Implementing the NiSource

Multi-Species Habitat Conservation Plan


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A Framework for Strategic Mitigation Using
Green Infrastructure Network Design and Decision Support Tools

THE CONSERVATION FUND

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Executive Summary

The Conservation Fund successfully completed a project supported by a Section 6 Cooperative Endangered Species Conservation Fund grant entitled: “Determining Mitigation Needs for NiSource Natural Gas Transmission Facilities - Implementation of the Multi-Species Habitat Conservation Plan (MSHCP).” As a complementary effort to NiSource’s development of a MSHCP, the Fund developed a geographic ecosystem-based decision support framework that helps find the best locations for mitigation for impacted federal listed species addressed by the MSHCP. This transparent, defensible decision-making process for selecting mitigation projects serves as a model for future strategic mitigation efforts to harmonize green and gray infrastructure. This report summarizes the key elements of the Section 6 project.

The Case for Strategic Mitigation

Within 'gray' infrastructure development in the United States, such as new roads, utility lines, energy facilities, and pipelines, avoidance and minimization strategies are first applied to address impacts on federally listed threatened and endangered species. When unavoidable impacts occur to federally listed species and/or their habitat, compensatory mitigation is required from the United States Fish and Wildlife Service (USFWS), which administers the Endangered Species Act (ESA). Traditionally, USFWS addressed the impacts of gray infrastructure projects through a permitting process outlined in Section 7 of the ESA. Often Section 7 permits are anchored to the impacts of an individual construction project or maintenance projects and require mitigation to be located on site or in very close proximity to the project. This approach, while intended to protect the federally listed species, has resulted in compensatory mitigation occurring on an incremental, project-by-project basis, often at a smaller scale that does not yield the maximum benefits for the impacted species or for the project developer. Within the past few years, mitigation has begun to be addressed before the construction phase, with a proactive regional scale approach in an effort to improve conservation outcomes.

For compensatory mitigation projects to deliver the greatest 'bang for the buck' and to take advantage of economies of scale from pooling the impacts of many projects together, it is critical to establish a transparent, defensible decision-making process for selecting mitigation projects. The Conservation Fund (the Fund), through its project within the NiSource Multi-Species Habitat Conservation Plan (MSHCP), has developed a decision support framework that helps decision makers find the best locations for mitigation. The NiSource project serves as a model for future strategic mitigation efforts involving green and gray infrastructure.

The NiSource MSHCP decision support framework has four main elements:

1. **Identify mitigation needs:** Establishing a transparent process to ensure that mitigation requirements are clearly defined and based on the best available science and stakeholder review.

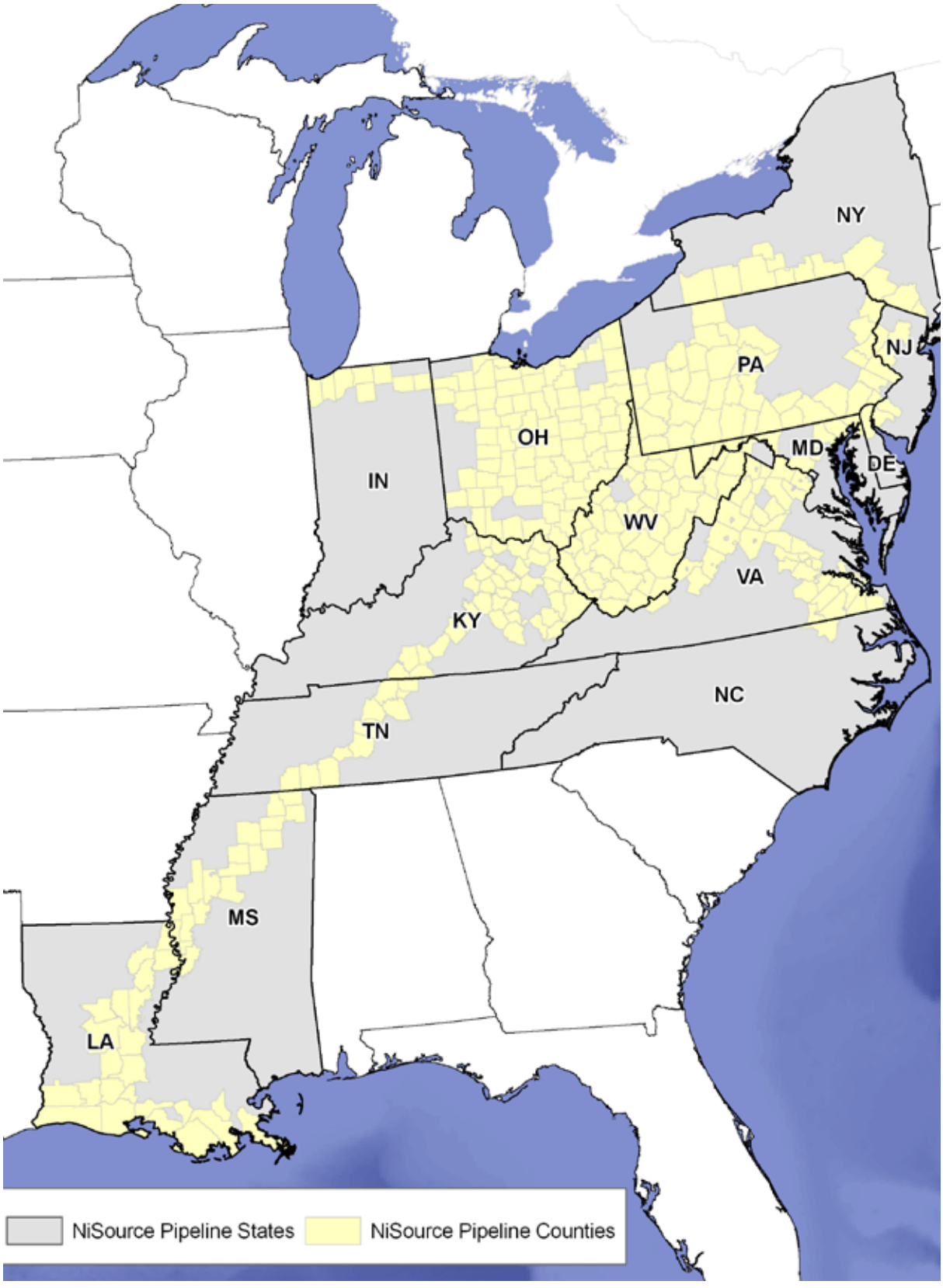
2. **Design a green infrastructure network:** Providing a framework for potential mitigation actions within a strategically planned, interconnected natural resource network, based on the latest peer reviewed science that also provides multiple ecosystem benefits.

3. **Establish mitigation project selection criteria:** Defining criteria that are based on available resource data and that are applied in a logically consistent manner and are consistent with regulatory requirements.

4. **Evaluate and select the best projects:** Developing a process to identify projects that provide the greatest benefit at the lowest cost within constrained budgets.

This report describes key tools that can be used to implement a strategic, advance mitigation framework, including facilitated focus groups, green infrastructure network design, the logic scoring of preference (LSP) method and optimization.

NiSource MSHCP and Section 6 Project Overview



NiSource Inc. (NiSource), a Fortune 500 natural gas transmission and storage company, operates a 15,500 linear mile network of natural gas pipelines covering over 6.4 million acres through 14 states. NiSource pipelines extend from the Gulf of Mexico to New York and from the Atlantic coast to the Great Lakes (see map). The company annually delivers nearly a trillion cubic feet of gas to nearly four million customers.

In compliance with Federal law, NiSource has traditionally conducted numerous biological consultations annually on federally listed threatened or endangered species that might be affected by routine pipeline construction, operations and maintenance. This permit-by-permit, year-by-year approach, in addition to being costly and time-consuming for the company and USFWS, is also ineffective at addressing the habitat protection needs of the affected species.

In an effort to enhance this process and generate better conservation outcomes, NiSource and USFWS embarked upon a MSHCP that, when completed, would allow NiSource to operate under a single, consolidated permit for the next 50 years covering 44 federally listed threatened and endangered species. The MSHCP would include measures NiSource can take to avoid, minimize, and mitigate their potential impacts to covered species. Under the plan, NiSource would fund the mitigation projects needed to satisfy their compensatory mitigation required for the covered species over the next 50 years.

As a complementary effort to the MSHCP, the 14 affected state natural resource agencies received an Endangered Species Act Section 6 Cooperative Grant to design a consistent and effective mitigation approach across the NiSource system. The state natural resource agencies enlisted the assistance of the Fund to develop a decision support framework that help find the best locations for mitigation that meet the requirements of the MSHCP. In partnership with the states, NiSource, and USFWS, the Fund mapped a green infrastructure network, identified potential mitigation opportunities, and designed decision support tools that will ensure implementation of strategic mitigation for the MSHCP.

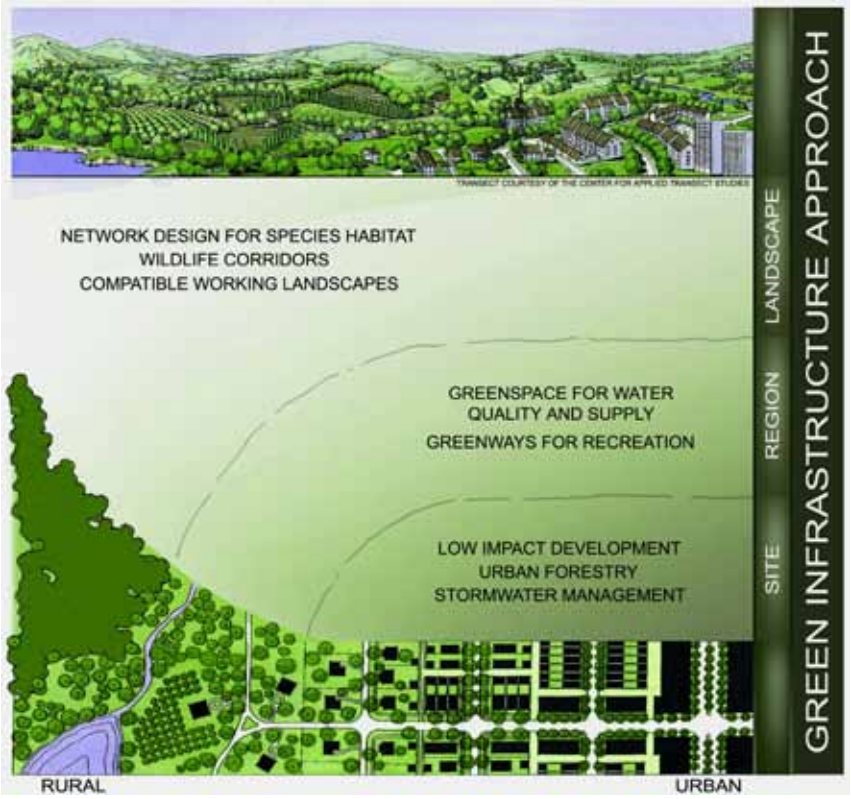
1. Identifying Mitigation Needs

As part of implementing the NiSource MSHCP, the Fund established a transparent process for USFWS, NiSource, and the states to ensure that mitigation requirements were clearly defined and based on the best available science.

A key element of this process was a series of focus group meetings with staff and species experts from state natural resource agencies, staff from The Nature Conservancy and USFWS personnel convened in 2008 and 2010 at pivotal moments in the project. The primary purposes of the first set of focus group meetings were to introduce states to the concept of green infrastructure, obtain targeted information on criteria and thresholds for the green infrastructure network design, and solicit feedback on an initial set of potential mitigation opportunities. The second set of focus group meetings centered on obtaining targeted feedback on mitigation project selection criteria and refinement of the list of potential mitigation opportunities for NiSource MSHCP take species. In between the two sets of focus group meetings, the Fund solicited feedback from the states, NiSource, and USFWS on the draft green infrastructure network design protocol document.

2. Designing a Green Infrastructure Network

Utilizing a green infrastructure approach provides NiSource, USFWS and the state natural resource agencies with a robust planning method to integrate species habitat mitigation within the context of an interconnected network of lands and waters, providing multiple benefits across the entire range of NiSource's natural gas pipeline transmission activities. Such an approach will also ensure a consistent methodology is used to determine selection of mitigation. The methodology employed in this process was accepted by the 14 participating states in the process. The green infrastructure network was not used to determine how much mitigation should occur in response to a take, but rather will be used to guide the types and locations for such mitigation opportunities at an ecosystem level.



What is Green Infrastructure?

Green Infrastructure is defined as a strategically planned and managed network of natural lands, working landscapes, and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations. Green infrastructure is a well established planning method that recognizes that limited resources are available to identify and protect the lands most suitable for conservation and that competing values, needs and opportunities must be evaluated to develop the most efficient and effective land conservation strategies. The green infrastructure approach has been utilized by numerous states and local communities within the NiSource service area.

Green Infrastructure is based on the well-established principles of landscape ecology and conservation biology. The network consists of core areas, corridors, and hubs that provide essential habitat to endangered and threatened species and that link to broader natural functions and processes at the ecosystem scale.

Cores

are areas that contain well-functioning natural ecosystems, and provide high-quality habitat for native plants and animals that meet a minimum size threshold based on landscape conditions (see diagram on following page). These are the nucleus of the green infrastructure network.

The Fund collaborated with the state natural resource agencies on the selection of core habitats for the 14-state area. For this project, forests, wetlands, and aquatic systems were selected given the landscape characteristics of the area. Cave and karst systems also were analyzed, but mostly were addressed through species modeling work completed for the Indiana Bat (*Myotis sodalis*) and Madison Cave Isopod (*Antrolana lira*). Mapping these core habitats helped visualize an interconnected network of forests, wetlands, and aquatic systems where mitigation projects could be strategically implemented to meet the requirements of the MSHCP that also advanced other conservation objectives.

Core Forests

are contiguous areas of relatively undisturbed, mature forest with a minimum size threshold based on landscape conditions. For a current green infrastructure project ongoing in Maryland, core forest areas had to include forest blocks with at least 247 acres (100 hectares) of mature interior deciduous or mixed forest habitat that provided habitat for a majority of forest interior dwelling birds in the study area.

Core Wetlands

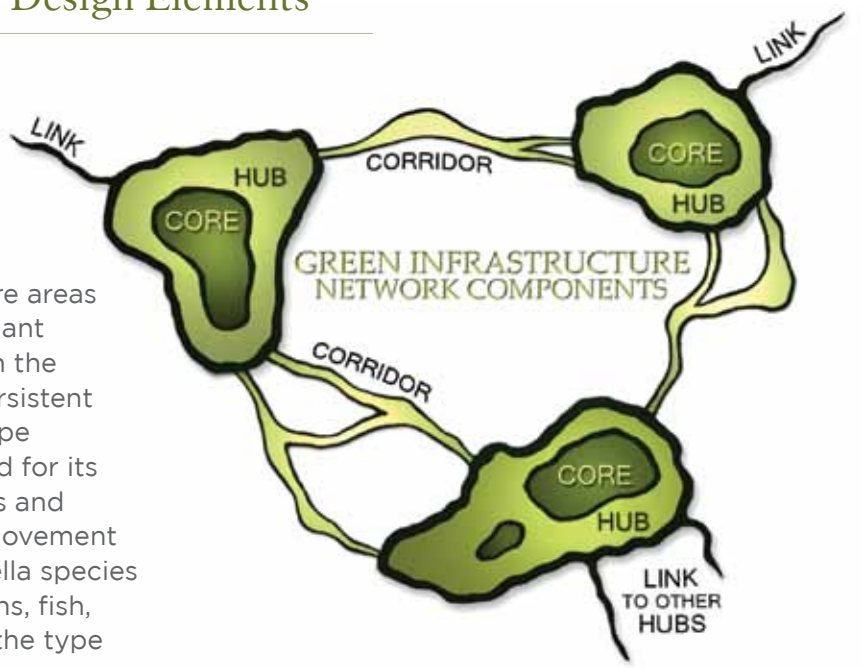
are contiguous natural areas with relatively undisturbed wetlands that meet a minimum size threshold based on landscape conditions. For a recent green infrastructure project in Delaware, core wetland areas had to be at least 25 acres (10 hectares) in size and include habitat for umbrella species dependent upon riparian forest (Louisiana waterthrush, wood turtle), forested wetlands (Prothonotary warbler), wetland-forest complexes (amphibians, turtles), and/or marsh (Least bittern).

Core Aquatic Systems

contain a threshold amount of relatively unimpaired streams based on landscape conditions plus associated riparian forest and wetlands. Umbrella species for aquatic systems often include fish, mussels, and benthic macroinvertebrates. For a recent green infrastructure project in Delaware, core aquatic systems had to contain at least a kilometer of streams with minimal impacts from channelization, dams, and road culverts.

These core areas were combined with corridor and hub areas to create a characterized green infrastructure network map that shows the overlap of the core habitats. Core areas are not mutually exclusive. In fact, the overlap of core areas demonstrates locations where protection of natural systems will likely benefit numerous species that may be dependent on multiple landscape types throughout their life cycle.

Green Infrastructure Network Design Elements



Corridors

are linear features that link core areas in order to allow animal and plant movement between them with the goal of creating viable and persistent metapopulations. The landscape between core areas is assessed for its linkage potential, and conduits and barriers to wildlife and seed movement are identified. Corridor umbrella species can include reptiles, amphibians, fish, and mammals, depending on the type of linkage.

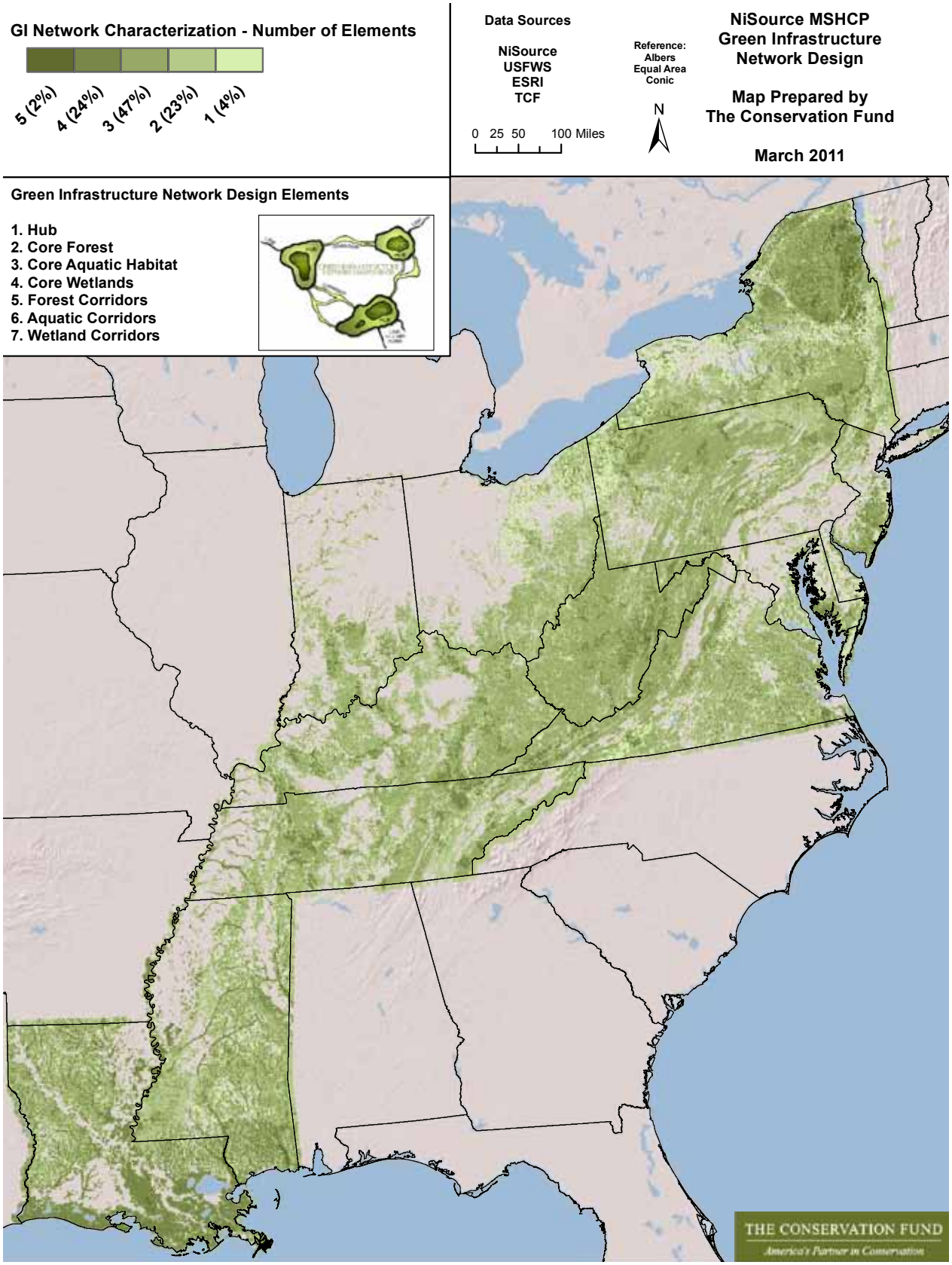
Hubs

are aggregations of core areas, other habitat, and other natural land, divided by major roads or gaps that meet a minimum size threshold based on landscape conditions. Hubs are intended to be large enough to support populations of native species, serve as sources for emigration into the surrounding landscape, and link to areas outside the extent of the analysis area for a particular project.

Umbrella and keystone species native to an area are used to determine size, connectivity, and other thresholds in the green infrastructure network design. Umbrella species are a species or group of species, such as forest interior dwelling birds, whose habitat needs overlap those of other animals and plants. Keystone species are those with an important role in ecosystem function, such as pollinators and top carnivores. Habitat preferences of umbrella and keystone species help identify core areas and hubs. Connectivity requirements of less vagile (i.e. mobile) species (e.g., amphibians and small mammals) are used to model corridors. When sufficient habitat is protected to sustain umbrella and keystone species, other important components and microhabitats will be encompassed and are more likely to be protected as well.

The Fund collaborated with the state natural resource agencies and USFWS to identify umbrella and keystone species as well as establish appropriate criteria and thresholds for the green infrastructure network. The resulting network design protocol was used to guide the Geographic Information System (GIS) network design modeling.

Green Infrastructure Network Design



3. Establishing Mitigation Project Selection Criteria

Each species addressed by the MSHCP has a set of project selection criteria that will be used to help evaluate and rank potential mitigation projects. The MSHCP currently includes nine species where potential mitigation projects meeting specific requirements will need to be identified over the 50-year timeframe of the MSHCP (see table). These species are referred to as take species, as USFWS has to calculate the number individuals with each listed species impacted by activities and how much mitigation is required.

The Fund generated a list of mitigation project selection criteria (known as a 'decision tree') for each species based upon analysis within the MSHCP. These decision trees have been designed using a state-of-the-art method known as 'logic scoring of preference' (LSP) to ensure that all criteria and weightings are designed to reflect fundamental properties of human reasoning and ensure that the benefits calculated accurately reflect the desired intent of decision makers.

Each decision tree evaluates to what extent a potential mitigation project meets the particular take species habitat mitigation requirements (including habitat quality, location, likely protection in perpetuity, and protection of other listed species) as well as how it supports the green infrastructure network design, advances state and regional planning goals, and leverages other financial and partnership resources. Examples of these decision trees are shown on the following page.

Each criterion spans a range of characteristics from most to least suitable in terms of meeting species mitigation requirements. Where each project falls within this range is represented numerically on a standard scale from 0-100 that represents how well it satisfies that particular criteria (100 being the highest). In addition to the score for each criterion, weights are assigned relative to other criteria within its 'branch of the tree' since some factors are more important than others in evaluating a potential project. In addition, criteria have a 'logic structure' that designates them as mandatory, sufficient, or desired based on their contribution to species protection. The criterion scores, weights, and logic structure have been assigned through scientifically rigorous techniques in consultation with species and decision support experts from USFWS, the States, and the Fund.

NiSource MSHCP Take Species Requiring Mitigation

- Bog Turtle
- Clubshell
- Fanshell
- Indiana Bat
- James Spinymussel
- Madison Cave Isopod
- Nashville Crayfish
- Northern Riffleshell
- Sheepnose

Madison Cave Isopod Decision Tree & Elementary Criteria

KEY
Bold - Criteria where values are directly input into ISEE v1.1

Italic - Catagories with logic structure (i.e. mandatory/desired, simultaneity, replaceability)

1 Madison Cave Isopod Mitigation Projects
- 11 *Habitat Mitigation Needs*
  - 111 *Mandatory Requirements*
    - 1111 **Mitigation Units**
    - 1112 *Site Assessment*
      - **11121 Parcel Size**
      - **11122 Scope of Protection**
    - 11113 *Physical Conditions*
      - **11131 Hydrologic Linkages**
      - **11132 Karst Surface Drainage**
      - **11133 Karst Feature Density**
      - **11134 Vegetative Cover**
    - 1114 *Species Occurence*
      - **11141 Isopod Density**
      - **11142 Population EO Rank**
    - 1115 ***Project Location***
  - 112 *Desired Characteristics*
    - 1121 *Protection in Perpetuity*
      - **11211 Point & Nonpoint Polllution Risk**
      - **11212 Sedimentation Risk**
      - **11213 Human Disturbance Risk**
      - **11214 Water Withdrawal Risk**
      - **11215 Project Monitoring**
    - 1122 *Listed Species Protection*
      - **11221 Nisource MSHCP Take Species**
      - **11222 Federal & State Listed Species**
- 12 *Strategic Conservation Goals*
  - **121 Green Infrastructure Network**
  - 122 *Adopted Plans & Leverage*
    - **1221 State Wildlife Action Plans**
    - **1222 Conservation Planning**
    - **1223 Collaboration**

GREEN INFRASTRUCTURE NETWORK

121

Value	%
0	0
1	50
2	70
3	80
4	90
5	100

Characterized green infrastructure network.

The value is generated by combining the following GIS layers: GI hubs (2 points), GI core forest (1), GI aquatic areas (1), GI wetlands (1) and GI corridors (1). The maximum number of points is 6, and 5 points is sufficient for complete satisfaction of this criterion.

The value is a proxy for the contribution of the mitigation project to the protection of an interconnected network of natural resource lands. This criterion is not a mandatory requirement.

4. Evaluating and Selecting the Best Projects

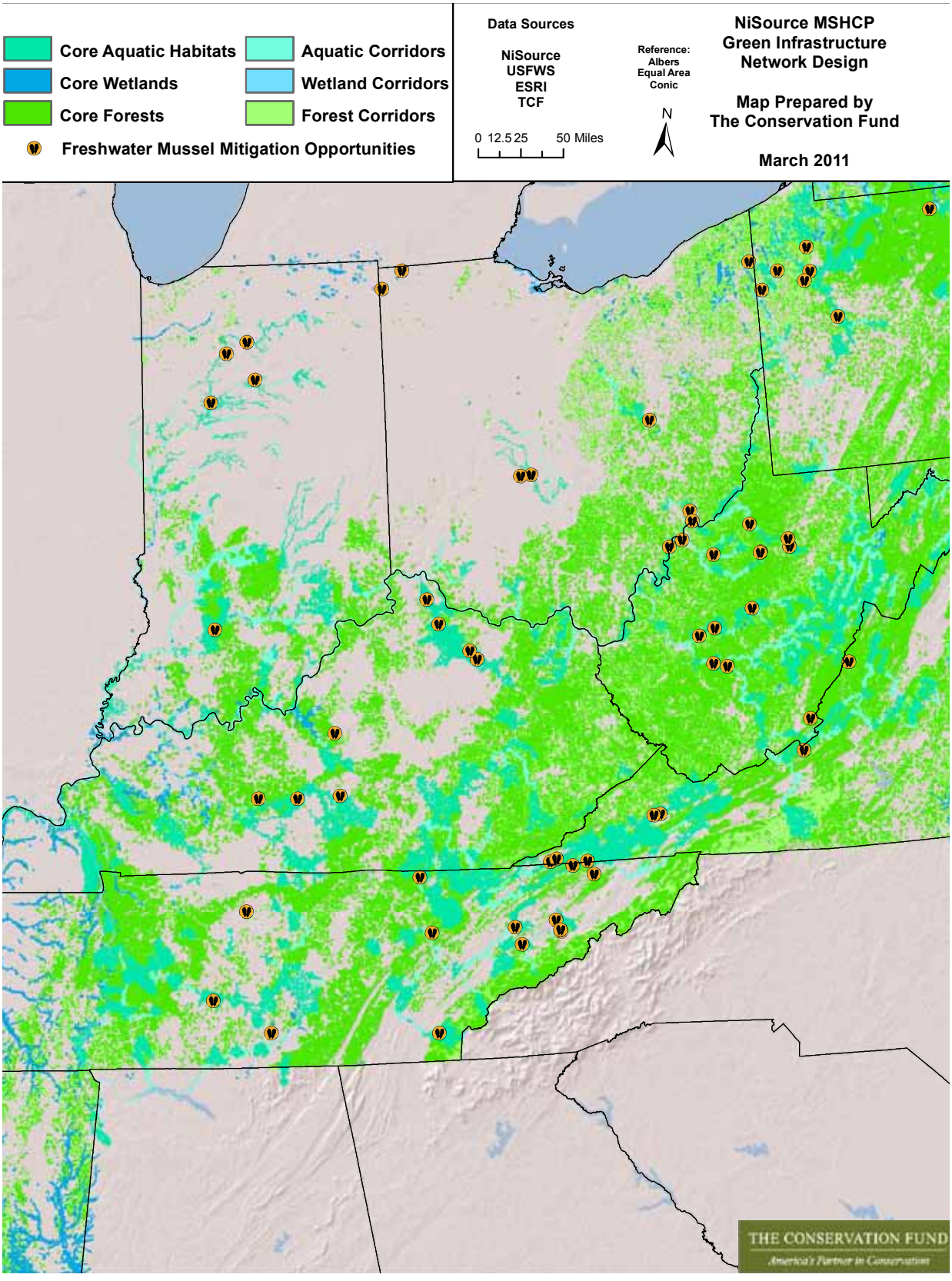
While all mitigation project selection will be governed by the decision making process outlined in the MSHCP, the Fund has designed a decision support framework that can be used to select mitigation projects that best meet NiSource's compensatory mitigation needs. This approach is currently under advisement by NiSource. The Fund has collaborated with Dr. Jozo Dujmović, one of the world's pioneers in the use of LSP for decision making, to design a customized desktop software package (ISEE v1.1) and a web-based application (LSPweb v1.0) to support the ongoing refinement of the species decision trees as the MSHCP begins to be implemented in 2011.

Potential mitigation projects would receive a numerical score on a 100-point scale that represents the percent satisfaction that the project meets the decision tree criteria. The LSP software tools ensure that criterion scores, weights, and logic structure are structured properly and follow the scientifically rigorous techniques of the LSP method. A project's percent satisfaction, when combined with the costs of implementing the project, can be used to help evaluate and rank potential mitigation projects. When trying to select a single project to meet mitigation requirements, the LSPweb application streamlines the selection process and helps clarify the tradeoffs involving benefits and costs for potential projects.

In situations where a large number of projects need to be selected concurrently within a relatively fixed budget constraint, tools using the concept of optimization are most suitable for helping to select multiple projects at a time. The Fund has collaborated with Dr. Kent Messer from the University of Delaware to develop the Optimization Decision Support Tool (ODST). The ODST is an Excel™ (soon to be web-based) application that allows users to evaluate mitigation opportunities based on a variety of evaluation techniques: (1) identifying an optimal set of mitigation projects within a fixed budget constraint, (2) exploring the relative cost effectiveness of mitigation projects and selecting the portfolio with the highest benefit: cost ratio, and/or (3) identifying the minimum cost required to achieve a defined benefit level.

The Fund believes that the LSP and optimization tools will assist decision makers in dramatically extending the limited financial resources devoted to mitigation. Previous projects have demonstrated that the application of optimization to conservation programs results in significantly more acreage conserved with higher overall conservation benefits than more traditional approaches.

Mitigation Project Opportunities



Conclusion

The decision framework developed for the NiSource MSHCP can be applied to other habitat conservation plans and to other types of mitigation and environmental stewardship efforts including transportation, wind energy facility siting, and other forms of 'gray infrastructure'. Called "one of the most ambitious environmental agreements in U.S. history" by the Wall Street Journal, the NiSource MSHCP and the decision tools within the project, truly represents a new approach of balancing nature and commerce. Green infrastructure planning provides an opportunity to uncover the best mitigation sites and helps to identify mitigation opportunities that also advance community planning objectives.

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