

Using GIS to Identify Critical Lands for Conservation

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More than 40 land trusts and conservancies exist in Rhode Island. Their mission is to conserve open space by purchasing land or the development rights to land. Although millions of dollars of federal, state, and foundation funds are available to buy land for conservation, there is not enough money to buy all possible open space. Tough decisions have to be made on what constitutes the most critical lands to preserve. To complicate the situation, decisions have to be made fast because sprawl and development are quickly transforming rural and coastal Rhode Island into suburbia. In our work with Geographic Information Systems (GIS) training, outreach, research, and database development, we are frequently asked by conservation organizations to identify which areas in a community are most important to preserve. The answer is simple: the best areas achieve the most conservation goals.

The fundamental premise of our model is that, all things being equal, a property that contains multiple resources has greater conservation value than a property with a single resource.

For example, a property that contains a unique habitat and sits atop a groundwater aquifer is important for both water resource protection and ecological preservation and offers greater conservation value than a single resource site. By targeting these areas within a particular community for acquisition, multiple conservation goals are achieved with limited budgets.

Critical resources vary with geography. We have organized our data into categories or resource themes that can be used by local conservation groups to determine relative value of one parcel over another. Each resource theme can be defined by one or many data elements used in our analysis, as follows:

Groundwater Resources

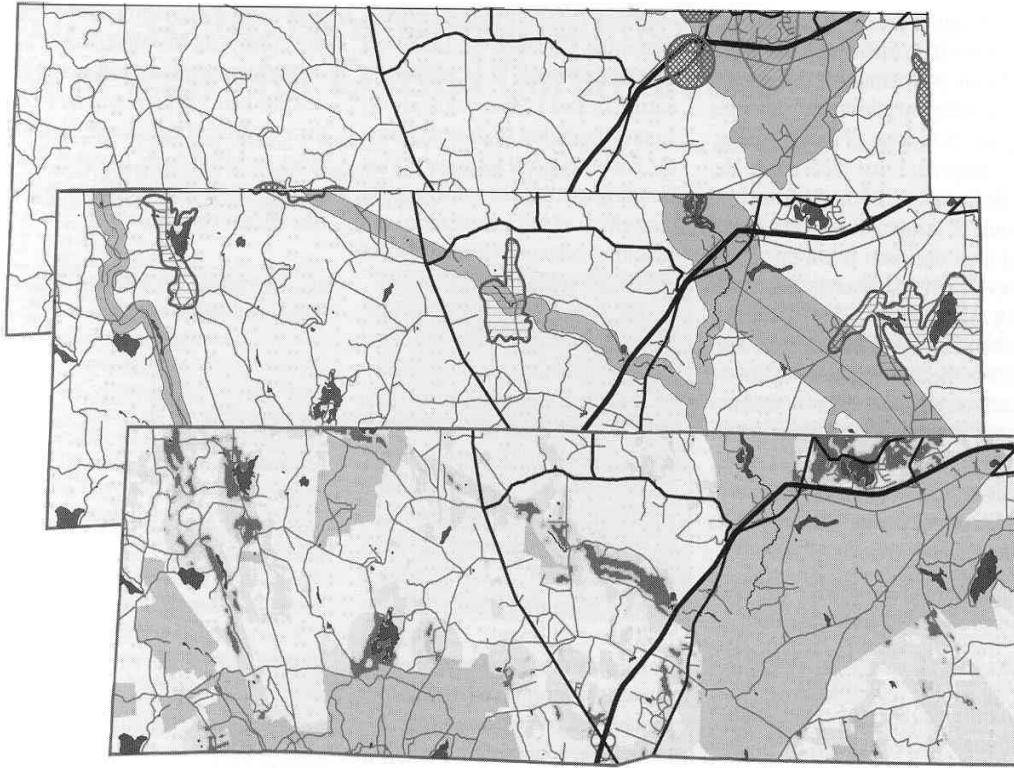
Groundwater is the source of potable water for many private households and public and private water supply companies in Rhode Island. Land uses can jeopardize groundwater quality (e.g., industrial uses, agricultural uses, dense residential areas with septic systems). Acquiring land that helps to protect groundwater quality, such as aquifers, recharge areas, and public wellhead protection areas, is an important conservation measure.

Surface Water Resources

Rivers, streams, lakes, and ponds are important for ecological, hydrological, and aesthetic reasons. They provide critical habitat for insects, fish, birds, and plants. The quality of our coastal and estuarine habitats depends on the quality of water they receive. In some areas, the rivers and streams drain into reservoirs, which provide drinking water for large numbers of people. Rivers, streams, lakes, and ponds are a recreational (fishing, swimming, canoeing) and aesthetic resource for many people. Lands adjacent to surface water resources are important targets for conservation.

Biodiversity Resources

The fauna and flora of a region are irreplaceable natural resources that, in many areas, are threatened by suburban sprawl, habitat fragmentation, and competition from introduced species. Many elements of the GIS database relate to the protection of biodiversity. Rare and endangered species and the habitats that support them are of fundamental importance. Large, contiguous tracts of native habitat are a buffer to fragmentation. Some habitats, such as fresh and saltwater wetlands, provide breeding or forag-



Priority areas for conservation are identified by mapping specific types of resources, which are overlaid to create a composite map. Shown here in light gray from top to bottom are groundwater resources, recreational resources, and the composite map for West Greenwich.

ing habitats for native and migratory animals. Lands adjacent to important habitats provide a buffer for those habitats. Other adjacent lands build corridors between the bioreserves.

Agricultural Resources

In southern New England and other densely populated regions of the country, farms are being consumed by suburban sprawl. Farmland protection has become an important conservation theme. Pastures and croplands set within a mosaic of forests, wetlands, lakes, and ponds create rural settings

with immense aesthetic value. These areas are defined by the GIS database as both locations of actual working farms and soil conditions that are suitable for agriculture.

Cultural, Recreational, and Aesthetic Resources

The public highly values lands that have significant recreational or aesthetic worth. Local conservation organizations also are concerned about protecting sites of historic or archeological importance. Data elements for these areas include points of histori-

cal and archaeological significance, sites of special scenic value (rural roads, scenic vistas), areas permitting public access to recreational targets (shoreline, ponds, rivers), and hiking or bicycling greenways.

Identifying Priority Areas for Conservation

Each of the five composite resource themes was overlaid to produce a final composite map. The composite map, excluding already protected areas, is the final result of the analysis and is used as a conservation-planning

guide. Based on the number of resources within each area, levels of priority can be determined ranging from areas of highest priority with multiple resources to areas of lower priority. It is important that users realize the scale limitations of the final result. It would be inappropriate to make plat/lot-level decisions based on source data from 1:24,000 or smaller scales (e.g., 1: 50,000 or 1:75,000). Furthermore, it is important that users realize that the highest priority regions are based on relative levels of occurrence in the study area. When large parcels of land are purchased or protected, they need to be removed from the final composite map and new values computed.

Implementing the Model: The West Greenwich Land Trust Case Study

In 1997, the West Greenwich Land Trust received funding from the U.S. Environmental Protection Agency through the Pawcatuck Watershed Partnership to identify priority areas for conservation. The Land Trust partnered with URI and commissioned a critical lands study. The Land Trust's mission is to preserve open space, wetlands, and surface and groundwater resources and to maintain existing agricultural, wildlife, recreational, scenic, and historic land use. As an entirely volunteer organization,

making the most of time and resources is essential. Therefore, the Land Trust has focused much of its education, outreach, and conservation efforts around the critical lands study, using the results as a tool for conservation planning, guiding the strategic planning efforts of the organization, and educating community members about critical resource areas.

The West Greenwich Land Trust has used the study results in several ways. In addition to the final composite map, individual resource theme maps (i.e., groundwater resources, agricultural resources) have proven to be invaluable when information on a particular resource was needed, such as agricultural preservation or drinking water protection. Identifying the resource value of a particular area also may prove to be very beneficial in making the case for future grant applications to fund conservation or preservation programs.

With the results of the study, the Land Trust has thus far:

- Created a database of property owners within priority areas;
- Conducted an outreach program that targets property owners, resulting in discussions about shared conservation interests;
- Obtained funding from Rhode Island DEM's Open Space Grant Program; and

■ Developed educational materials and displays for the community.

To date, the critical lands model we describe here has been used by more than a dozen Rhode Island communities and land trusts to guide their open space acquisition efforts (www.edc.uri.edu/criticallands). ■

Alyson McCann earned a BS in environmental studies from the University of Vermont and an MS in natural resources science from URI. She has more than 10 years experience working with GIS for natural resource protection and management. She has conducted numerous GIS training programs for municipalities, businesses, state and federal agencies, and educational organizations.

Duane Chapman received a BS and an MS in natural resources science from URI. He maintains the Rhode Island GIS database Web site for the Environmental Data Center. Chapman is working on a GIS model for prioritizing coastal wetland restoration efforts within Narragansett Bay and developing a protocol for municipalities to prioritize land acquisitions for open-space conservation.

Aimee Mandeville has worked on GIS projects for the National Park Service, RI Department of Environmental Management, and many Rhode Island communities. She has taught federal, state, and municipal employees how to use GIS techniques to help plan for growth. She earned a BS and an MS in natural resources science from URI and is a staff member of the Environmental Data Center.

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