**Tennessee Freshwater Mussel Strategic Plan:**

**Overview of Conservation Planning GIS/database tool**

**The Nature Conservancy, Tennessee Chapter**

**April 18, 2011**

## Background

The State of Tennessee has historically supported 129 of the nation’s 300 native freshwater mussel species (Order Unionoida), making it the second-most species-rich mussel fauna of any state. Unionoid mussels are proportionally the most imperiled group of animals in the State of Tennessee and in the United States. The dramatic demise of this fauna nation-wide has occurred since industrial development and modification of rivers during the last century, resulting in the extinction or significant decline of over 70% of these species. Within Tennessee, the U.S. Fish and Wildlife Service (USFWS) has listed 40 mussel species as endangered under provisions of the Endangered Species Act of 1973.

The Tennessee Wildlife Resources Agency (TWRA) and the USFWS are the regulatory bodies primarily responsible for conservation and management of Tennessee’s mussels. These agencies collaborate with other government agencies, nonprofit organizations and the public to fund, implement, and ensure effective resource stewardship. Over the past decade, these cooperative efforts have resulted in the development of various tools and publications to help guide recovery and conservation efforts of mussels including the Tennessee State Wildlife Action Plan (2005), a Plan for the Controlled Propagation, Augmentation, and Reintroduction of Freshwater Mollusks of the Cumberlandian Region (“Cumberlandian Plan” 2009), and natural heritage databases (Tennessee Department of Conservation, Tennessee Valley Authority, USFWS). However, none of these references provides a comprehensive and cohesive plan that focuses on all aspects of mussel recovery and conservation, including habitat protection and restoration, with the goal of guiding overall conservation efforts for native freshwater mussels in Tennessee.

The intention of the Core Team partnering on this recent effort is that the Tennessee Freshwater Mussel Strategic Plan will utilize the products of previous planning efforts and cooperative input from regional mussel experts and the public to produce a comprehensive, adaptive, and effective strategy for the recovery and conservation of Tennessee’s native freshwater mussels. The Nature Conservancy is serving as the coordinator and lead planner for this effort, which also includes representatives from the USFWS, TWRA, TN Department of Environment and Conservation, National Park Service, Tennessee Valley Authority, and the US Army Corps of Engineers.

## Vision

The vision of the Tennessee Freshwater Mollusk Strategic Plan is to conserve Tennessee’s freshwater mussel fauna and ensure its ecological function in perpetuity. The specific goals of the Strategic Plan follow.

1. Identify and protect high quality freshwater mussel habitat.
2. Identify and prioritize historic mussel habitats in need of restoration.
3. Facilitate responsible and coordinated reintroduction, augmentation and propagation efforts and support the state and regional facilities needed to achieve these activities.
4. Maximize efficiency of and increase capacity for freshwater mussel recovery and restoration.
5. Foster partnerships that support the conservation and stewardship of native mussels in Tennessee among State agencies, Federal agencies, and the public

**Overview of Conservation Planning GIS/database tool**

The Nature Conservancy (TNC) previously worked with the Tennessee Wildlife Resources Agency on the development of the State Wildlife Action Plan (SWAP 2005). As part of this planning effort, TNC experts developed a database and spatial mapping tool to manage the large amounts of data on Species of Greatest Conservation Need (SGCN), their habitats, and problems affecting these species and habitats. The database and mapping tool are a combination of ESRI ArcView and Microsoft Access database software products, which allows the user to examine both database and spatial information through series of unique queries.

At the time of its initial development, the SWAP tool compiled seven different datasets of SGCN element occurrence records from state and federal Heritage programs as well as academic sources. Over 171,000 SGCN records were included at the time, as well as information on terrestrial, aquatic, and subterranean habitats. This tool allowed for a spatially explicit prioritization of habitats and locations statewide that were critical for SGCN conservation, including freshwater mussels. In addition, the database architecture allows for the incorporation of new datasets as they become available over time.

For the Freshwater Mussel strategic planning effort, TNC gathered more element occurrence information for both mussels and their host fish, particularly in the Tennessee & Cumberland river basins. Altogether, TNC added 3,000 more mussel occurrence records and over 113,000 host fish observation records to the database. Information on 126 potential recovery sites previously captured only in word processing format by the Cumberlandian Plan was also converted and included in the database. Compiling the information into the database now allows for both tabular and map summaries to be produced by species, host fish species, and stream location. Many data presentation and analysis options are now available to the planning team as they develop conservation strategies.

TNC made another major improvement in the GIS/Access tool by compiling available spatial datasets that can help further our understanding of habitat suitability for mussel recovery at both the landscape and site levels. “Point” source water quality data consists of information from TDEC’s Water Pollution Control datasets, which contain several different types of permit information. This data was classified according to each permit’s general association with different potential stressors including agriculture, development, mineral extraction, and hydrologic change. Other point data comes from the National Inventory of Dams, which also includes data on reservoir size and storage capacity. This data can be used to look at potential connectivity as well as hydrologic stresses in a watershed.

“Nonpoint source” data used for current habitat condition assessments include the latest Southeast GAP vegetation classification (based on 2000 satellite imagery), the land parcel classification dataset from the Tennessee Department of Economic and Community Development, and the NRCS Crop Survey data from 2009. The GAP data is a very good dataset for understanding the distribution of natural systems; the ECD land parcel data allows for a clearer identification land uses in urban and suburban areas. TNC took the list of crops in the NRCS dataset and developed a ranking system (1-5) according to the level of potential stress to aquatic systems posed by different crop types. TNC also has developed a method for examining the location of future land development based on the UT Center for Economic and Business Research population projections for Tennessee. The cumulative future development model constructed by TNC is helpful in understanding which priority mussel restoration or protection sites may be under pressure from landuse change by urban/suburban expansion in the next 20 years.

When combining the current condition data with the species prioritization data, we can determine what problems our various priority geographies may be experiencing and better determine companion conservation strategies to reduce stresses to those habitats over time. These companion habitat recovery & restoration strategies will help ensure that species reintroduction and augmentation investments are more successful long-term.

The future condition assessment based on the TNC model allows us to understand what watersheds may be adversely impacted by greater urbanization. If certain priority geographies for species recovery appear to be under future development threat, do we need to invest heavily in those places? If so, what companion strategies must be put in place to make these efforts more successful? When looking at current and future condition outputs thus far, we can see that agriculture and mining tend to be constrained to certain geographies. However, urban development is much more widespread and could impact a number of priority geographies.

The final advancement of the GIS/Access tool being made at this time is the utilization of National Hydrography Dataset+ (NHD+) information. The NHD+ allows watersheds to be broken down into smaller scale catchments which are useful for analyzing both local scale and cumulative point and nonpoint source watershed impacts. TNC has used ArcGIS and the NHD+ to define the hydrologic connections between catchments and has incorporated the information on dam location and storage capacity from the National Inventory of Dams (NID). Combining the NHD+ and NID data allows us to see hydrologic disconnects created by dams of different sizes, which refines the capability of the spatial analysis to determine the most critical catchments for prioritizing conservation investments.