate overlap between a watershed based partnership, like the ORBFHP, and a state based partnership (e.g., SARP), a system based partnership (e.g., Midwest Glacial Lakes FHP), or a species range based partnership (e.g., EBTJV).

Discussions regarding overlap were extensive. In some cases, solutions were readily apparent, but this was not always the case. In a major step to minimize overlap, the ORBFHP drew the boundaries of our partnership to exclude the Tennessee River and Cumberland River drainages. This reduced the overlap with SARP from 8 to 4 states, with the only significant remaining overlap occurring in Kentucky.

Since then, ORBFHP members have had additional in-depth discussions with the Kentucky Dept. of Fish and Wildlife Resources, SARP, and other overlapping partnerships. Through close communication, the overlapping partnerships can achieve a synergy and strength that results in highly effective coordination and habitat protection/restoration gains.

The ORBFHP will work with SARP in a complementary rather than competitive fashion. We will also do everything we can to minimize redundancy. Currently, the ORBFHP Science and Monitoring Committee are working closely with the SARP Science and Data Committee. Through these and other efforts, the partnership will look for opportunities to collaborate and minimize duplication of effort. In the case of the Reservoir FHP, we desire overlap because at the time the ORBFHP was establishing conservation targets, a conscious decision was made to not to pursue reservoirs as a target but rather to defer to the Reservoir FHP. We will take advantage of their assessment efforts as well as their strategies and actions to address reservoir issues.

Figure 11. Existing Fish Habitat Partnerships



Implementation

In short, the Ohio River Basin FHP matters only to the degree that its actions improve the status of the previously identified key habitats/conservation targets. In order to improve habitat ratings that are currently fair at best the highest leverage strategies and actions must implemented in a focused manner, in priority conservation areas, to fullest degree possible for as many priority habitat types/conservation targets as possible.

To that end, the Partnership intends to expedite the implementation of its identified habitat improvement actions by:

a. Securing more funding for the ORBFHP area.
b. Promoting the adoption of identified high leverage strategies in priority watersheds.
c. Coordinating and informing within its administrative area to reduce redundancy.
d. Identifying and addressing needs that are uniquely fish habitat related but are not addressed by another program/effort.

Focusing of Partnership Resources

The ORBFHP will evaluate cooperative projects submitted by partnership members or applicants for funding rigorously within the framework of its mission statement and guiding principles. In general, the ORBFHP intends to solicit and evaluate grant requests in the following manner.

The annual grant cycle will follow an open RFP format with proposals accepted at any time although an announcement will be circulated around June 1 of each year. It is likely that applicants will be asked to enter their own projects into an online format that would also be linked to other regional or national project databases using a similar format. Proposals will be compiled by the ORBFHP Coordinator and transmitted to the Science and Monitoring Committee by September 7. Recommendations would be completed and forwarded to the Steering and Coordination Committee for a decision and recommendation to the funding agencies in the basin.

Grant requests will initially be screened to determine whether the proposed project aligns with one or more of the strategic goals of the ORBFHP and is located within a priority HUC area. The ORBFHP intends to allocate 80% or more of its grant funding to restoration projects located within the priority areas identified from the ongoing basin-wide habitat assessment. Priority consideration will also be given to those projects that address identified data gaps, aspects of the basin-wide habitat assessment, and/or directly address the ORBFHP Strategic Objectives.

Furthermore, the Partnership will develop a grading system (poor, fair, good, and very good) for each of the major habitat types that summarize its ability to provide the key ecological needs of its signature fish and mussels. Projects submitted for funding will eventually need to score and reference the current habitat condition(s) within the proposed project area and demonstrate how the actions taken would improve the habitat's ability to supply needed ecological conditions.

Finally, the ORBFHP intends to achieve maximum leverage of funding and the time commitment of its members by giving priority to those applications that contain commitments for cash/in-kind contributions from additional partners. Similarly, simple benefit-cost ratios (e.g., number of stream miles improved/connected or acres of floodplain restored/connected per dollar/person hours expended) may be used to evaluate proposed projects.

Partnership Coordination Framework

The ORBFHP faces significant coordination workload due to the physical size of the partnership area and the number and severity of threats to its key habitats. It is anticipated that a full-time Coordinator will be needed soon to provide administrative support to the Steering and Coordination Committee and act as a liaison with the NFHAP Board, and key partners. In addition, there will be a need to coordinate with other major efforts on the Ohio River, such as the USACE's Ohio River Ecosystem Restoration Program authorization (US Army Corps of Engineers 2000).

The Great Lakes and Ohio River Division was authorized by Congress (Water Resources Development Act of 2000) to create an Ohio River Ecosystem Restoration Program for the mainstem of the Ohio River in Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois. This program would restore significant ecosystem function, structure, and dynamic processes (that have been degraded) to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. The program would be initiated and monitored by a partnership of federal and state resource agencies and regional environmental interest groups. The authorization would provide up to 200 million dollars in federal funding although funds have not yet been appropriated to implement the restoration program.

The ORBFHP will have the ability to act as an umbrella organization with agreed upon priorities to interact with the USACE in any applicable authorizations. Similar needs/opportunities are envisioned with other sweeping conservation programs including anticipated climate change adaptation funding.

Effective internal and external communication will be needed to accomplish the ambitious role that the ORBFHP envisions. To this end the Partnership and Outreach Committee will maintain a dedicated ORBFHP website for the purposes of external communications (e.g., informational and educational purposes, RFP postings, research, project status updates). A special emphasis will be placed on building relationships with local watershed groups in priority areas.

Internal communication to partnership members and their representatives will take place through the use of a listserve, videoconferencing, and/or annual meetings. The ORBFHP has also been very effective with one-on-one contact with groups and individuals. We believe this result in an inclusive and lasting partnership.

Evaluation and Reporting

The ORBFHP will abide by its fourth guiding principle that states *Use of sound science and measurement of results are foundational.* Partners have already donated significant amounts of time preparing an initial assessment of the condition of the major watersheds in the basin as well as ranking the impact of future stressors to those watersheds. The condition assessments and threat rankings were based on expert opinions from throughout the Ohio River basin. These same experts could also grade the watersheds they are familiar with in the context of the Biological Condition Gradient (BCG) developed by the USEPA. On a regular basis throughout the existence of the partnership, local experts could be asked to re-grade these same watersheds.

Comparisons of the BCG from different time periods would be one measure of the progress of the partnership.

Other potential metrics used by the partnership to report progress include existing state-developed biological indices using fish and macroinvertebrates. Each state in the basin currently has existing numerical biological criteria in place using one or both of these groups and assessments of watersheds and/or stream reaches have been conducted and reported to the USEPA on a biannual basis in the form of 305b (or integrated) reports. Other metrics include results of periodical national surveys such as USEPA's National Rivers and Streams Assessment or USGS's National Water Quality Assessment.

In addition, raw biological and water quality data collected as part of national surveys and by state agencies for routine assessments are currently being gathered and organized by the partnership. The biological datasets will be assessed using various species diversity metrics and by several diversity indices such as the Modified Index of Centers of Diversity (MICD) which highlights areas that have high abundances of the rarer species in a basin. Finally sufficient hydrologic and morphological data exists throughout much of the ORBFHP area to utilize the Hydro QHEI, (a hydrologic index developed by former Ohio EPA employees now with the Midwest Biodiversity Institute) or the Index of Hydrologic Alteration developed by the Nature Conservancy.

Ultimately though, the success of the ORBFHP will be evaluated by its progress on conservation target viability rankings throughout the basin. Continuation of or revisions to cross cutting habitat improvement strategies and strategic actions will be informed by the response and rate of progress in the viability of conservation targets as measured by the maintenance and/or improvement of their key ecological attributes. As such it will be necessary to develop a list of monitored biological and environmental attributes and work with FHP agency members, USFWS Landscape Level Cooperatives, and universities to ensure that regular, systemic monitoring in at least priority areas will occur. Development of the appropriate monitoring program should be completed no longer than 2 years from the end of the ORBFHP aquatic habitat assessment as this process may result in the identification of additional variables that influence habitat suitability.

The partnership will continue to link to the Framework for Assessing the Nation's Fish Habitat by using the variables selected in the Ohio River Basin Stream Habitat Assessment and referencing subsequent assessments to document successful habitat protection and restoration. The ORBFHP intends to communicate progress measures to the National Fish Habitat Board on an annual basis and conservation target status evaluations at 5 year intervals. Data from and results of comprehensive habitat assessments will be transferred or reported to the National Science and Data Committee within 1 year of completion. GIS files will be maintained by a designated ORBFHP member and available to the Board or its committees upon request.

Revisions

The ORBFHP strategic plan will be revised every 5 years in the absence of a significant need for additional planning. Significant changes to habitat improvement/protection strategies and/or strategic actions that occur as result of unanticipated threats or changes in severity/scope of known ones would trigger a strategic plan revision. Other causes for revision would include adaptive management changes revealed by habitat assessment information, revision of conservation targets, or significant change in partnership composition.

Appendices

Appendix A. HUC-4 Units of the Ohio River Basin Fish Habitat Partnership (Excludes the Tennessee River and Cumberland River Basins)

HUC Unit Name	States Drained	Watershed Area (Sq mi)
Allegheny	NY and PA	11,600
Monongahela	MD, PA, and WV	7,310
Upper Ohio	PA, WV, and OH	13,200
Muskingum	OH	7,980
Kanawha	NC, VA, and WV	12,200
Scioto	OH	6,440
Big Sandy-Guyandotte	VA, WV, and KY	5,900
Great Miami	OH and IN	5,330
Middle Ohio	WV, OH, KY, and IN	8,850
Kentucky-Licking	KY	10,500
Green	TN and KY	9,140
Wabash	OH, IN and IL	32,600
Lower Ohio	KY, IN, and IL	12,500
Total Watershed Area		143,550

Appendix B. Headwater and Small River Fish (long ear sunfish, rainbow and orangethroat darters) Viability Assessment

Headwater and Small River Fish			Indicator Ratings Desired future condition = Good or Very Good					
Category	**Key Attribute**	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current status**	**Rating Source**
Landscape Context	Lateral Connectivity (FP features)	% of FP features connected in 2 year flood.	<20%	20-35%	35-50%	>50%	TBD	
	Longitudinal Connectivity (stream reaches)	% of contiguous stream miles connected	<70	70-79	80-90	>90	Fair	Expert Opin.
	Habitat Quality	QHEI	<51	52-60	60-70	>70	Fair	Rough Guess
	Invertebrate Assemblage	# of EPT Taxa	0	1-2	3-4	>5	Poor	Expert Opin
	Baseflow	Baseflow Index	<.35 cfs/sq mi	.35-.5 cfs/sq mi	.51-.74 cfs/sq/ mi	>.74 cfs/sq mi		
	Riparian Buffer Dynamics	% tributary miles w/ min 50+ ft buffer	TBD	TBD	TBD	TBD	TBD	
	Water Quality	TSS Concentration	TBD	TBD	TBD	TBD	TBD	
Size	Fish Community Density	CPUE indicator spec. per 500m electrofishing zone	TBD	TBD	TBD	TBD	TBD	
Condition	Stable Indicator Fish Communities	% of 500m electrofishing zones with 2+ year classes	<20	20-40	41-60	>60	Fair	Expert Opin.
	Fish Assemblage	IBI score (wading)	<20	20-34	35-46	>46	TBD	

Appendix C. Medium River Fish (smallmouth bass, spotted bass, logperch, and tippecanoe darter) Viability Assessment

Medium River Fish			Indicator Ratings Desired future condition = Good or Very Good					
Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current status	Rating Source
Landscape Context	Lateral Connectivity (FP features)	% of FP features connected in 2 year flood.	<20 %	20-35%	35-50%	>50%	TBD	
	Longitudinal Connectivity (stream reaches)	% of contiguous stream miles connected	<70	70-79	80-90	>90	Fair	Expert Opin.
	Fish Health	Modified Index of Well-Being	TBD	TBD	TBD	TBD		Rough Guess
	Invertebrate Assemblage	# of EPT Taxa	0	1-2	3-4	>5	Fair	Expert Opin
	Large prey availability	Crayfish/ or other large prey items	TBD	TBD	TBD	TBD		
	Water Quality	# of days per season with SCS events)	>2	2	1	0	Poor	Expert Opin
	Water Quality	TSS Concentration	TBD	TBD	TBD	TBD	TBD	
Size	Medium River Fish Community Density	CPUE indicator spec. per 500m electrofishing zone	TBD	TBD	TBD	TBD	TBD	
Condition	Stable Indicator Fish Communities	% of 500m electrofishing zones with 3+ year classes	<20	20-40	41-60	>60	Fair	Expert Opin.
	Reproducing Smallmouth	YOY CPUE	<1	1-7	9-11	>11	TBD	
	Fish Assemblage	IBI Score Boating	<20	20-34	35-46	>46	Fair	Expert Opin.

Appendix D. Great River Fish (sauger, paddlefish, sturgeon sp., and blue sucker) Viability Assessment

Great and Large River Fish			Indicator Ratings Desired future condition = Good or Very Good					
Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current status	Rating Source
Landscape Context	Flow Regime	% of key projects with flow regimes that enable spawning	<20%	21-50%	51-75%	>75%	Poor	Rough Guess
	Lateral Connectivity (FP features)	% of FP features connected in 2 year flood	<20%	20-35%	35-50%	>50%	TBD	
	Longitudinal Connectivity (stream reaches)	% of contiguous stream miles connected	<70	70-79	80-90	>90	Poor	Expert Opin.
	Fish Community Health	MORFIN Fish Assemblage Score	<3	3 – 4.9	5- 6.0	>6	Good	Expert Opin.
	Suitable Spawning Substrate	# of rock/cobble bars w/ sufficient current velocity/ stream mi	<1.0	1-2.5	2.6-4.0	>4.0	TBD	Rough Guess
Size	Great River Fish Community Density	CPUE of indicator spec. per 500m electrofishing zone	TBD	TBD	TBD	TBD	TBD	
Condition	Stable paddlefish and sturgeon communities	Ohio River pools with at least 3 year classes present	<6	6-10	11-15	>15	Poor	Expert Opin.

Appendix E. Off-Channel (largemouth bass & pickerel sp.) Viability Assessment

Off-Channel Fish			Indicator Ratings Desired future condition = Good or Very Good					
Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current status	Rating Source
Landscape	Lateral Connectivity (FP features)	% Connected in two year flood event	<20%	20-35%	35-50%	>50%	TBD	TNC F.P. Assess
	Water Quality	Diurnal D.O. swings (ppm)	>3	2-3	1-1.9	<1	TBD	Basin Hab. Assess
	Fish Health	Modified Index of well-being	TBD	TBD	TBD	TBD	TBD	BSU Assess ment?
Size	Off-channel Fish Community Density	CPUE of indicator spec. per 500m electrofishing zone	TBD	TBD	TBD	TBD	TBD	
Condition	Access by juvenile paddlefish	Juvenile paddlefish catch per hour electrofishing	<1	1-3	3-6	>6	Poor	Expert Opin.
	Species Composition /Dominance	% Native	<70	70--80	81-90	>90	TBD	BSU Assess ment?

Appendix F. Native Aquatic/Riparian Vegetation Viability Assessment

Native Aquatic/Riparian Vegetation			Indicator Ratings Desired future condition = Good or Very Good					
Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current status	Rating Source
Landscape	Lack of Invasive species	% Catchment Area w/o invasives	<50%	50-70%	71-90%	>90%	TBD	On-site res.
	Native Aquatic Veg.	% NAV/mile	<25%	25-50%	51-75%	>75%	TBD	On-site res.
	Light Penetration	Secchi Disk Reading (% of depth)	<10%	10-50%	51-75%	>75%	TBD	Rough Guess
	Stable substrate	Gravel point bars interspersed with fines	<2.0	2-2.9	3.0-3.9	>4.0	TBD	Rough Guess
Size	Native Aquatic Species Diversity	# of native species/reach (monitored sites)	0	1-2	3-4	>4	TBD	On-site res.
	Native Riparian Species Diversity	# of native woody species/reach (monitored sites)	0-2	3-5	6-9	>9	TBD	On-site res.
	Areal extent	% of acreage with natives at (monitored sites)	TBD	TBD	TBD	TBD	TBD	

Appendix G. Fluvial Dependent Native Mussels (e.g. fanshell, northern riffleshell) Viability Assessment

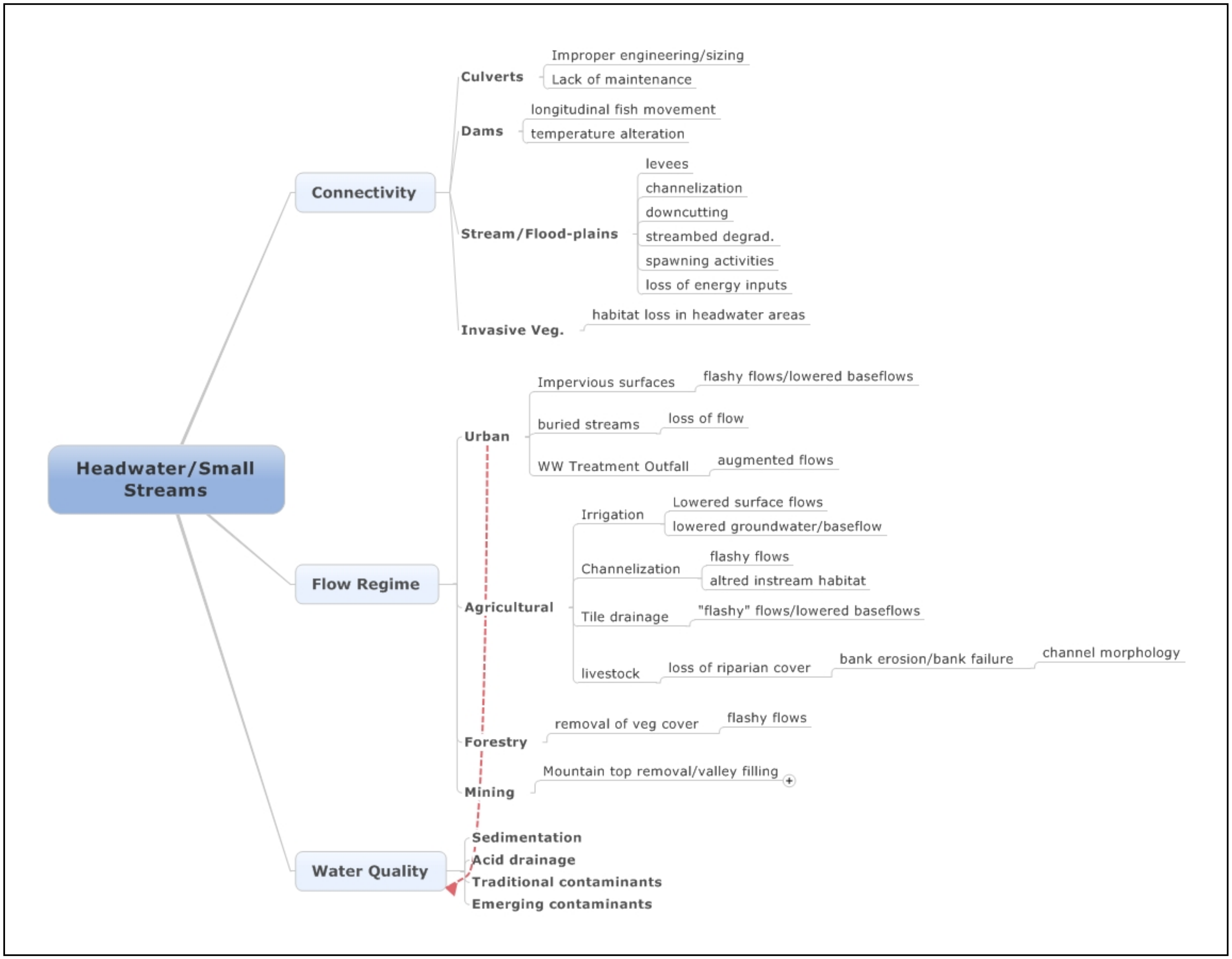
Fluvial Dependent Native Mussels (riffle species)			Indicator Ratings Desired future condition = Good or Very Good					
Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current status	Rating Source
Landscape Context	Host fish at mussel beds	% presence of host fish at mussel beds	<25%	25-49%	50-75%	>75%	Fair	Rough Guess
	Suitable Substrate	# of gravel bars/riffles w/ sufficient flow/stream mi	<2.0	2-3.9	4.0-5.9	>6.0	TBD	Rough Guess
Condition	Fish Assemblage	IBI score (Wading)	<20	20-34	35-46	>46	Fair	Expert Opin.
	Fish Assemblage	IBI score (Boating)	<28	28-39	40-56	>56	Fair	Expert Opin.
	Fish Species	Presence of host fish for riffleshell	0	1	2-3	>3	TBD	Rough Guess
	Mussel Assemblage	Absolute abundance (indiv/sq m)	TBD	TBD	TBD	TBD	TBD	
	Mussel Assemblage	Mussel IBI	TBD	TBD	TBD	TBD	TBD	
	Mussel Assemblage	Native Mussel Species Richness (live only)	< 4	4-10	10-20	>20	Fair	Expert Opin.
Size	Reproduction	Sites with riffleshell recruitment	<10	10-19	20-30	>30	Poor	Expert Opin.

Appendix H. Threats Sources to Conservation Targets (Present – 10 years)

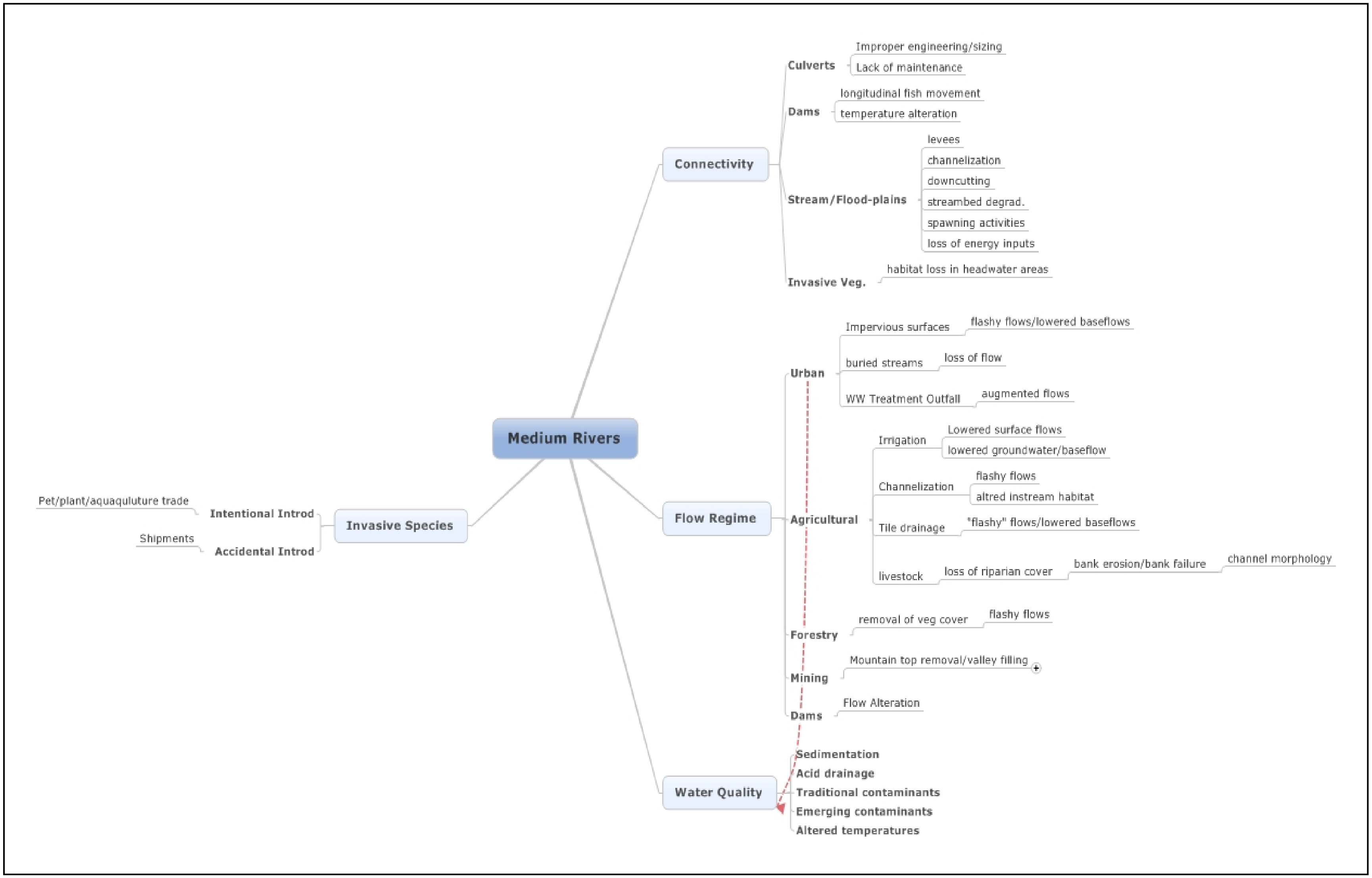
Threat Sources Across Targets	Fluv. Depend. Native Mussels and Hosts	Great and Large River Fish	Medium Sized River Fish	HW/Small Stream Fish	Off Channel Systems	Native Aquatic/ Riparian Vegetation	Overall Threat Rank
Project-specific threats	1	2	3	4	6	7	
Class III Dams (25 -40 feet high)	High	High	High	Medium	Medium	Medium	High
Impervious Surface run-off (CSO and SSO)	High	Medium	Medium	High	Low	Medium	Medium
Agricultural Sedimentation	High	High	High	High	High	High	High
Class IV (Lowhead) and smaller dams	High		High	High			High
Sediment from mining	High	Medium	High	High	Medium	Medium	High
Class I and II Dams (>40 feet tall)	High	High	High	Medium	High	High	High
Invasive Fish Species	High	High	High	Medium	High	Medium	High
Sediment from Urban Development	High	High	High	High	High	High	High
Acid Mine Drainage	High	High	High	High	Medium	High	High
Changing Climates (water temp)	High	High	High	High	High	High	High
Rusty Crayfish		Medium	Medium			Medium	Medium
Water Temperature	High	High	High	High	High	High	High
Zebra Mussels	High	Low	Low	Low			Low
Atmospheric Deposition	High	High	High	High	High	High	High
Channelization	High	Low	Medium	High	High	High	High
Sediment from Silviculture	High	High	High	High	High	High	High
Culverts and Bridges	High			High			High

Threat Sources Across Targets	Fluv. Depend. Native Mussels and Hosts	Great and Large River Fish	Medium Sized River Fish	HW/Small Stream Fish	Off Channel Systems	Native Aquatic/ Riparian Vegetation	Overall Threat Rank
Project-specific threats	1	2	3	4	6	7	
Flood Control Structures (dikes, levees)	High	High	High	High	High	High	High
Invasive plants (riparian)				High	Low	High	Medium
Change in Land-Use (not-urbanization)	Medium	Medium	Medium	High	Medium	High	Medium
Channel Dredging (commercial gravel mining)	High	High	Medium	High	Medium	High	High
Coal prep plants	High	Low	Medium	Medium	Low	Medium	Medium
Development - land use change (urban)	High	Low	Medium	High	Medium	High	Medium
Endocrine Disruptors	?	?	Medium	Medium			Medium
Marcellus shale drilling	High	Low	High	High		Low	Medium
Point Source Contaminants			Medium	Low			Low
Sediment from Livestock	High	Medium	High	High		High	High
Surface Mining	High		Medium	High	Low	Medium	Medium
Eutrophication (Ag and Urban)	Medium	Medium	High	High	High	Medium	Medium

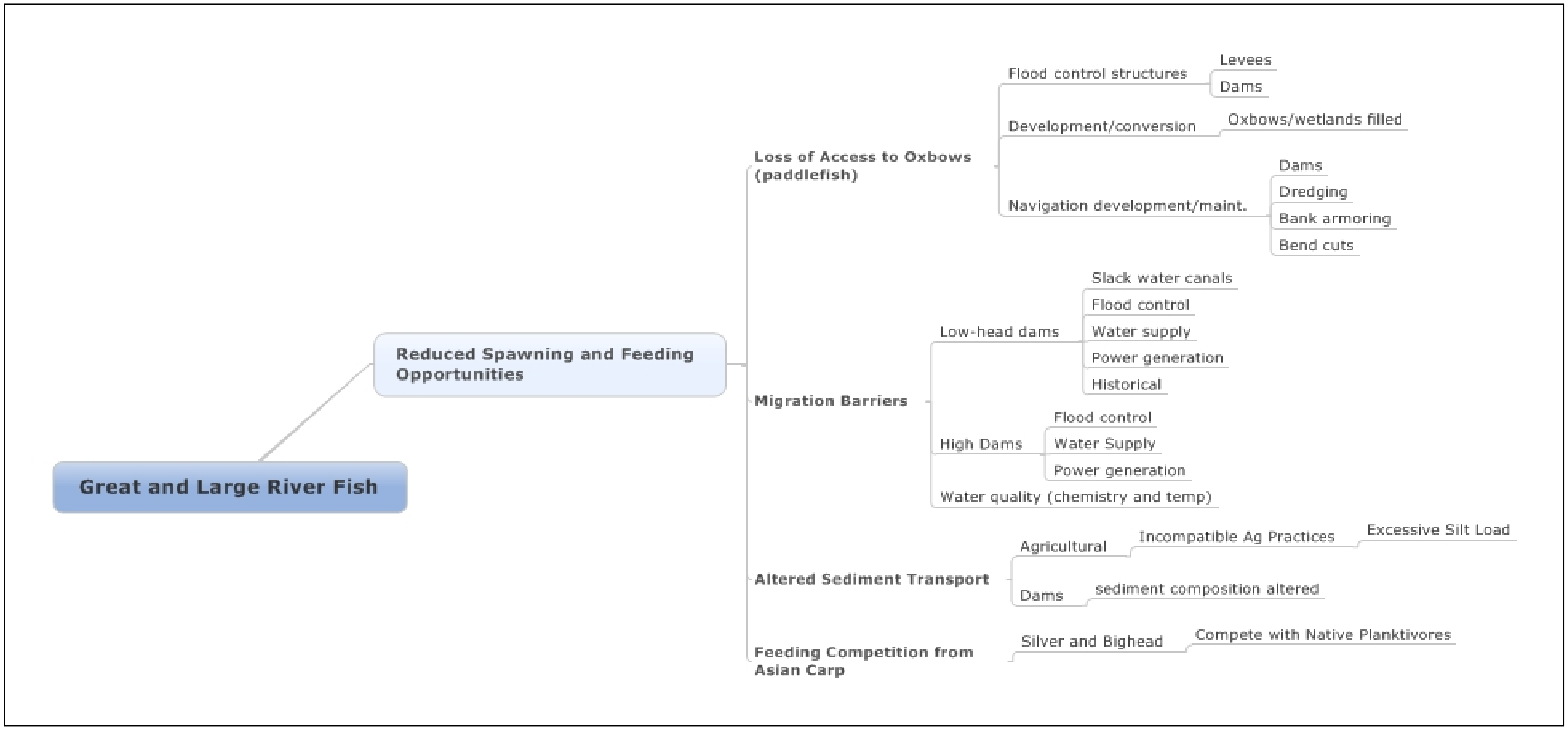
Appendix I. Headwater and Small Rivers Fish Situation Analysis Diagram



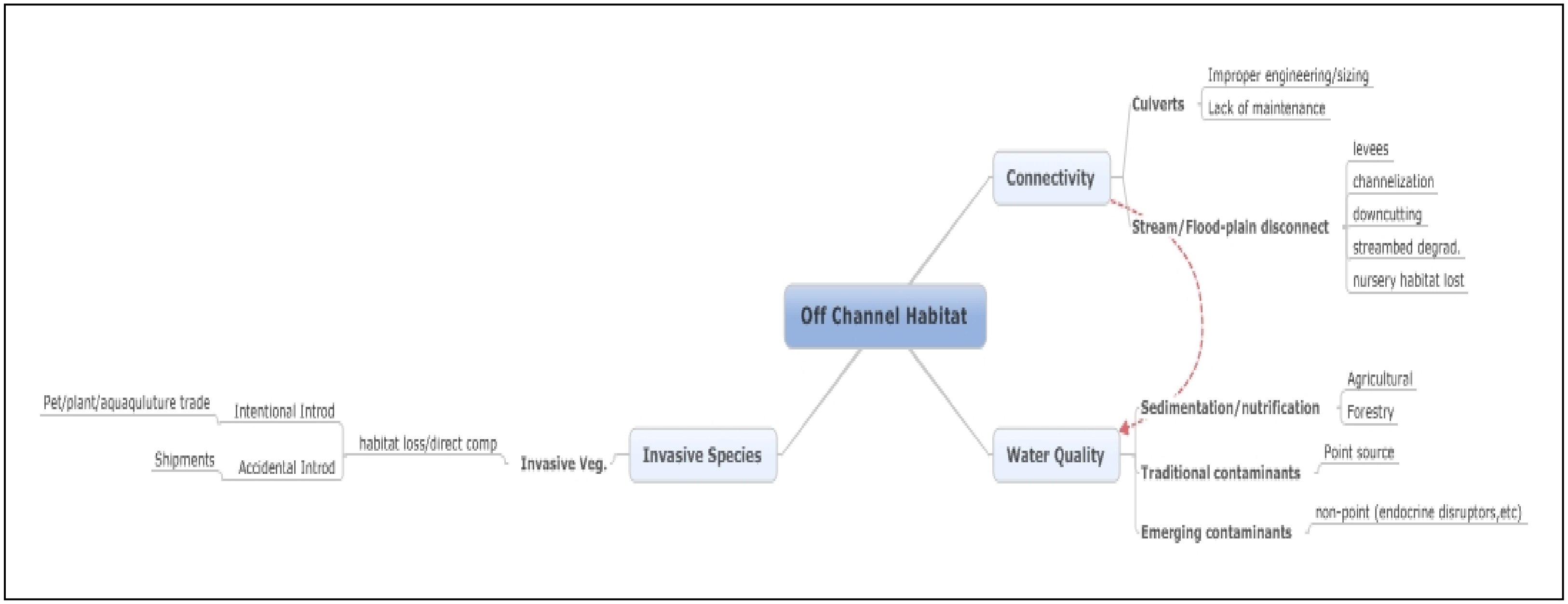
Appendix J. Medium Rivers Fish Situation Analysis Diagram



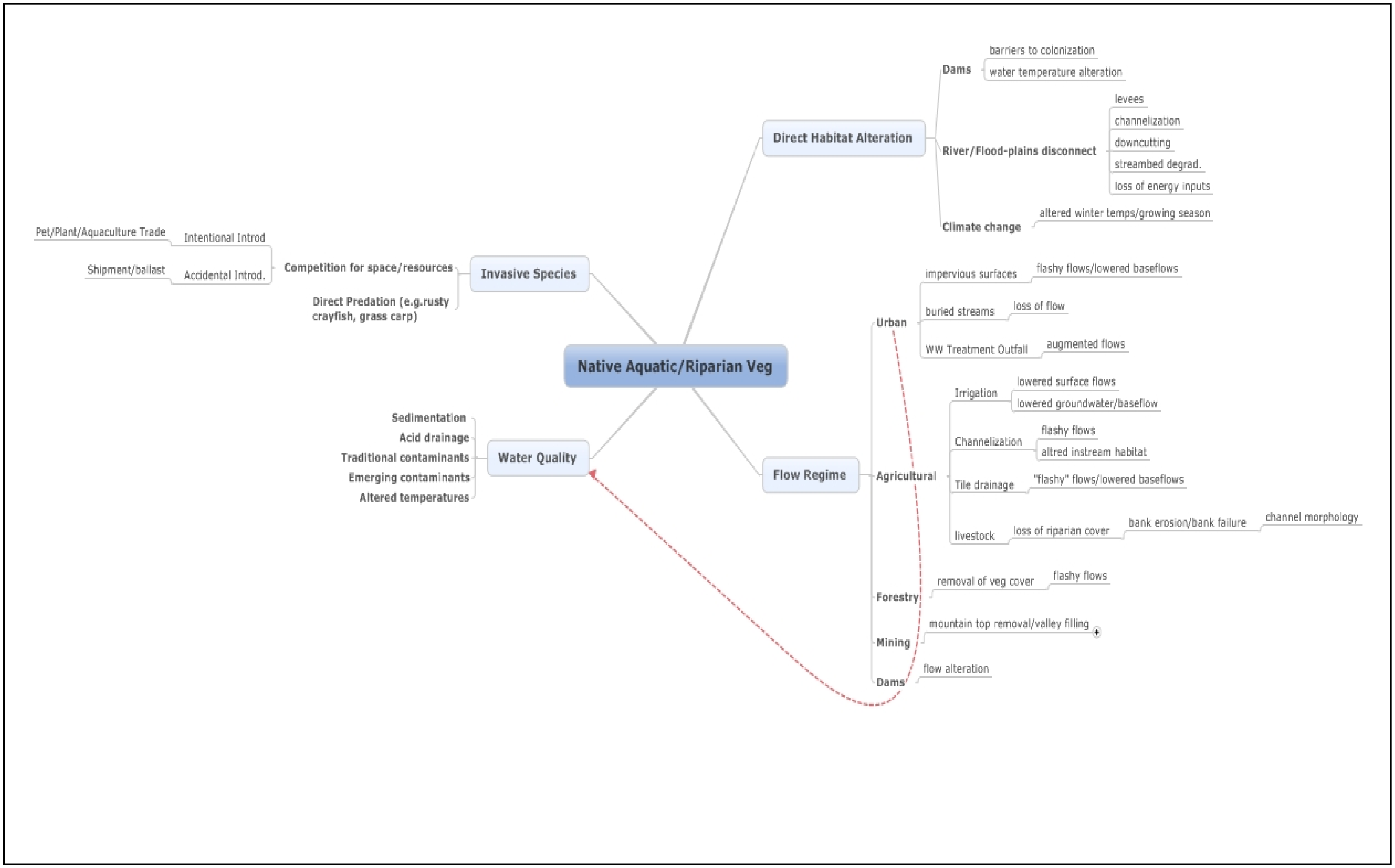
Appendix K. Great & Large Rivers Fish Situation Analysis Diagram



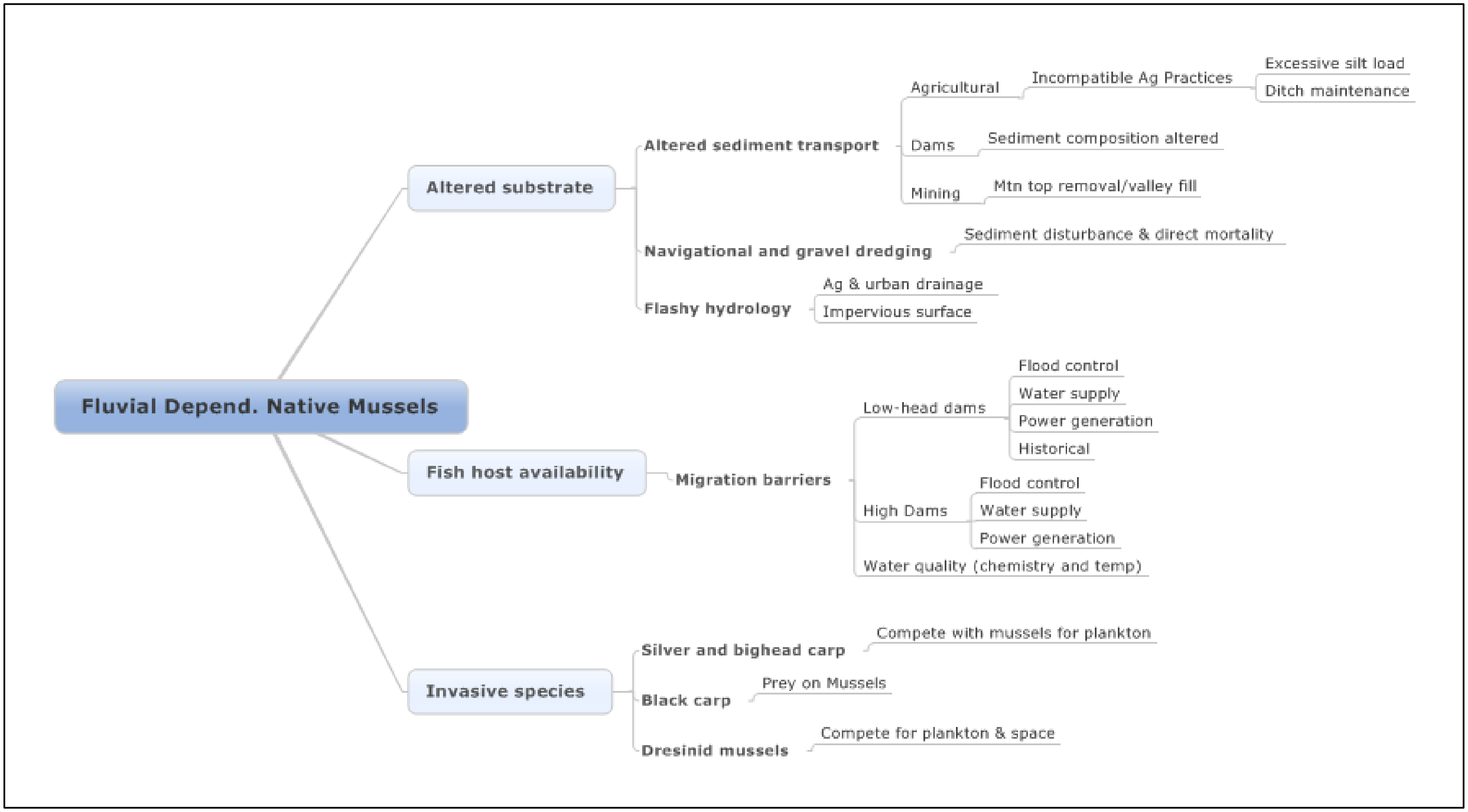
Appendix L. Off Channel Habitat Situation Analysis Diagram



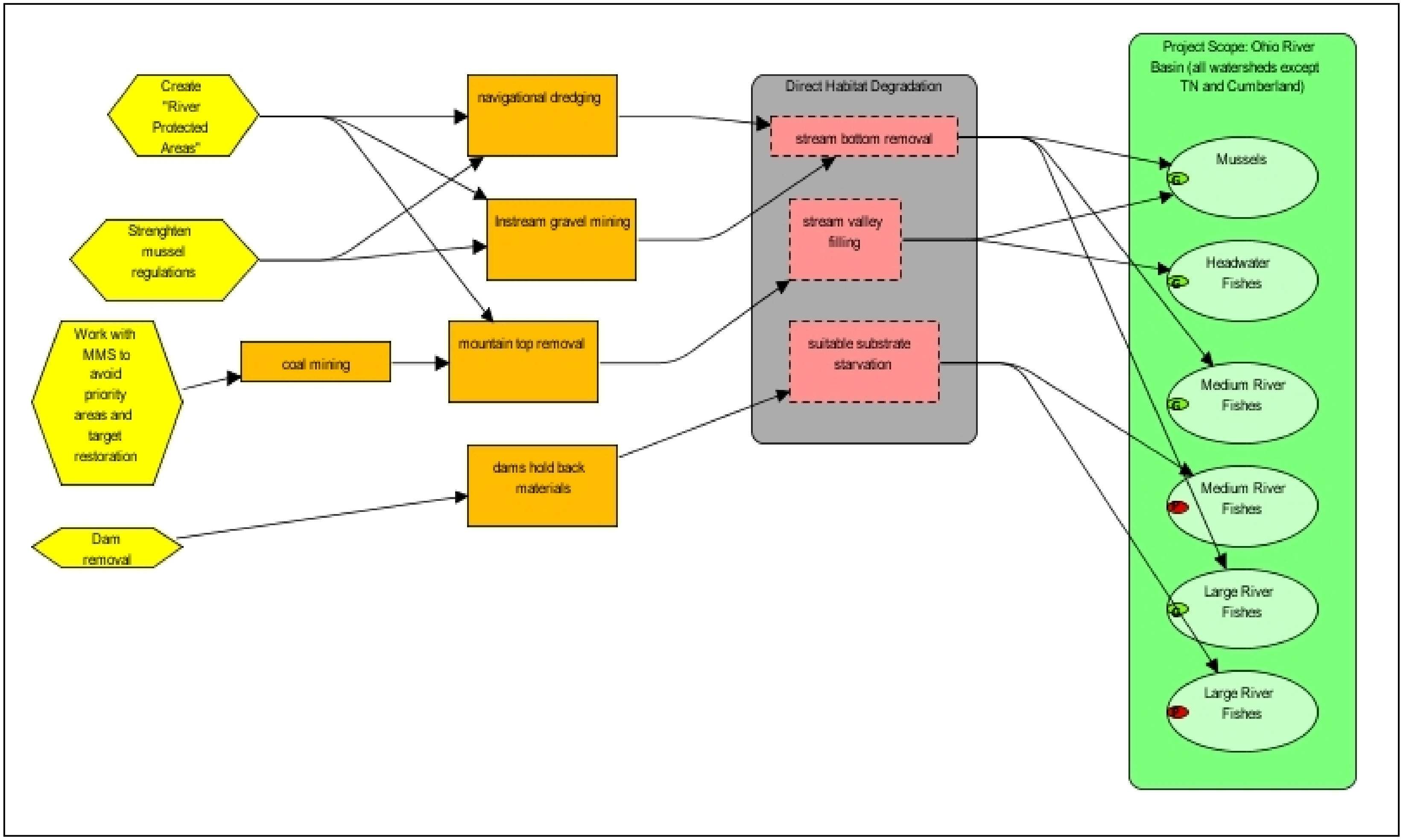
Appendix M. Native Aquatic/Riparian Vegetation Situation Analysis Diagram



Appendix N. Fluvial Dependent Native Mussels Situation Analysis Diagram



Appendix O. Direct Habitat Degradation Threat-Habitat Type Situation Analysis Example



Appendix P. ORBFHP Partnership Diversity and Strength

Ohio River Fish Management Team

The Ohio River Fish Management Team (ORFMT) was formed in 1990 and consists of state fisheries conservation personnel from the Ohio River main stem states of PA, WV, OH, KY, IN, and IL. The ORFMT works cooperatively to assess the fisheries of the Ohio River and seeks to apply fisheries management techniques in a holistic manner. The ORFMT also serves as the Ohio River sub-basin group within the structure of MICRA, the Mississippi Interstate Cooperative Resource Association that combines the efforts of 28 state natural resource departments to improve interjurisdictional river resource management in the Mississippi River Basin. Population dynamics information collected in the past and future by this group will serve as an important database for evaluating the success of ORBFHP habitat protection/restoration strategies within the main stem of the Ohio River.

Kentucky Nature Preserves Commission

The Kentucky Nature Preserves Commission protects Kentucky's natural heritage by (1) identifying, acquiring and managing natural areas that represent the best known occurrences of rare native species, natural communities and significant natural features in a statewide nature preserve system; (2) working with others to protect biological diversity; and (3) educating Kentuckians as to the value and purpose of nature preserves and biodiversity protection (KY State Nature Preserves Comm. 2010). The current focus on inventorying rare native species (including freshwater mussels) within the state of Kentucky is particularly beneficial to the present and future efforts of the ORBFHP because virtually all of the state drains to the Ohio River and the waters of Kentucky include the highest number of main-stem river miles within the basin.

US Fish and Wildlife Service

The US Fish and Wildlife Service is one of the primary originators and sponsors of the National Fish Habitat Action Plan and plays a major role within the ORBFHP as both a facilitator of this partnership formation process (via a strategic planning grant from the Carterville, Illinois Fisheries Office) and as stakeholder in future work. A key USFWS site within the basin is the Ohio River Islands NWR.   This refuge was established in 1990 to protect, conserve, and restore habitat for wildlife native to the river and its floodplain.   Ohio River Islands currently consists of twenty-two islands and three mainland tracts totaling approximately 3,300 acres that are scattered along nearly 400 miles of the Ohio River. Planning is underway to evaluate mainland wetlands and backwater areas for possible inclusion in the refuge. The Ohio Islands NWR is currently authorized to acquire up to 8,000 acres within the mainstem and associated corridor of the Ohio River between Pittsburgh, Pennsylvania and Cincinnati, Ohio.

US Army Corps of Engineers

The USACE through its Great Lakes and Ohio River Division (commonly referred to as the Lakes and River Division or LRD) has federal jurisdiction over the navigable waters of the basin and operates and maintains an extensive series of locks and dams for navigation on the mainstem and major tributaries to the Ohio River through its Pittsburgh, Huntington, Louisville, and Nashville districts. The LRD also is responsible for flood control (some with associated hydropower production) at a number of tributary sites within the basin.

Ohio River Sanitation Commission
The Ohio River Valley Sanitation Commission (commonly referred to as ORSANCO) is a federal interstate commission that was created in the 1940s in response to widespread and severe pollution at the time within the mainstem of the Ohio River from Pittsburgh, PA to its confluence with the Mississippi River. ORSANCO is responsible for creating and implementing water quality and other environmental health related regulations along the Ohio River mainstem.

ORSANCO is a particularly strong partner for not only achieving future success of the ORBFHP but also measuring outcomes as a part of its mission requires that it monitor water quality parameters and biological indicators of the same within its purview. To this end, ORSANCO maintains an extensive and highly sophisticated series of real-time flow, and water quality monitoring stations and biological sampling sites and conducts annual fish population sampling at various locations within the Ohio River. Sample data at many sites extends back to at least the mid 1960s.

US Geological Survey
The US Geological Survey through its Surface Water Division operates the nation's largest network of real-time stream flow gages and is at the forefront of water related science research and application. USGS currently operates stream gages within the Ohio River basin and is engaged in number of cooperative studies with stakeholders.

Within the context of the ORBFHP, the USGS has unique water quality and hydrology modeling expertise that address prima fascia basin threats such as sedimentation (SPARROW) and altered hydrology (IHA equivalent). USGS also possesses extensive groundwater hydrology expertise and modeling ability not found in other partnership team members.

US Forest Service
The US Forest Service is both a stakeholder in the Ohio River basin and a key to the future success of the ORBFHP. The USFS operates a number of forest units within the PA, WV, OH, KY, and IN portions of the watershed that cumulatively exceed 5,627,000 acres. Within these forests the Forest Service regulates timber harvest and road crossings along a large number of headwater stream reaches.

In recent years the USFS has been a national leader in developing timber harvest and unpaved road maintenance BMPs that reduce sedimentation through the use of their WEPP (Watershed Evaluation Prediction Program) model. The Forest Service has also been an innovator in stream crossing design and has recently begun to sponsor a number of workshops on stream crossing designs and techniques that promote aquatic organism passage. In a similar manner, several national forest units within the Ohio River basin have sponsored workshops at the state level to facilitate USFS expertise and technology transfer regarding headwater aquatic organism passage.

US Environmental Protection Agency
The US Environmental Protection Agency is a natural fit within the ORBFHP given its authority under the Clean Water Act to regulate the nation's water quality and provide funding for the restoration of it. EPA's National Exposure Research Laboratory is located nearly in the geographic center of the Ohio River Basin in Cincinnati, OH and includes a focus on aquatic

toxicity.   Cincinnati based staff have been involved in the ORBFHP from its beginnings contributing greatly to the partnership's water quality expertise.

The Nature Conservancy

The Nature Conservancy (TNC) is an international, non-profit science-driven conservation organization dedicated in part to the preservation of aquatic biodiversity and the lands and waters needed for its survival. As the largest private conservation organization in the world it has well developed conservation planning and stream flow expertise, and GIS analysis capabilities. In the past 2 years the Conservancy has expanded its efforts to conserve and restore functioning of entire aquatic systems such as the lower Great Lakes-St Lawrence River and the Ohio River. The Nature Conservancy in Ohio acts as the Ohio River planning and project lead and coordinates with various state operating units from New York to Illinois to carryout conservation strategies at scale.

Within the scope of the ORBFHP the Conservancy received a grant from the USFWS through the Carterville, IL Fisheries Office to lead the strategic planning process for the candidate partnership and develop a business plan as a part of the application to the National Fish Habitat Board for full partnership status. As a private conservation organization TNC has a track record within the Ohio River Basin of working well at many different scales with private landowners, state and federal conservation agencies, and advocacy groups. A number of ongoing TNC activities such as a developing MOU with the USACE LRD and a GIS based floodplain analysis strengthen the effectiveness of the ORBFHP. Additionally TNC-OH possesses a dedicated GIS position that has contributed to developing preliminary basin-level analysis for the partnership.

Ohio River Foundation

The Ohio River Foundation (ORF) was created in 2000 and is based in Cincinnati, OH. ORF's mission is to protect and restore the water quality and ecology of the Ohio River and its tributaries for the health and enjoyment of present and future generations. As a foundation whose focus is solely on the Ohio River and its basin the ORF adds strength and depth to the resources and connections of the ORBFHP.

Marshall University

Marshall University is located in Huntington, WV in close proximity to the Ohio River and USACE Huntington District Headquarters. The Ohio River and its tributaries have long been of interest to university staff and student and a number of research projects have been conducted including those funded or otherwise facilitated by the Huntington District. Marshall's staff has also been of great assistance during the formation of the ORBFHP serving as volunteer hosts and designers for the partnership's web page. University staff and students could serve as a future research source.

Ball State University

Ball State also has a strong interest in the Ohio River watershed and has conducted a number of research projects on Ohio River tributaries. University staff was of invaluable assistance in providing information on ecological relationships of smaller headwater streams to major tributaries and could serve as a future research source.

Appendix Q. Composition and Function of ORBFHP Committees

<u>**Steering and Coordination Committee:**</u>

- **Illinois Division of Fisheries**
- **Indiana Division of Fish and Wildlife**
- **Kentucky Department of Fish and Wildlife Resources**
- **Ohio Division of Wildlife**
- **Pennsylvania Fish and Boat Commission**
- **West Virginia Division of Natural Resources**
- Other states in the basin would have a seat available upon request
    - Maryland Fisheries Service
    - New York Department of Environmental Conservation; Division of Fish, Wildlife and Marine Resources
    - North Carolina Wildlife Resources Commission
    - Tennessee Wildlife Resources Agency
    - Virginia Department of Game and Inland Fisheries
- **USDA-NRCS**
- **USACE**
- **USEPA**
- **USFS**
- **USFWS**
- **USOSM**
- **USGS**
- **ORSANCO**
- **TNC**
- **At large seats** for the following groups to rotate every 2 years.
    - 1 seat for a large environmental NGO (e.g., Sierra Club, Audubon, AFS)
    - 2 seats for universities
    - 2 seats for environmental user businesses (e.g., Bass Pro, Dicks)
    - 2 seats for industries (e.g., utilities, barge companies)
    - 2 seats for environmental user groups (e.g., TU, bass clubs)
    - 2 seats for local/regional government
    - 1 seat for local watershed group or watershed coalition

The primary function of the Steering and Coordination Committee members will be to move the overall partnership in the direction that is most beneficial to meeting our mission and objectives. This group will be co-chaired by a state DNR and the USFWS. Where appropriate, those on the committee should be at a level in their agency/organization to commit resources, whether financial or in kind.

Decisions will be reached by consensus but if needed, a vote will be used. Only decisions with a 3/4 majority vote will be acted upon to help maintain the cooperative nature of the partnership (i.e., only strongly supported decisions, either by consensus or majority vote will move forward). Selections for at large seats will be made by standing members of the Steering and Coordination Committee.

Coordinator:

- USFWS

Coordinator will work with all committees to facilitate and coordinate various aspects of the FHP. The Coordinator role is currently filled by USFWS, but could be filled by other appropriate agencies in the future.

Science and Monitoring Committee:

- Indiana Department of Environmental Management
- Thomas Moore College
- Marshal University
- ORSANCO
- Pennsylvania Fish and Boat Commission
- Shearwater Systems
- The Nature Conservancy
- USEPA
- USGS

This committee works with the Steering and Coordination Committee to determine what data are available and how best to combine them to assess current habitat and how best to measure our future improvements to the basin. Membership is open to interested individuals.

Partnership and Outreach Committee:

- Ball State University
- Concerned Citizen
- Kentucky State Nature Preserves Commission
- Marshall University
- ORSANCO
- Ohio River Foundation
- Sierra Club
- Southern Illinois University
- USFWS

This committee will work with the Steering and Coordination Committee to identify and recruit additional people/groups that are beneficial to the ORBFHP. This committee will also to make sure that we have good information and tools to reach out to prospective new members of our group, and that we have long-term capabilities in place for communicating with existing partners and for recruiting new ones. Membership is open to interested individuals.

Implementation Committee:

- USFWS

This committee will grow as implementation grows to help be sure that we are effective in translating planning into action. Membership is open to interested individuals.

Fundraising Committee:

- Shearwater Systems
- Southern Illinois University

Its key function is to compile funding opportunities and to match those funding opportunities to funding sources. Membership is open to interested individuals.

Other Committees:

Additional committees will be formed as needs arise and as approved by the Steering and Coordination Committee.

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