



THE WOODS HOLE RESEARCH CENTER

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WHRC researchers use a "SLEUTH" to Predict Urban Land Use

According to NASA-funded researchers, developed land in the greater Washington-Baltimore metropolitan area is projected to increase 80 percent by 2030. Scientists used a computer-based decision support model loaded with NASA and commercial satellite images to simulate three policies affecting land use.

The researchers, Claire Jantz and Scott Goetz, from the University of Maryland, College Park, Md., and the Woods Hole Research Center, Woods Hole, Mass., also found a 39 percent increase in developed land in the region from 1986 to 2000. Some of the most striking changes occurred around the Dulles Airport area in Northern Virginia. "The satellite observations provided us with an unprecedented ability to monitor the urbanization process and capture the patterns of urban sprawl," Goetz said.

The study also showed how high resolution commercial imagery from Space Imaging's IKONOS satellite can be used to complement NASA's imagery from Landsat satellites. IKONOS images, with resolutions up to one meter (3.28 feet), were used with county-level air photos to link to 30-meter Landsat observations, which cover vast areas and offer a longer time frame for assessing urban change.

Observations from the NASA and commercial Earth observation satellites were then used in a United States Geological Survey (USGS) computer model, called SLEUTH. The model was applied to 23,700 square kilometers (9151 sq. miles) of the Washington-Baltimore metropolitan area. The initial aim was to simulate the impact of future policy scenarios on the area and Chesapeake Bay watershed. The study is reported in the March issue of *Environment and Planning B*. It explains how models may be used to forecast the effects of urban growth and runoff on the Chesapeake Bay estuary system.

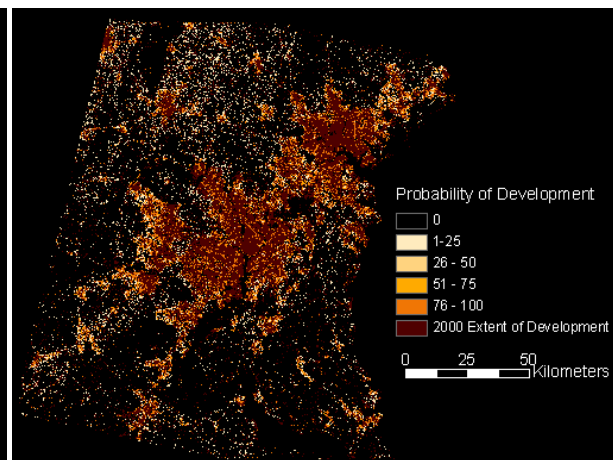
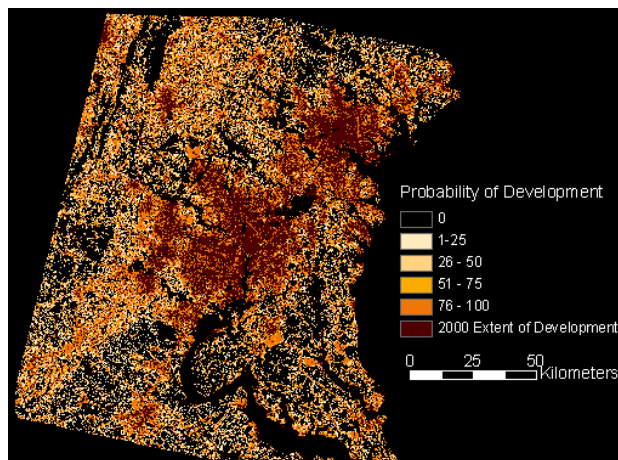
The project was designed in part to aid research on the declining water quality of the Chesapeake Bay estuary, due in part to disruptions in the hydrological system caused by urban and suburban development. The goal was to create a modeling system that could assess future development and support decision making by exploring the potential impact of different regional management scenarios. Future growth was projected out to 2030 using three different policy scenarios. The scenarios were based on current trends, managed, and ecologically sustainable growth.

The current trends scenario simulated how the Washington metropolitan area might change if development policies remained the same. This scenario included forest and agricultural preservation already in place, leaving unprotected areas open for development. In this scenario, development increased by 80 percent by 2030.

The managed growth scenario assumed added protection of forests and agriculture areas and placed moderate growth boundaries around already built areas. In this scenario, development increased by 30 percent by 2030. In the ecological scenario, strong protection of most forests and agricultural areas was projected, so development only increased by 20 percent by 2030.



Study site



Growth forecast for 2030 under the current trends scenario

Growth forecast for 2030 under the ecologically sustainable scenario

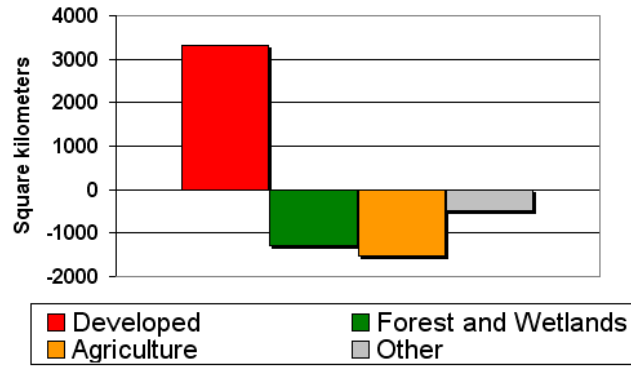
"The model is a tool that can be used for land use planning and resource management," Jantz said. "It offers the ability to explore and visualize alternative futures."



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The model is applicable to land use studies, and it has small to large-scale potential. It can also help decision-makers assess the configuration of landscapes in forests and urban areas, and understand sources of runoff related to water quality in streams. The Maryland Department of Natural Resources is exploring use of the model to target forest resources, restoration and conservation activities.



Potential loss of resource lands by 2030 if current growth patterns continue.

Since its release to the public domain in 1999, the SLEUTH model has been widely used, including applications in Tampa, FL, the New York metropolitan region, and San Francisco, CA. The USGS applied SLEUTH to predict urban and transportation change over time, at a coarser resolution than Jantz et al's research, for the entire Mid-Atlantic region out to the year 2100. These applications and sensitivity tests of SLEUTH have provided the model developers, at the USGS and the University of California at Santa Barbara, with opportunities to improve the performance of the model. One of the challenges presented to users of the SLEUTH model is the massive computing resources required for calibration. For this study, the USGS provided access to their Beowulf parallel computing cluster to calibrate the model at very fine resolution for the greater Washington-Baltimore metropolitan area.

NASA's Earth Science Enterprise is dedicated to understanding the Earth as an integrated system and applying Earth System Science to improve prediction of climate, weather, and natural hazards using the unique vantage point of space. NASA funded the study, with additional funds from the Chesapeake Bay Foundation. For information about NASA programs and research on the Internet, visit:

For more information:

About this project at NASA

The official SLEUTH website

Project results presented at the Chesapeake Bay Foundation.