

Research Strategies

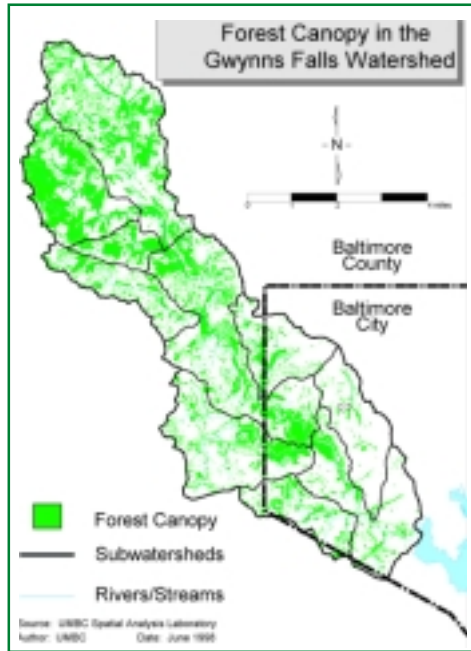
Patch Dynamics. Both urban and wild lands vary over space, and can be mapped as patchworks. However, the composition, behavior, and arrangement of patches changes through time. A patch dynamics approach is being used to detect, quantify, and assess changes in spatial patterns of social, infrastructural, and ecological processes through time in Baltimore.

Ecosystem Processes

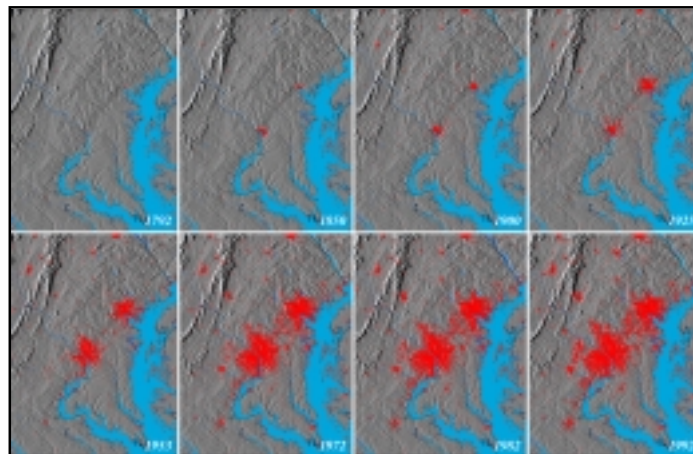
The ecosystem flux approach is being used to determine the functions of different patch types. Key energetic and material fluxes are being measured in soils, streams, vegetation, and commodities. Both the patch dynamics and the flux approaches are used at different spatial scales, so that environmental relationships important to households, neighborhoods, municipalities, and the Chesapeake Bay region can be assessed.

Experiments

An experimental approach is being used to determine how patch structure influences ecosystem function. Experiments will also manipulate patch structure by removing exotic species, and creating forest gaps to test what controls urban forest regeneration. The experimental strategy will also examine declining housing density by testing the ecological consequences of different spatial patterns of neighborhood revitalization.



Patch analysis using remote sensing data and GIS modeling.



Two hundred year urban expansion mapping and modeling (UMBC, NASA, Census Bureau, USGS).

Baltimore Ecosystem Study

The Baltimore Ecosystem Study (BES) aims to understand metropolitan Baltimore as an ecological system. The program brings together researchers from the biological, physical, and social sciences to collect new data and synthesize existing information regarding how both the built and wild ecosystems of Baltimore work. As a part of the National

Science Foundation's Long Term Ecological Research Network, we also seek to understand how Baltimore's ecosystems change over long time periods. The ecological knowledge we create helps support educational and community-based activities, and interactions between the project and the Baltimore community are important components of our project.

Results of such experiments can be used to inform management of watersheds and parks, and help guide the choices that people make to revitalize their neighborhoods.

Modeling

Modeling is being used to study relationships between social, ecological, and physical factors, and to develop scenarios of future land use and patch change. Feedbacks between ecological and socio-economic factors can be explored using the new simulation models being developed for the Baltimore ecosystem.

Public Participation

In order to learn the most about the social and institutional structure of the Baltimore ecosystem, to conduct research sensitively in people's neighborhoods, and to produce results that can engage people, BES is interacting with the public in a variety of ways.

Education and Application of Ecological Knowledge

Throughout the long-term ecological research project, linkages to the public and to schools and community based educational programs are being developed for each component of the BES effort.



Biologists assessing macroinvertebrates for stream health.

Fostering Interest in Environmental Careers

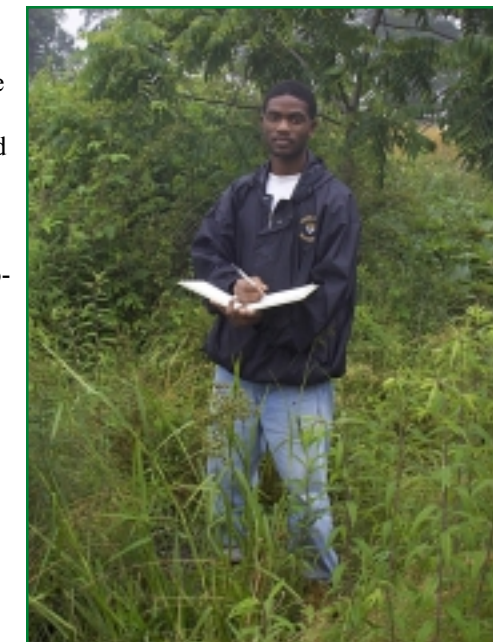
The project offers a series of after-school and summer opportunities for students, starting with youngsters and progressing through high school and college students. Participants are involved directly in the research and management aspects of the BES project, gaining skills, exposure to diverse role models, and encouragement to consider environmental career opportunities.



Sampling sediment on an urban floodplain.

Developing User-friendly Models

BES scientists are directly engaging decision makers and managers in developing simulation models of the metropolis. Easy-to-use interfaces are being constructed so that decision makers in government and non-governmental organizations, as well as community groups, can explore the ecological implications of changes in the areas they are concerned with. These positive links with citizens and decision makers are key to sustaining scientific research in an urban setting.



Mr. Kamau Crawford of Tuskegee University records ecosystem data.

Public Engagement

BES has a responsibility to share its results with the public. From routine posting of research results via the Internet and presentations at local meetings, to periodic feature stories and articles about scientists, managers, students, and educators involved, the project is helping spread information about the ecology of the regional urban system and its connection to the concerns of the individuals and groups.

The Baltimore Ecosystem Study

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Ecology's Greatest Challenge: Human-dominated Ecosystems

The Baltimore Ecosystem Study is a Long Term Ecological Research project that explores metropolitan Baltimore as an ecological system. The project involves researchers and educators from over two dozen colleges, universities, community groups, and government agencies from the local to federal levels. The research program advances scientific understanding of urban ecosystems, and serves as a resource for education and decision making by communities and land managers responsible for sustaining the quality of life for millions of citizens in the greater Baltimore metropolitan area.

The research measures interactions between ecological, social, and physical factors to understand the current structure and function of the Baltimore ecosystem. This interdisciplinary program is discovering how and why the Baltimore ecosystem changes over time.

The goals of the Long Term Ecological Research program in Baltimore are:

- 1) To quantify and spatially link socio-economic, physical, and ecological processes in an urban region;
- 2) To determine how the relationships among processes change over the long term, making both historical reconstructions and future projections;
- 3) To experimentally examine the structure-function relationships that underlie ecological concerns of urban residents, including sustainability of forests and urban streams, the invasion of exotic species, and the relationship of neighborhood revitalization to environmental quality; and
- 4) To produce models for sharing research results with the general public, educators, and resource managers concerned with how the environment affects quality of life.

LTER
Long Term Ecological Research

BALTIMORE ECOSYSTEM STUDY

Guiding Questions of the Baltimore Ecosystem Study

I. How does the spatial structure of ecological, physical, infrastructural, and socio-economic factors in the metropolis affect ecological processes?

Data and models generated to answer this question are providing a new basis for understanding the structure of urban ecosystems. It is important to understand whether the major effect of humans is a) indirect, through their effects on the spatial patch structure of urban ecosystems, or b) direct, through their behaviors as individuals or groups. A long time span is needed to understand the linkages, feedbacks, controls, and cycles of patchiness in urban regions.



II. What are the fluxes of energy, matter, capital, and population in an urban system, and how do they change through time?

The increased energy subsidy in and around cities drives changes in ecosystem function. The key inputs, outputs, and flows of the Baltimore ecosystem must be quantified and related to one another. In addition, the patch template discussed under Question I can control the rates and pathways of important fluxes in the metropolis. Linking the spatial and flux information will help determine the “ecological footprint” of the Baltimore urban ecosystem.



A structural patch assessment for the Rognel Heights neighborhood (data: M.L. Cadenasso).

III. How can urban residents develop and use an understanding of the metropolis as an ecological system to improve the quality of their environment and their daily lives?

There is a dynamic interplay between the intellectual pursuit of ecological understanding and the development of ecological literacy and ecologically sound practice in a metropolitan area. The general public, students and teachers, and various policy makers and environmental managers all have a stake in increasing the level of understanding for the common goal of a sustainable future.



Volunteers planting trees in Baltimore.

