

**BALTIMORE ECOSYSTEM STUDY**  
**Long-Term Ecological Research**  
**1998 Annual Report**

The first year of the Baltimore Ecosystem Study has been an exciting time of scientific discovery, developing important syntheses, refining our complex organization, and linking effectively with the communities and institutions in the Baltimore metropolitan region. Although our project grew from existing social science, geographic, and ecological research in Baltimore, the novel integration that it represents required strengthening this foundation to support our research and outreach over the long-term. Our most significant organizational accomplishments were 1) hiring as Site Manager, Mr. Kenneth T. Belt, a long-time staff member of Baltimore City's Department of Public Works with experience in water quality issues and measurement, and 2) the renovation of our office and lab space at the University of Maryland, Baltimore County. We have made much progress in research, education, comparison, data management, outreach, and publication.

**RESEARCH HIGHLIGHTS**

*Field Surveys and Plot Establishment.* Our studies of the array of existing ecosystems in the Baltimore region has begun with a sampling strategy that documents the diversity of cover types from complementary perspectives. Vegetation and land cover will be documented via remote sensing, transects across the entire Gwynns Falls watershed, and transects across the subcatchments we will intensively study. Vegetation and ecosystem function will be jointly assessed in permanent plots in the subcatchments. A gradient approach will be complemented by sampling of tree-covered patches at the coarse scale. This dual strategy will permit us to discover the new patch types that ecologists have yet to discern in cities and their surroundings. We have discovered that both approaches are required to allow integration with social science data, and to identify units that people and institutions interact with. The vegetation and cover studies are the foundation for ecosystem process research.

We have begun to document forest patch types and their configuration, and to relate those parameters to remotely sensed data. We have chosen to begin with the simpler, more readily ecologically recognizable patch types -- forest or tree-covered patches -- and to build more complex patch types that recognize a clear social component by using integrated social-biological sampling. Seventy patches < 1 ha have been measured, with a total of 150 to be completed this year. Additional categories of 1-5, and > 5 ha tree-covered patches will be included in the future. More detailed compositional and demographic studies of 30 tree-covered patches will be conducted to permit ecosystem processes to be related to patch parameters and to increase the variety of sites in which we measure productivity and population processes.

We have established permanent plots in forested areas in a reference, rural watershed, in a medium density residential park, and in a park located in a high density residential neighborhood. Plots locations have been permanently surveyed and marked, and vegetation is being sampled. Lysimeters have been installed in these plots. These will be the sites of the intensive ecosystem process studies. A total of 12 such sites, with duplicate plots, will be established.

Locations for paleoecological cores have been identified in wetlands and in Baltimore Harbor near the mouth of the Gwynns Falls. Preliminary probings indicate sufficient undisturbed sediment in both kinds of locations to generate long environmental histories to relate to social and land cover changes. Historical data from a detailed 1910 vegetation survey, and from Brush's 1974 forest plots within metropolitan Baltimore are being digitized for the first time, for inclusion in the BES data base.

***Instrumentation.*** Small watersheds (ca 40 ha) have been identified for further study. A forest reference, agricultural reference, high density old residential, medium density new residential, and medium density old residential sites have been selected. Additional sites in industrial, and mixed urban land covers will bring the total intensive sites to 20. Hydrological and meteorological instrumentation is being installed on the selected plots.

Boundary condition watersheds have also been selected. These divide the main Gwynns Falls drainage into portions having different degrees of urbanization. Sites have been located at the rural fringe, residential/urban core, and the mouth of Gwynns falls. We have instrumented the residential urban core. Stream sampling began in July 1998.

***Social-economic Analyses.*** Currently underway are stakeholder network analyses at the watershed and neighborhood scales, and analysis of historical changes in boundaries of socio-political units, such as wards and sanitary districts. Causes of mortality by ward are being assessed for historical census data. The development of ozone policy and its relationship to scientific information available at particular times, is being assessed from 1950 on. A cluster analysis of consumer activity is being developed.

***Scientific Integration.*** Two hydrologically-based models which will be central to our ultimate integration, the RHESSys, and the Patuxant Landscape Model (PLM) are being modified to account for parameters we have identified in our developing theoretical framework. RHESSys is being altered for finer scale GIS parameterization, relationship to ecological patch configuration, and linkage with the Chesapeake Bay. The PLM is being expanded to accommodate social processes and drivers that are relevant to metropolitan Baltimore. Additional integration will build on these initial steps.

## **EDUCATION HIGHLIGHTS**

We are mandated to interact with the established educational initiatives and institutions in the Baltimore region. We have established an Education Steering Committee, comprising 41 leaders from public and private schools, and all grade levels. Formal relationships are being finalized with the Baltimore City and Baltimore County school districts. An Education Coordinator has been hired to enhance the liaison between the project and the educational community. Collaboration with existing school- and community-based educational initiatives is underway, including Save Our Streams, Kids Grow, Junior Tree Tribe, Project RAISE, and Super Kids Camp.

We have established a School/Community Research Partnership program, conducting planning and testing sessions with teachers this summer. The program will partner teachers and schools with BES scientists, and promote inquiry based educational activities, and explore ecological research opportunities on school grounds. BES scientists are preparing to interact with teachers in program development, and with students in the collection of scientifically rigorous data.

## **CROSS-SITE AND INTERNATIONAL PLANS**

Our Data Management team participated in the LTER Data Managers meeting in Albuquerque, and will host the 1998 Network Data Managers? meeting. We have assisted in writing the LTER Data Access Policy.

Comparative research in advanced planning by BES researchers includes permanent plot research in both the Central Arizona-Phoenix LTER and Baltimore. In addition, we are exploring the generality of our integrative approach and modeling via comparisons with researchers studying Bloomington, IN. During the year, BES scientists have met with colleagues to explore further collaborations with urban and urbanizing sites in Israel, England, New Zealand, and Germany.

We are planning a civil infrastructure workshop for the winter-spring 1999. This will incorporate civil infrastructure into the BES on the same theoretical and empirical footing as ecological, social, and hydrological approaches. Although we will concentrate on experts from Baltimore and surroundings, the rich resource of engineers in the region assures us of high quality input. In addition to promoting the integration of ecological and infrastructural perspectives, the workshop will help design specific studies incorporating civil infrastructure in Baltimore. We will involve participants from other LTER sites in this workshop.

## **DATA MANAGEMENT AND UPDATES**

Very few of the new data sets that are the subject of the Baltimore Ecosystem Study have advanced to a stage where posting on the web is justified. However, the Data Management team has established a web site at <http://baltimore.umbc.edu/lter> which refers to relevant existing data. We maintain an internal web page for site use, and have established a master list serve and list serves for nine specific working groups within the project. The theoretical framework for the Human Ecosystem concept (Burch and Grove 1997) will be used as a navigation device to access data on the project. A BES Data Management Guide resides at <http://baltimore.umbc.edu/lter/publications/data&pubs.htm>. In addition, we have developed and implemented a Data Request Tracking Database.

Although a number of field and archival data sets are being readied for incorporation into the BES data management system, closest to readiness is the 1990 census data in a format most appropriate to integration with other data of concern to us.

## **OUTREACH ACTIVITIES AND TRAINING**

Research Experiences for Undergraduates (REU) students are involved in the project this summer, including John Macon and Lonnie Lanham, from UMBC, and Ben Hardt from Brown University. Kamau Crawford, from Tuskegee University, an IES REU student conducted field work at BES. Graduate training is benefitting PhD candidates Shawn Dalton (Johns Hopkins), Steve Kenworthy (Johns Hopkins), Helen Thompson (Rutgers) Jonah Smith (Rutgers), and Alejandro Flores (Yale). Post-doctoral Associate Dr. M.L. Cadenasso is a member of the project.

Media outreach has been effective, including the cover story in Science News for 4 April 1998 (153[14]:219-221), and a feature in BioScience (48:581-585). Articles have also appeared in the Baltimore Sun (?The Experts Pick Baltimore for Ecology Study? 20 October 1997), and the Chronicle of Higher Education (?Ecology?s Last Frontier? 13 February 1998). Radio interviews with Wisconsin Public Radio and Earthwatch Radio have also been granted. The third semi-annual IES ?Science for the Media? event, held at the National Press Club on 26 January 1998, featured the Baltimore Ecosystem Study LTER. Finally, the Baltimore Ecosystem Study participated in the Coalition for National Science Funding Exhibition and Reception in Washington DC on 20 May 1998.

We participated in the following activities representing outreach to the scientific community in general, the LTER Network in particular, and various user communities:

1. National State Foresters. Urban Forest Subcommittee: Phoenix AZ 20-23 April 1998.
2. USFS Forest Inventory and Analysis Implementation Committee: Annapolis MD, 16 July 1998.
3. LTER Workshop at AIBS-ESA meeting, 2 August. Long-Term Ecological Research: the New Urban Focus (Gosz, Pickett, Pouyat, Barber, Ringold, and Crouch)
4. ESA-AIBS Fieldtrip, 1 August 1998, Baltimore Long-Term Ecological Research Project (Grove and Zipperer)
5. AIBS-ESA Symposium, 5 August 1998, Urban Ecological Systems: A New Frontier (Pouyat, Barber, Pickett).
6. Keynote Presentations (2) at Conservation of Biological Diversity, Annapolis, MD, 11 May 1998. (Burch; Pickett)
7. Forest Fragmentation Round Table, U.S. Forest Service and Society of American Foresters, Bethesda, MD, January 12, 1998. (Brush, Zipperer, Pickett)

#### **ADDITIONAL GRANTS RECEIVED**

1. Maryland Sea Grant (NOAA) for history of Chesapeake food web (Brush).
2. Forest Service: Land Use History of Chesapeake Bay watershed (Brush).
3. Forest Service: Household Survey of Consumer Activities (Grove).

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**PUBLICATIONS**

**Journal Articles**

Brush, G. S. and Hilgartner, W.B. (revised and resubmitted). "Paleoecology of submerged macrophytes in the Chesapeake Bay." Ecology (to be accepted without further review).

Foresman, T.W. "Spatial Analysis and Mapping on the Internet." Journal of Public Health (in press).

Grove, J.M. and Burch, W.R. Jr. 1997. "A Social Ecology Approach to Urban Ecosystem and Landscape Analyses." Urban Ecosystems 1(4): 259-275.

Pickett, S.T.A., Burch, W.R. Jr., Dalton, S., Foresman, T.W., Grove, J.M. and Rowntree, R. 1997. "A Conceptual Framework for the Study of Human Ecosystems in Urban Areas." Urban Ecosystems 1(4): 185-199.

Pasternack, G. B. and Brush, G.S. 1998. "Sedimentation cycles in a river-mouth tidal freshwater marsh." Estuaries (in press September issue).

Zipperer, W.C., Foresman, T.W., Sisinni, S.M., and Pouyat, R.V. 1997. "Urban tree cover: an ecological perspective." Urban Ecosystems 1(4): 229-246.

**Book Chapters**

Brush, G. S. 1997. History and impact of humans on Chesapeake Bay. In: R. D. Simpson and N. L. Christensen, Jr. (eds.) "Ecosystem Function and Human Activities: Reconciling Economics and Ecology. Chapman & Hall, New York, New York: 125-145.

Burch, W.R. Jr., and Grove, J.M. 1998 (In Press). Ecosystem Management-some social, conceptual, scientific, and operational guidelines for practitioners. World Resources Institute and Elsevier Press: Washington, D.C.

Parker, J.K., Sturtevant, V., Shannon, M. Grove, J.M., and Burch, W.R. Jr. 1998 (In Press). Partnerships for Adaptive Management, Communication and Adoption of Innovation, Property Regimes, and Community Deliberation: the contributions of mid-range social science theory to forest ecosystem management. World Resources Institute and Elsevier Press: Washington, D.C.

### *Other Publications*

#### Conference Proceedings:

Grove, J.M. 1998. Cause and Consequence: the social dimensions of ecological restoration. Conservation of Biological Diversity: A key to the restoration of the Chesapeake Bay Ecosystem and beyond. May 10-13, 1998. Annapolis, Maryland.

#### Printed Abstracts:

Grove, J.M. & Pickett, S.T.A.. Hydrological, Ecological and Social Systems in Urban-Rural Watersheds: Integration for Restoration. Thirteenth Annual Conference: Applications of Landscape Ecology in Natural Resource Management. March 17-21, 1998. Michigan State University, East Lansing, Michigan.

Grove, J.M. 1998. Cause and Consequence: the social dimensions of ecological restoration. Conservation of Biological Diversity: A key to the restoration of the Chesapeake Bay Ecosystem and beyond. May 10-13, 1998. Annapolis, Maryland.

Grove, J.M., Redman, C. Pickett, S.T.A., and Grimm, N. An Hierarchical Patch Dynamics Approach to the Long Term Study of Urban Ecological Systems. Seventh International Symposium on Society and Resource Management. May 27-31, 1998. University of Missouri-Columbia, Columbia, Missouri.

#### Published Papers and Reports:

Foresman, T.W., Pickett, S.T.A, and Zipperer, W.C. 1997. Methods for spatial and temporal land use and land cover assessment for urban ecosystems and applications in the greater Baltimore-Chesapeake region. *Urban Ecosystems* 1(4):201-216.

Pickett, S.T.A., Burch, W.R. Jr., and Dalton, S.E. 1997. Integrated urban ecosystem research: Themes, Needs, and Applications. *Urban Ecosystems* 1(4):183-184.

Law, N. Review of stormwater control BMP (Best Management Practices). BES Report, July 1998.

### **PRESENTATIONS**

L.E. Band, Invited presentation, Ecological Society of America Meetings, Baltimore, Maryland, August 2-8, 1998.

Christopher P. Steele, Managing Ecological Data: The Baltimore Ecosystem Study Perspective, 1998 Chesapeake Bay Biodiversity Conference, Annapolis, Maryland, May 10-13, 1998.

Christopher P. Steele, Baltimore Ecosystem Study representative at 1997 National Science Foundation Land Margin Ecosystem Research All-Scientist Meeting, Solomons, Maryland

Christopher P. Steele, poster presentation on sharing spatial and ecological data in the Baltimore-Washington Region, 1997 International Conference on CODATA at the National Institutes for Health, Bethesda, Maryland.

W.C. Zipperer, Structure and Function of Forest Fragments along Urban to Rural Gradients: Recommendations for Management from an Urban Long-Term Ecological Research Site, Society of American Foresters National Convention, Michigan State University, East Lansing, Michigan, September 19, 1998.