Seizing the Day for Ohio River Restoration: A Vision for Science-Based Ecosystem Restoration Integrated with Equity and Justice
Oct. 2, 2020 Virtual Session, Ohio River Basin Symposium & Summit 2020
Background Document

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1. Introduction and Overview

The National Wildlife Federation (NWF) is excited to be collaborating with stakeholders in support of ecosystem restoration in the Ohio River Basin. We believe this is an opportune time to increase attention to many environmental threats in the basin, build on earlier efforts, and engage with partners to develop a visionary ecosystem restoration plan for waters in the basin. We believe such a plan, with involvement of representatives from the federal government, states, local communities (including disproportionately impacted residents), academia, NGOs, and private sector partners can contribute significantly to a large-scale, federally funded ecosystem restoration program in the basin that leads to billions of dollars of new investment that also benefit the economy and local communities.

Recent work has been centered around a broad strategic planning process led by the Ohio River Basin Alliance (ORBA), the Louisville District of the U.S. Army Corps of Engineers (USACE), and the Ohio River Valley Water Sanitation Commission (ORSANCO). This work has resulted in a basin-wide strategic plan, *Plan for the Ohio River Basin, 2020-2025*.[1] The plan identifies six goals – and objectives and strategies to meet them – including a Healthy and Productive Ecosystems Goal. For each goal area, a work group is being formed to identify specific approaches that can be carried out to meet objectives. NWF is leading and coordinating the work group for the Healthy and Productive Ecosystems goal. We propose a science-based, stakeholder-driven process that explores in more depth threats to habitats and ecosystems, establishes targets, and identifies restoration and protection strategies. In addition, we envision a process informed by equity and justice concerns that leads to solutions that help people who have historically borne the brunt of pollution and environmental degradation – including people of color, low-income and rural communities, and Tribal Nations. We believe that a robust investment in ecosystem restoration can lead to a broader restoration economy in the region that supports local workers, jobs, and economies.

The three objectives (summarized) under the Healthy and Productive Ecosystems Goal in the new strategic plan are:

1. Through stakeholder involvement, develop a restoration plan that identifies at-risk ecosystems and threats facing them.
2. Secure federal funding for restoration of the Ohio River Basin.
3. Manage and control invasive species within the Ohio River Basin.[2]

The regional plan offers broad latitude for the Healthy and Productive Ecosystems Work Group to craft a restoration plan for the Ohio River Basin. We want to ensure that the final restoration action plan is commensurate to the threats facing the region. NWF is proposing in this document a restoration framework and approach to pursue over the next 15 months to develop an ecosystem

restoration plan that can serve as the basis for the development of a federally funded restoration program. The draft framework is being presented at the 2020 Ohio River Basin Symposium and Summit, and we hope to generate discussion and ideas on how to optimize the framework in support of a solid ecosystem restoration plan. The remainder of this document includes a brief overview of the basin and threats to ecosystems, recent assessment efforts that can inform this project, a brief overview of the draft framework, and next steps for developing a sound, stakeholder-driven strategy in support of ecosystem restoration in the Ohio River Basin.

2. Overview of Ohio River Basin and Frameworks to Support Restoration

The Ohio River Basin encompasses 204,000 square miles across portions of 15 states and is home to over 27 million people. The Ohio River has been called a "working river" given the importance and economic significance of navigation.[3] The Ohio River mainstem runs 981 miles from the confluence of the Allegheny and Monongahela Rivers in Pittsburgh to its mouth in Cairo, Illinois (Figure 1). The ORB contains at least seven physiographic regions, including the Appalachian Plateaus extending across the north-south length of the basin, Interior Low Plateaus, and the Coastal Plain in the southwestern portion of the basin.[4] The region is home to significant biodiversity, including over 350 species of fish and more than 120 species of mussels, many of which are listed as threatened or endangered.[5] Land use and land cover vary in the basin, with over 50 percent of the basin forested, and 35 percent of the basin in agriculture, with high concentrations of agricultural land in the Ohio, Indiana, and Illinois portions of the basin. Wetlands represent a smaller portion of the total basin area (< 1 percent), and as in other regions of the country, historic losses have been significant.[6]

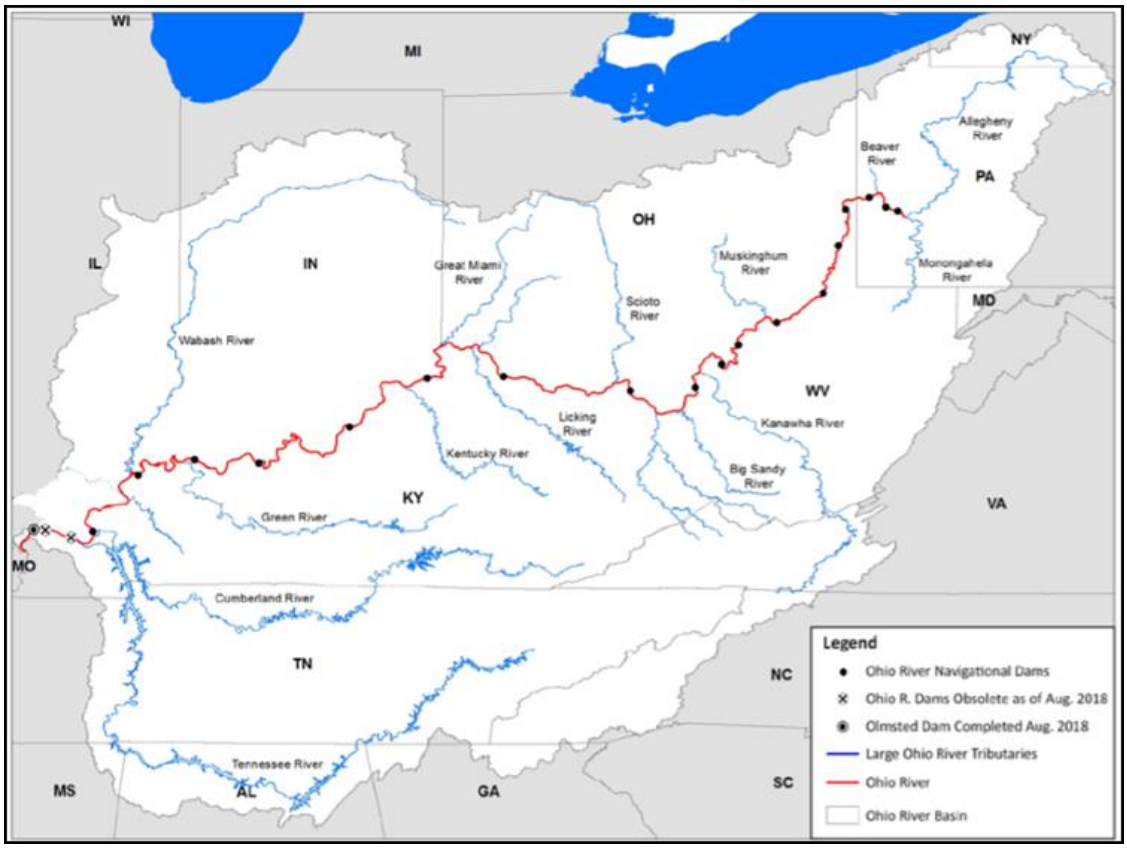

Figure 1. Map of Ohio River Basin.[7]

The Ohio River Basin is categorized by the U.S. Geological Survey (USGS) as a two-digit "Hydrologic Unit Code" (HUC) watershed and is composed of 18 four-digit sub-basins, generally defined by the watershed of a river or river segment (e.g. Upper Ohio). The Ohio River Basin can be similarly divided into 16 Level III ecoregions (or areas of similar ecosystems and environmental resources).[8] Consideration of distinct sub-basins and ecoregions can help inform ecosystem restoration planning in the basin.

Threats to aquatic habitat in the Ohio River Basin include pollutants such as excessive sediments and acid mine drainage, as well as flow alterations (often termed *causes* of threats in a water quality context)[9] and *sources* of threats such as dams and other hydrological modifications, agriculture, timber operations, invasive species, mining, oil and gas operations, and climate change.[10,11]

Ecosystem restoration planning and implementation can benefit by using conceptual frameworks, which typically include a conceptual diagram illustrating relationships between key drivers, stressors, ecological impacts, and management responses. In addition to visualizing relationships between known or suspected stressors and ecological impacts, such diagrams can help ensure appropriate management actions are being taken to address key problems, reduce impacts, and lead to restoration.[12] The potential value of increased use of conceptual frameworks in the Great Lakes region was recently reviewed,[13] and a general framework is presented in Figure 2.

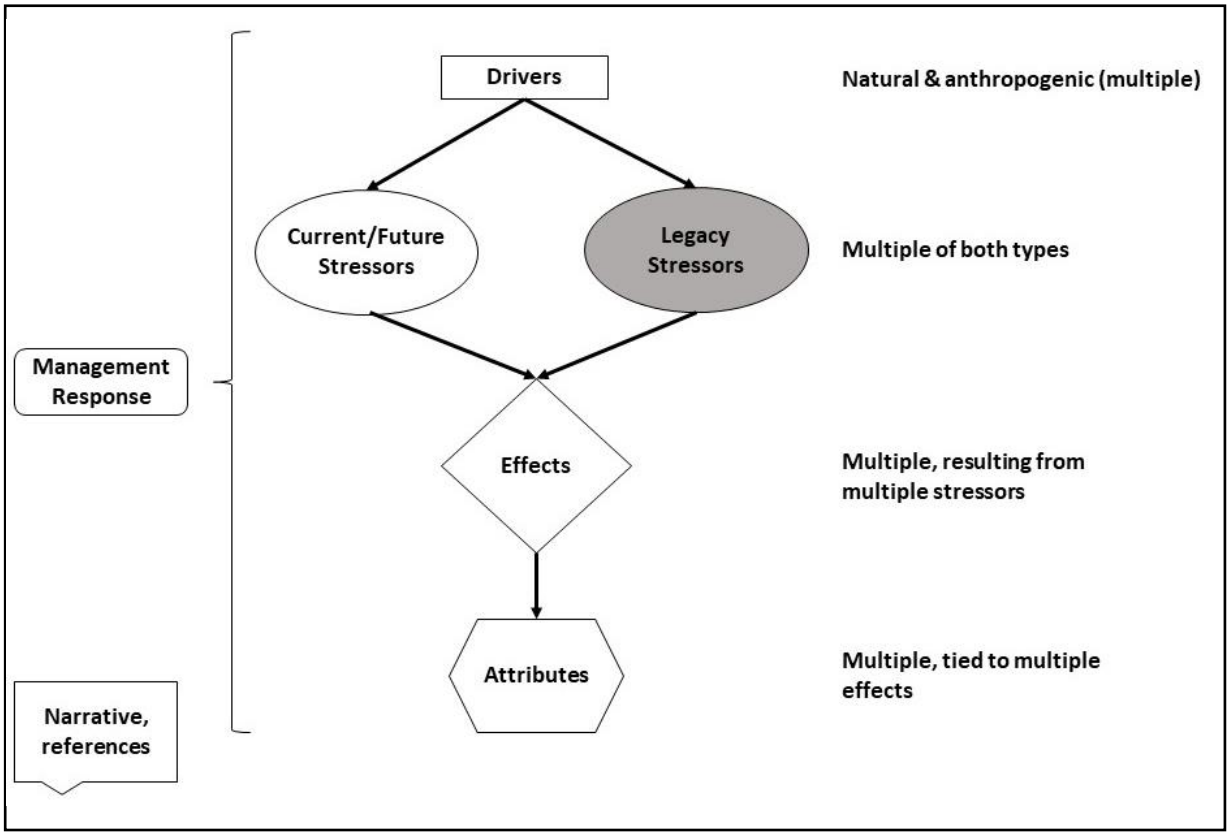

Figure 2. Conceptual model diagram proposed for consideration in Great Lakes restoration planning.[14] Note this framework draws on the commonly used driver-pressure-state-impact-response framework for ecological restoration and the Kissimmee-Okeechobee-Everglades (Florida) ecosystem framework.[15]

For the conceptual model shown in Figure 2, drivers (either natural or anthropogenic) influence stressors, which in turn cause effects, and changes in attributes. (See Figure 3 for elaboration on each component). The framework allows for management responses at all levels, with potential narrative elaboration and references. The framework can be applied to different stressors and can be modified to cover multiple drivers, stressors, effects, and attributes. We propose to utilize this framework in the Ohio River Basin, as described in the next section.

Driver: Driving forces that can be natural or anthropogenic that have large-scale influences on natural systems. Examples include terrestrial activities, aquatic activities, invasive species, climate change.
Stressors: Stressors can be physical of chemical changes brought about by drivers and cause significant changes in natural systems. Examples (Stark, 2013) include direct habitat degradation, altered water quality, altered population dynamics, altered hydrology.
Effects: Physical, chemical, and biological responses caused by stressors. Include physical, chemical, biological, hydrological.
Attributes: Multimetric indices (or indicators) of watershed health. Examples (from USEPA) include landscape condition, habitat, hydrology, geomorphology, water quality, biological condition.

Figure 3. Elaboration on components in Figure 2, drawing on Stark, 2013,[16] and USEPA.[17]

Multiple environmental assessment efforts have been carried out over the past two decades relevant to ecosystem restoration planning in the Ohio River Basin, with each identifying components (such as stressors or threats, and attributes or condition) analogous to those reviewed above. Key components of seven assessments from the past decade are summarized in Table 1 on the following page. The first two assessments were coordinated by The Nature Conservancy, identified major habitat types in portions of the Ohio River Basin, and set targets and identified general strategies to meet targets.[18,19] The next four assessments in Table 1 involved the development and/or use of indicators of different ecosystem components at varying scales. For example, the Tennessee Integrated Assessment of Watershed Health was a statewide screening level assessment that followed the approach in the U.S. Environmental Protection Agency (USEPA) Integrated Assessment of Healthy Watersheds program. The approach assessed watershed health broadly based on six sub-indices, including for habitat, hydrologic, and biological condition, and also identified watershed vulnerabilities, based on threats from land use changes, water use, and climate change.[20]

The biennial integrated report on Ohio River water quality developed by ORSANCO,[21] though focused on water quality, also provides information on biological condition and stressors relevant to broader ecosystem restoration. State integrated water quality reports would similarly offer additional insights to the current effort; for example, the latest Ohio integrated report identifies habitat modification as a top cause of aquatic life impairment in the state.[22]

Two additional assessment efforts are relevant to the current Ohio River Basin planning work. The Southeast Aquatic Habitat Plan resulted from a volunteer effort of resource managers and others to better coordinate management of aquatic resources in the 2000s. The plan included high-level objectives addressing physical habitat, riparian zones, watershed connectivity, hydrologic conditions,

and four other themes, and identified four integrated conservation strategies, each with multiple actions. Furthermore, the plan highlighted a vision and recognized the importance of building on then-existing work to identify geographic priorities as well as the importance of measuring success.[23] Additional assessments at the state level have been done as part of State Wildlife Action Plans. Assessment work for these plans, including identifying key habitats, threats to wildlife, and actions to address the threats, could inform the current Ohio River Basin effort.[24]

The Great Lakes region has seen extensive restoration planning and implementation for two decades, and can serve as a model for development of an Ohio River Basin restoration program. The large-scale Great Lakes Restoration Initiative (GLRI)[25] was informed by the earlier multi-stakeholder Great Lakes Regional Collaboration Strategy, released in 2005, which included goals, recommendations and estimated funding needs for implementation.[26] For our proposed framework, we draw particularly on the earlier Great Lakes work, the conceptual model work reviewed above, the Ohio River Basin Fish Habitat Partnership Strategic Plan, the Tennessee Integrated Assessment of Watershed Health, and the Southeast Aquatic Habitat Plan.

Table 1. Recent Assessment Reports Relevant to Ohio River Basin Restoration

Assessment	Key Components	Reference
Ecosystem Flow Recommendations for the Upper Ohio River Basin in Western Pennsylvania	• Identified 11 major habitat types (from headwaters to great rivers) and ecosystem flow needs • Flow recommendations, including by season and habitat type	Dephilip and Moberg, 2013[27]
Ohio River Basin Fish Habitat Partnership Strategic Plan	• Identified six habitat types (e.g. large and great rivers, native aquatic and riparian vegetation) and signature fish species in each • Identified targets, threats, and strategies for addressing threats, for each of the six habitat types	Stark, 2013[28]
Clinch and Powell River Integrated Assessment of Watershed Health[a]	• Ecological indicators calculated for five watershed attributes – landscape, geomorphic, hydrologic, biologic condition, and water quality. • Characterized relative watershed health, and the screening assessment can inform protection, restoration	Matthews et al., 2015b[29]
Tennessee Integrated Assessment of Watershed Health[a]	• (Statewide) Utilized same ecological indicators as Clint and Powell River (previous), plus habitat condition • Screening approach that characterized relative watershed health, and included vulnerability assessment, to inform protection against future threats	Matthews et al., 2015a[30]
America's Watershed Initiative – Ohio and Tennessee Rivers	• Indicators for six goal areas, including ecosystems • Ecosystems indicator developed based on four indices – living resources, water quality, habitat, and wetland area change.	AWI, 2015[31]
Tennessee River Basin Report Card	• Scores developed across the three domains of stressors (e.g. development, sedimentation), condition (e.g. aquatic biodiversity) and management response (e.g. wetlands protection)	UMCES, 2017[32]
ORSANCO Assessment of Ohio River Water Quality Conditions	• Biennial assessment (under Clean Water Act) of Ohio River water quality, for mainstem • Includes data related to aquatic life use (including fish, macroinvertebrates) by pool	ORSANCO, 2020[33]

[a]: These assessments are based on the approach developed by USEPA through the Integrated Assessment of Healthy Watersheds program, which includes development of watershed health index values that can inform management decisions.[34]

3. Proposed Framework and Approach to Restoration Planning in the Ohio River Basin

In developing an approach to organize work for the Healthy and Productive Ecosystems Work Group for the Ohio River Basin, we are relying on the following key considerations:

1. Objectives and values identified in the *Plan for the Ohio River Basin, 2020-2025*, including addressing climate change and vulnerable populations;[35]
2. An assumption that conceptual models can be used to help ensure management actions lead to desired ecosystem outcomes;
3. Recent ecosystem assessments in the basin and restoration program work outside the basin, as reviewed in the previous section;
4. Development of a final product that can serve as a roadmap for a major federally funded restoration program.

In light of these considerations, we are proposing that activities of the Healthy and Productive Ecosystems Work Group be organized as shown in Figure 4 below. The effort would be spread across six focus areas, with one committee for each, and work would include identification of emphasis and review of available assessments, datasets, and geospatial coverage for each committee, and development of report sections. Then an integrative effort (involving more coordination between committees) would entail use of conceptual models to assist in identifying broad restoration and protection targets and objectives, a prioritization process, and development of a final plan with restoration and protection recommendations.

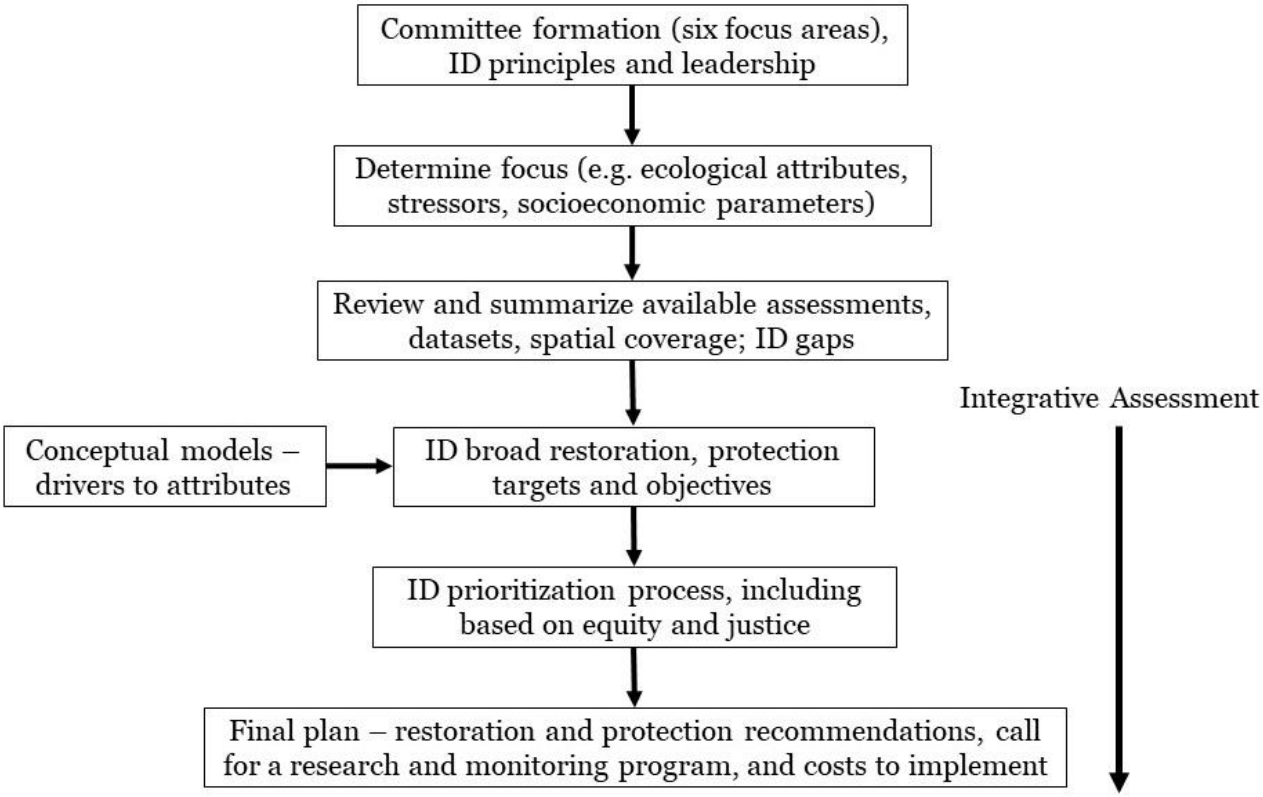

Figure 4. Proposed process for Healthy and Productive Ecosystems Work Group.

Our proposal recommends six focus areas/committees, as follows:

1. Healthy Species and Habitats
2. Hydrology
3. Water Quality
4. Aquatic Invasive Species
5. Climate Change
6. Healthy Communities

All of these focus areas are addressed in some form in the *Plan for the Ohio River Basin, 2020-2025.*[36] Note that focus area 3 on water quality would overlap with the Abundant Clean Water goal in the *Plan*; however, the current intention is work in the Healthy and Productive Ecosystems Work Group would focus on water quality threats to fish, other aquatic life, and wildlife. In many cases, of course, reducing pollution to benefit aquatic organisms would often benefit people as well. Considering the conceptual model diagram previously described (Figure 2), these focus areas would cut across different components in the conceptual model. For example, focus areas 1 and 6 would be considered attributes (with focus area 6 referencing human communities), and focus areas 2-5 stressors or drivers. Targets can be identified across all focus areas, with the ultimate goal of meeting targets for attributes. In many cases, this may mean either remediating historic stress (e.g. loss of habitat) or meeting objectives involving ongoing stressors, such as pollutants or aquatic invasive species. For each focus area, it is assumed that assessments will consider availability of information basin-wide, including potentially based on sub-basins (as noted in Section 2). Examples of issues and resources potentially considered in each focus group are provided in Table 2 below.

Table 2. Examples of Issues and Resources to Consider for each Focus Area.

Focus Area	Example Issues	Example Resources[a]
Healthy Species and Habitats	• Threatened, endangered species • Wetlands, riparian, instream habitat	• USEPA National Rivers and Streams Assessments • Multi-resolution Land Characteristics Data
Hydrology	• Locks and dams • Urban development	• Hydromodification data from USACE • ORSANCO, state integrated reports
Water Quality	• Suspended solids, dissolved oxygen, acid mine drainage, metals, organic pollutants	• ORSANCO, state integrated reports • USGS National Water Quality Network Data
Aquatic Invasive Species (AIS)	• Established AIS (e.g. bighead carp) • AIS at risk to enter Ohio River Basin	• USGS Nonindigenous Aquatic Species Database • USFWS risk assessments
Climate Change	• Warming temperatures, changed precipitation patterns • Assessment of species, habitat vulnerabilities	• IWR 2017[37](and information therein) • Natureserve, Climate Change Vulnerability Index
Healthy Communities	• Disproportionately impacted communities, including communities of color, rural and low-income communities, and Tribal Nations • Locations of historic, current mines, industrial operations, waste sites	• USEPA Environmental Justice and Screening Mapping Tool • CDC Social Vulnerability Index • Assessments on economic benefits of restoration

[a]: Additional acronyms: USFWS: U.S. Fish and Wildlife Service; IWR: Institute for Water Resources; CDC: U.S. Centers for Disease Control and Prevention.

As noted previously via Figure 4, conceptual models can be useful in the restoration planning process within each committee and the process overall, including developing targets and increasing the chance that management actions can be most effective at meeting restoration targets. Figure 5 below is an example of a simple conceptual model utilizing the framework described in Section 3. In this example, surface mining and resulting valley filling results in loss of habitat and vegetation, ultimately affecting streamflow and condition of aquatic life. Data on altered biotic conditions (i.e., the attributes) could be compiled throughout the Ohio River Basin (e.g., through tributary assessment reports), along with assumed links to causes, which would then have implications for management responses that can address the issue. Depending on the extent of available data, such an assessment could indicate the extent of the problem (and any spatial variation) throughout the Ohio River Basin. This type of effort could be carried out for multiple stressors and attributes, and potentially at varying scales (e.g., emphasis in particular sub-basins), contingent on data availability. Furthermore, while useful in this restoration planning process, the use of similar conceptual models could be of value in any subsequent restoration program, including at the project level.

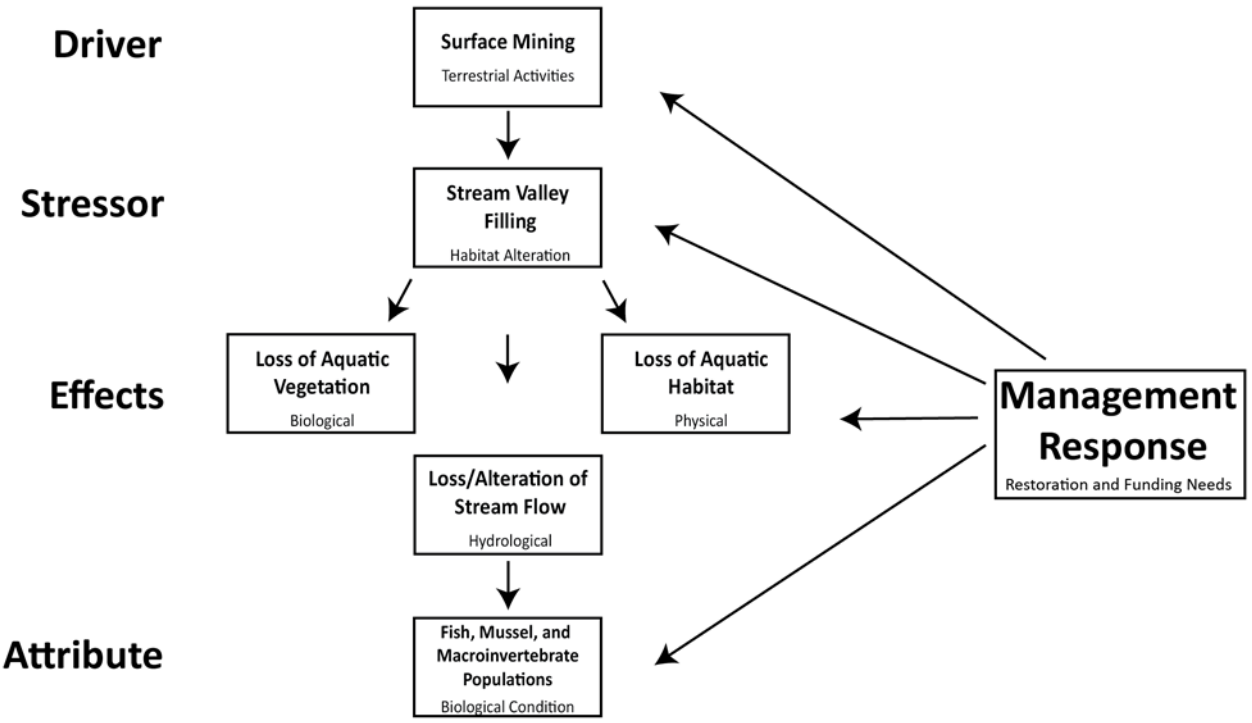

Figure 5. Example conceptual model diagram applied to surface mining and impacts in the Ohio River Basin.

In carrying out activities of the work group, it will be important to have regular communication between committee representatives to foster collaboration and avoid siloed efforts, including in the development and use of high-level principles to guide the restoration planning process.

One key principle identified in the *Plan for the Ohio River Basin, 2020-2025* is Consideration of Vulnerable Populations.[38] Researchers, activists, and agencies such as USEPA have long recognized that people of color, low-income and rural communities, and Tribal Nations have historically borne a disproportionate share of pollution and environmental degradation. We envision explicitly addressing

vulnerable populations, including through the work of the Healthy Communities Committee. In addition to reaffirming *Plan* principles early on in the process, we envision the work group can explore these issues in greater depth, including for example examining geospatial relationships between areas of greater conservation need and socioeconomic data, of the types indicated in Table 2. Additional review work can be carried out to provide estimates of restoration-based benefits, including jobs and broader economic activity. Considering this information in the integrative phase of the work (Figure 4) can help ensure a path toward a restoration program that can ultimately meet ecosystem objectives, address environmental injustices, and contribute to a more equitable restoration economy.

Finally, assessment activities as part of this work group will identify information and knowledge gaps, examination of which can entail close coordination with the Knowledge and Education to Inform Decisions Work Group. While it is assumed a restoration plan will be able to be developed based on existing information, it will be important to address these gaps in years ahead, which can be done through formal research and monitoring programs accompanying the restoration program. Research to fill knowledge gaps and monitoring of agreed upon indicators can help track progress and inform the restoration program overall, including in an adaptive management context.

4. Summary, and Next Steps

In summary, we are proposing a general restoration framework for the Ohio River Basin that will consider the conditions of species and habitats and stressors affecting them, use conceptual models to inform targets and strategies, identify additional research, monitoring and other information needs, and consider equity and justice and restoration economy principles and information in producing a comprehensive ecosystem restoration plan. We are taking feedback on this proposed process at the "Seizing the Day for Ohio River Restoration" session, Oct. 2, 2020, and in the following weeks, concerning the proposal, how it can be improved, and how we can best engage a wide range of stakeholders in developing an actionable restoration plan.

Our draft timeline for moving forward in this process is as follows:

October 2020 – January 2021: Finalize framework and structure, and assemble Healthy and Productive Ecosystems team, including committee members and leadership.

January – December 2021: Develop shared vision and principles; create outlines/work plans for individual committees; draft Healthy and Productive Ecosystems plan.

December 2021 – March 2022: Release draft plan for review and solicit public comments.

March – June 2022: Make revisions based on public input, finalize plan, and release in summer 2020.

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