USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Developing a Model for Watershed Management Through Determining Water Quality and Land-use impacts on the Endangered Topeka Shiner (*Notropis topeka*).

Focus Categories:COV, WQL, M&P

Keywords: Fish Ecology, Land-use, Landscape management, Land-Water Interactions, Watershed Management, Water Quality Management, Urban Drainage, Bioindicators, Habitat Restoration, Landowner Attitudes, Endangered Species.

Duration: September 1, 1998 - August 31, 1999

Federal Funds Requested:$34,000

Non Federal Funds Pledged:$32,065

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Congressional District: Ninth Congressional District, Missouri

Statement of Critical Regional or State Water Problems:

Runoff from agriculture and urban land-use causes significant harm to stream ecosystems (Jones and Clark 1987; McDonnell and Pickett 1990) and fish communities (Steedman 1988). The identification of specific characteristics of these impacts (such as quantities and toxicity) on stream ecosystems is necessary for stream water and habitat quality management (Richards et al. 1996). Degrading habitat and water quality are thought to be the main factors leading to extirpation of Topeka Shiner (*Notropis topeka*) populations (Roth et al.1996), which has led the species to be listed as an endangered species in Missouri, and to its current consideration for emergency listing under the Federal Endangered Species Act. Understanding and managing for the specific causes of these extirpations depends on understanding the relationship between land-use and water quality upstream from the extirpation sites. It also requires understanding the attitudes of landowners upstream from extirpation sites as regards potential land-use regulations that could remedy Topeka Shiner extirpations.

We propose to begin the construction of a regionally applicable model that quantifies the relationship between land-use and water quality relative to Topeka Shiner populations. This model will also integrate statistically valid information concerning landowner attitudes with possible land-use change scenarios necessitated by Topeka Shiner recovery objectives. Potential users of our Topeka Shiner recovery model include federal governments, such as The U.S. Fish and Wildlife Service; regional governments such as the Departments of Conservation and the Departments of Natural Resources of many Midwest states; local governments such as the Boone County Commission, Soil and Water districts, and the City of Columbia. Our model will specifically benefit Dr. Bruce Menzel, Chair of the Department of Animal Ecology, Iowa State University, who is working on a Topeka Shiner recovery effort in several Iowa watersheds. It will also be of interest to conservation groups such as Show-Me Clean Streams, a citizens group currently working to restore watersheds in Missouri, which has already requested our results.

Statement of results or benefits:

By modeling historic land-use change in a watershed that has experienced Topeka Shiner population extirpations (a basin where information exists on formerly occupied sites) we will derive a model that is potentially applicable on a regional level that we can use to

assist in species recovery. We will then test this model on selected watersheds in Iowa that are also experiencing Topeka Shiner extirpations. This model will integrate spatial information (through reliance on GIS-related technologies) concerning land-use, water quality, and currently occupied and unoccupied sites where Topeka Shiners had previously been found, and spatial information on landowner attitudes. It will include information gathered on a spatial scale that includes the entire watershed upstream from a site, as this has been found to be the best predictor of site-to-site variation (Roth et al. 1996). Landowner attitudes will also be considered within a spatial framework. Because landowners own the land on which management techniques would need to be implemented, it is crucial to integrate their attitudes towards land-use changes (as outlined by the Missouri Department of Conservation's *Topeka Shiner Action Plan*) into a species recovery model.

Due to the increasing influence of urban and agricultural land-uses in developing watersheds on species' habitats, especially as regards endangered species such as the Topeka shiner, we feel that a project that addresses these impacts, through modeling watershed processes and analyzing land-use decisions, is highly relevant at this time. We will develop specific models that represent people's attitudes and practices that are the cause of Topeka Shiner depletion, which could lead to future successful watershed remediation projects.