



RESEARCH SERVICES

OFFICE OF POLICY ANALYSIS,
RESEARCH & INNOVATION

TECHNICAL SUMMARY

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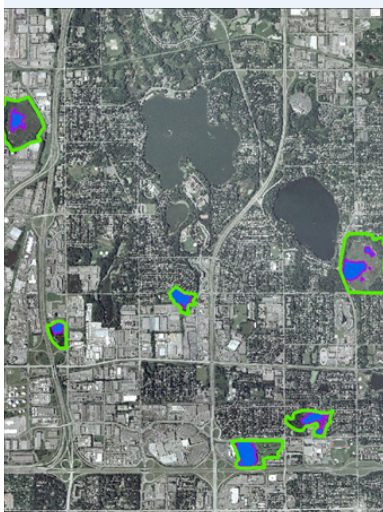
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Principal Investigator:

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PROJECT COST:

\$158,872



Researchers used geographic information systems software to map Twin Cities metro area wetlands and buffers.

Protecting Urban Wetlands with Buffer Zones

What Was the Need?

Mn/DOT has long recognized the importance of preserving and protecting the state's many wetlands. These marshes, swamps and bogs provide habitat to a wide diversity of plants and animals that could not otherwise thrive. Sustaining this ecosystem requires a minimum water quality, which is influenced by the runoff from upland areas. Runoff that contains sediments and chemicals from human activities such as farming, forestry and land development can negatively affect wetland ecosystems and reduce biodiversity.

Minnesota's [Wetland Conservation Act](#) requires that replacement wetlands of less than two acres be surrounded by a buffer zone at least 25 feet wide with no road, structures or other human activity. For all other replacement wetlands, the buffer has an average width of 50 feet with a minimum of 25 feet. These buffers help protect wetlands by filtering sediments and toxins out of the water running toward them, promoting the retention of nutrients in the soil, sheltering plants and animals from direct contact with adjacent human activities, and providing connectivity between the wetland and migratory destinations such as breeding grounds.

Research was needed to validate this minimum buffer width and to confirm whether width was an appropriate criterion for assessing how well buffers protect wetlands. Other potentially important criteria include vegetation, soil composition, land slope and surrounding land use.

What Was Our Goal?

The goal of this project was to evaluate the effect of buffer size and other characteristics on the ecological diversity and water quality of wetlands.

What Did We Do?

Researchers began by compiling a database with information about 64 wetlands in the Twin Cities metro area. Data included information on each wetland's size and type, levels of human disturbance and adjacent land use, water quality and chemistry, and Index of Biological Integrity scores for both plants and animals. These IBI scores represent the health of biological communities and the degree to which they have been impaired by human activities; IBI measures the abundance and variety of those plants and animals most sensitive to pollution.

Researchers then updated this database with topographical information to determine the characteristics of buffer zones adjacent to the wetlands, including the area of the contributing watershed, soil composition and hydrology, land slope, land use and buffer width in each direction from the wetland. This information was acquired using both aerial photographs and geographic information systems.

Researchers conducted a statistical analysis of the compiled data to ascertain any relationships between buffer characteristics, IBI scores and water quality. Statistical methods included linear regression, multidimensional scaling, recursive partitioning and clustering.

Using the assessment tool developed in this project, researchers can design buffers to meet the needs of a specific wetland, helping to save costs by avoiding efforts and land use that would not be effective in the given circumstances.

“This project gave us a good sense of what data we’ll need to collect going forward to conduct a more comprehensive analysis of wetland buffers.”

—Kenneth Graeve,
Botanist/Plant Ecologist,
Mn/DOT Office of
Environmental Services

“We developed a tool that should be very useful to agencies wishing to assess the impact of an existing or planned buffer on water quality and wildlife.”

—John Nieber,
Professor, University of
Minnesota Bioproducts
and Biosystems
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Buffers are limited in their ability to provide undisturbed connectivity to adjacent habitats in urban areas because of roads, houses and other developments, and do little to address the mortality of certain wildlife species at road crossings.

Finally, the Minnesota wetland buffer assessment tool was developed for evaluating the potential benefits of wetland buffers to water quality and wildlife when planning future Mn/DOT projects. This tool was applied to a subset of the wetlands studied through this project to show how it might work.

What Did We Learn?

Researchers did not find a statistically significant relationship between buffer characteristics and wetland water quality or ecological health. They concluded that establishing this relationship will require a larger data set with more detailed information on water level, water quality and ecological factors.

Researchers developed the Minnesota wetland buffer assessment tool, which uses a number of criteria (developed through a literature search) for rating how well buffers protect wetlands, including:

- Buffer width and area.
- The ability of the buffer to reduce stormwater volume and remove sediments, nitrogen and phosphorus from water flowing through it.
- Connectivity to adjacent habitats, measured by the amount of human disturbance within 500 meters of the wetland and the percentage of the wetland connected to upland areas.
- Vegetative characteristics, including diversity and the ability to provide cover to wildlife with benefits for such life functions as reproduction, feeding and migration.

This tool may be useful in designing buffers to meet a particular wetland’s specific wildlife and water needs. Its analyses in this study showed that while many metropolitan area wetland buffers are effective for increasing water quality, they probably have few benefits to wildlife. For the protection of wildlife, connectivity to adjacent habitats is a far more important factor than buffer width.

What’s Next?

The assessment tool still needs to be field-tested to evaluate its ability to predict the effects of any given buffer on habitat and water quality. Researchers recommend that Mn/DOT and other state and local agencies develop programs to more consistently and intensively monitor wetlands for water levels, water quality and biological diversity. Doing so will allow future studies to more definitively establish the effect of buffer width and other characteristics on wetlands.

This Technical Summary pertains to Report 2011-06, “Evaluation of Buffer Width on Hydrologic Function, Water Quality, and Ecological Integrity of Wetlands,” published February 2011. The full report can be accessed at <http://www.lrrb.org/PDF/201106.pdf>.