

Title of Paper: The Trust for Public Land: Introducing the Greenprinting Model

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Abstract: The Trust for Public Land (TPL) has developed a proactive GIS modeling suite to prioritize greenspace and parkland acquisitions. The models incorporate criteria from a variety of data sources including demographics, water quality, land development, health and economic benefits data. These models are designed to be applied to a variety of geographies using local and nationally developed datasets. Once land acquisition priorities have been identified, TPL works with city and county governments and organizations to identify funding sources, take out partners and facilitates the transactions. Software used to develop and implement the model suite include ArcGIS, ModelBuilder, ArcGlobe, ArcGIS Spatial Analyst extension, and CommunityViz.

Paper Body

King County's Department of Natural Resources and Parks (DNRP) is charged with protecting the area's environment in a time of tight budgets and rising land prices. It is required by law to balance multiple competing and sometimes conflicting mandates, each run by a separate DNRP program: protecting endangered species habitat, developing new parks and trails, keeping agricultural land in production, forestry, and flood control.

Land acquisition is an important tool for DNRP. But its budget is limited, making it crucial to identify the most important parcels for protection. Now, working with the Trust for Public Land (TPL), a national conservation nonprofit, the county is completing an ambitious GIS project to prioritize its land-acquisition targets and help it get the biggest bang for its conservation bucks, in part through identifying acquisition targets that meet several of these mandates at once.

The GIS application TPL has developed allows county officials to visualize and better understand land-acquisition choices. Developed using ArcView 9, the application crunches data from approximately 50 data sets describing each of the county's more than 500,000 individual land parcels. The application was developed in partnership with ESRI business partners Earth Analytic Inc. and Foresite Consulting Inc., and with Jones & Jones, a landscape architecture firm. The team also worked closely with county officials. The county awarded a contract for the work in October 2003 and DNRP adopted the model in July 2004.

Balancing Farm Preservation, Flood Control, and Habitat Conservation

TPL calls its GIS process Greenprinting. By creating a Greenprint, a community, county, region, or state can identify priorities for conservation, park creation and land management. The King County project got started when TPL approached a variety of state, county and local officials about developing a Greenprint for the Puget Sound region. King County—which was already developing a land-acquisition plan—eagerly embraced the idea. The county had been looking for ways to better coordinate its land-acquisition work and had already accumulated significant GIS experience, including the creation of an online GIS Center, <http://www.metrokc.gov/gis>.

One main purpose of the new GIS modeling system is to help DNRP balance its goals of flood control, farm preservation, forestry, habitat conservation, and recreation. Programs to meet these goals often compete with one another for funds and meeting one goal sometimes makes it harder to meet another.

For example, over the past century many of the county's wild rivers were tamed, diverted into concrete channels, their curves straightened and their seasonal flooding blocked to control flooding and maximize agricultural acreage. But those changes destroyed important habitat for Chinook salmon and bull trout, both now listed as threatened species.

Today, DNRP is mandated to restore salmon and trout habitat, in part by removing some of the concrete straightjackets and letting rivers return to their natural, sinuous course. At the same time, DNRP must preserve working farmland and control flood hazards—goals that can be threatened by restoring rivers.

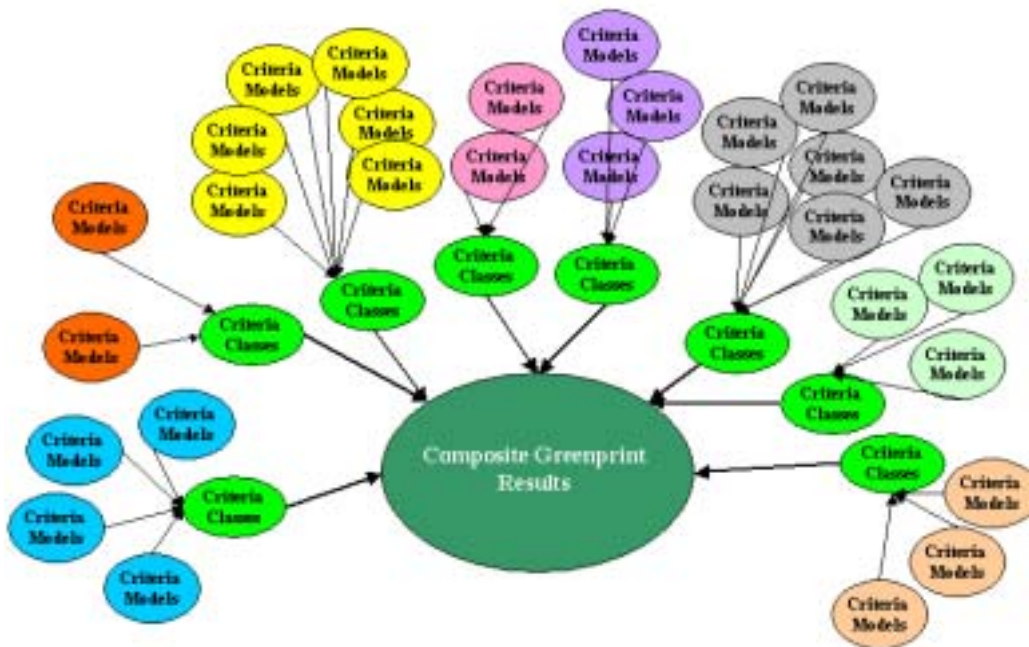
The King County Greenprint Model will help DNRP identify parcels where acquisition would meet multiple program goals. For example, the model will allow county planners to give priority to river restoration projects that would result in the lowest net loss of farmland or to farmland protection projects that improve habitat.

The model employs a broad range of data sets including:

- Natural resource data, such as the habitats of endangered species
- Water quality and hydrological data
- Landscape integrity data, such as wildlife migration networks and forest fragmentation
- Demographic and socio-economic data, helping identify population centers with little access to parks
- Regulatory data sets such as zoning layers, which identify lands with high conservation values that may also be attractive to developers
- A list of acquisition targets already identified by DNRP
- Proposed trail linkages; needed to connect local and regional trails and greenways

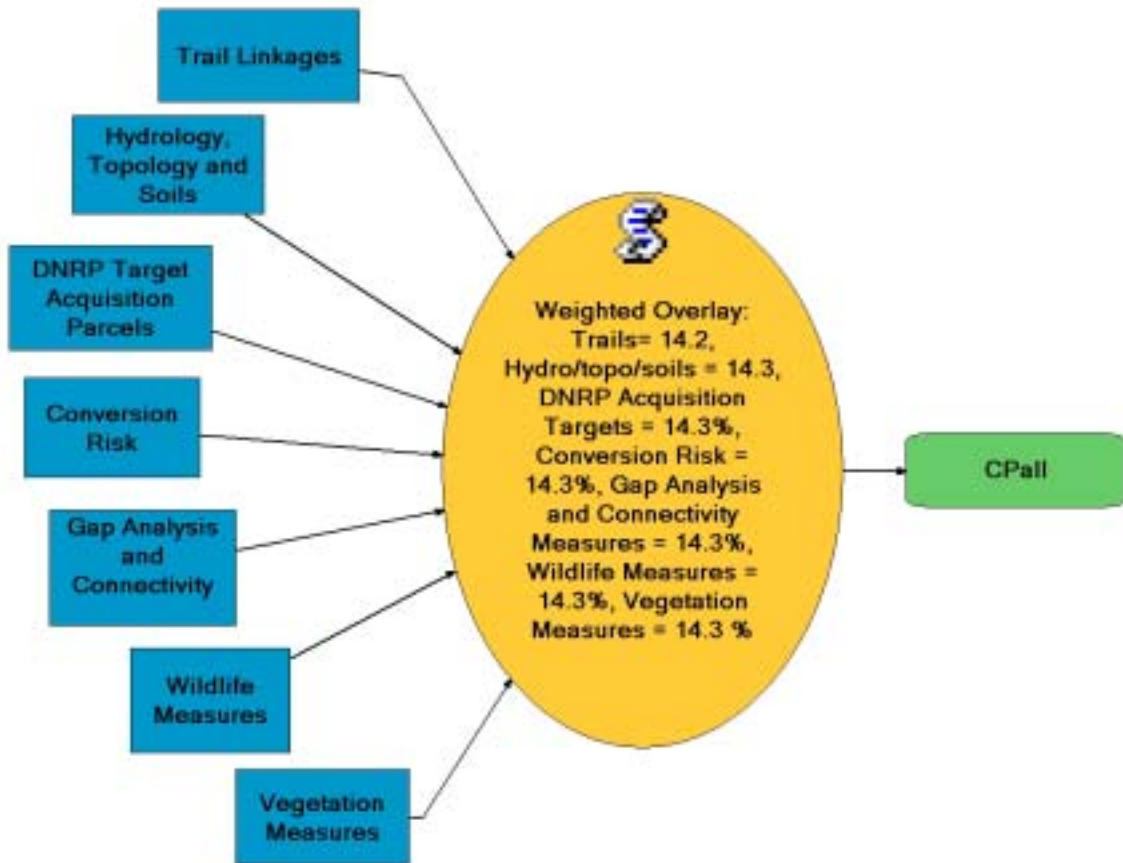
All data was organized into analysis criteria classes for assessing:

- hydrology, topography and soils conservation priorities
- wildlife considerations
- vegetative considerations
- a parcel's resource value
- gaps in existing parkland
- the risk that the land might be developed
- existing DNRP target acquisition parcels
- the value of the land in forming trail linkages.



We then set up ModelBuilder to create the model that would examine the data for as many as 50 sub-models within each of the criteria classes. This involved selecting which data categories it was important to analyze, the exact scope of some of the data elements to be analyzed, and how data should be ranked and weighted. Once the model was created, the submodels were run, creating a new raster layer that highlighted conservation priorities for that submodel. Then, the submodels were linked and a weight was assigned to each to form the final “conservation priorities” model layer.

CP All - Overall Conservation Priorities



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The final objective is to overlay the conservation priorities layer with the parcel data layer to determine parcel prioritization based on identified conservation values. Using zonal statistics, each parcel is scored based on a scale of 0-5, 0 being no conservation value and 5 being the highest conservation value. Once this layer is generated, users can begin to decipher landscape patterns to identify areas that can be conserved in order to meet King County's various conservation goals. Parcel ranking scores also can be used to establish a time-sensitive priority ranking for each parcel's potential acquisition. For example, parcels that have a score of 5, the highest conservation value, could be potential targets within the next year while parcels with a score of 3 might be placed on a potential acquisition schedule of 2-4 years.

Challenges, Solutions, and Strengths

The King County Greenprint is one of the first instances in which ArcGIS 9 Model Builder was used to model so large a landscape. TPL chose Model Builder, which it used with ArcView 9, in part because of its processing power and its ability to support the county's huge data set of 500,000 properties.

Model Builder also supports easy visualization of model flow and great model flexibility, including the ability to add additional model components, change the ranking and weighting factor of data elements, and implement completely new datasets.

Both TPL and the county also saw it as an advantage that county workers were already familiar with ESRI software—a potential benefit also for other communities where TPL might build similar models. “We wanted to create a tool that we could hand over to the client with the least amount of training and expense,” says Breece Robertson, TPL's Director of GIS Design and Applications. “Most of our clients nationwide are using ESRI software.”

Working on a large landscape raised significant challenges. Initially, TPL used vector data (point, line and polygon data) as input data for the model. But this led to slow processing speeds and long model run times. As a result, TPL converted all data into a raster format with a 100 foot cell size, and this cut processing time for submodels from 2 or 3 hours to 10 or 15 minutes.

One of the strengths of the model is its expandability as new conservation data becomes available. For example, Jones & Jones, a Seattle-based landscape architecture firm is building a “landscape integrity and scenic values” model that will quantify some of the intangible factors important to the experience of a landscape, such as its views. This layer aims to answer such questions as “where in King County can you go and see Mt. Rainier and the Cascades, the forests, the major riparian corridors, without seeing transmission lines and the city of Seattle, without seeing human impacts?” says Chris Overdorf, an associate at Jones & Jones.

Adding Human Knowledge

GIS is a powerful tool for communities engaged in proactive conservation planning, and it promises to become a more powerful tool as new data layers are developed and analysis becomes more sophisticated.

But GIS data is no substitute for the many layers of knowledge that conservationists and agency professionals accumulate over time. For this reason, the model was created with the close consultation of King County's staff, who had input on data, criteria, and prioritization. In one instance TPL developed a submodel to map where future regional trail connections could be located, only to learn that King County's regional trail planner had developed his own map of these missing links based on more than 30 years of institutional knowledge.

“After looking at his information, TPL decided they would abandon their submodel and use his information,” says Jennifer Knauer, DNRP’s project manager for the GIS system. “It’s the kind of information that really requires on-the-ground input that a model can’t do. Open space planning and conservation is an art as much as a science”

Roger Hoesterey, the director of TPL’s Northwest Region, who has been intimately involved with the Greenprint effort, agrees. “GIS data always has to be compared to what you actually see on the land,” Hoesterey says. “And in pursuing acquisitions you also have to include your knowledge of what land is available, what you can afford to purchase, what can be approved politically. “

"King County's growth challenges are straining our resources to make good land conservation decisions," says DNRP’s Marc Isaacson. “TPL's adaptation of Model Builder helped us with a new framework for analyzing and prioritizing our land conservation needs."

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Acknowledgments

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