

MARINE NOTES



When we think of ecosystems, we usually think of forests, deserts, prairies, the Arctic, lakes or estuaries like the Chesapeake Bay — and of the plants and animals that live in them. We often forget that people are an important part of many ecosystems and, in heavily populated areas such as cities, they have a major impact on them. According to Steward Pickett, metropolitan areas have gone largely unstudied as ecosystems in their own right, a serious oversight when one considers that some 75 percent of the U.S. population is now concentrated in cities and their surrounding suburbs.

From a scientific perspective, we know very little about how these ecosystems operate, says Pickett of the Institute of Ecosystem Studies in Millbrook, New York. He has been a leader in calling for sustained research on the ecology of urban centers, citing very practical reasons that relate to how new development and restoration is planned in these areas. “Ecological research needs to be focused more directly on populated areas,” he says, “to yield scientific understanding as well as generate expertise for policy makers.” The inability to predict ecosystem effects of land use changes — whether in residential neighborhoods, commercial districts or fringing rural areas that face intense land transformation — means that planning

SPOTLIGHT ON RESEARCH

BALTIMORE

The City as Ecosystem

BY MERRILL LEFFLER

“From a scientific perspective, we know very little about how these ecosystems operate.”

The City, continued

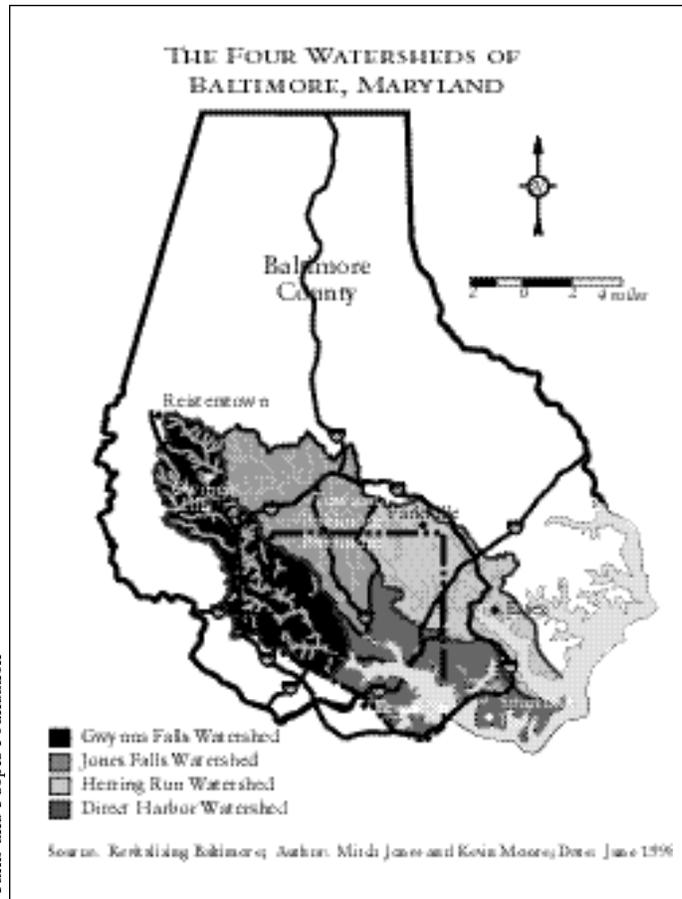
decisions are often made in the dark.

Equally important, Pickett observes, ecologists have largely ignored the changing relationships between humans and ecosystems. Such an understanding requires more than knowledge of physical and biological science, says William Burch of the Yale University School of Forestry and Environmental Studies. Since human beings and their communities play an integral role in how urban and suburban landscapes evolve, we need to understand how these changes come about and what social, cultural and political influences drive them. Also, how are human choices, in turn, affected by changes in the environment itself?

“What we need,” Pickett says, “is a new ecological understanding of how people behave and affect ecological systems.” Most ecologists have not been used to doing this, he adds. “It requires that we integrate substantially with social scientists.”

It is this unique challenge of joining environmental and human dimensions that has led Pickett, Burch and a team of ecologists, social scientists, foresters and geographers to become engaged in the Baltimore Ecosystem Study. With core funding from the National Science Foundation, this urban analysis forms part of NSF’s Long-Term Ecological Research Program, which has supported studies on “natural” systems and now, for the first time, two urban projects — in Baltimore, Maryland and Phoenix, Arizona.

“This is an immensely complex and pioneering effort,” Pickett says, which includes substantial support from the U.S. Department of Agriculture Forestry Service and participation by many partners, including the U.S. Geological Survey, Baltimore City, Baltimore County and the Maryland Department of Natural Resources. It not only focuses on the effects people have on the largely urbanized Baltimore watershed, but also attempts to understand the social behaviors that underlie those impacts — as well as attempts to involve the people themselves both in the study



Parks and People Foundation

“Ecological research needs to be focused more directly on populated areas.”

and in the improved decisionmaking that researchers hope will result. It is for these reasons that neighborhood outreach programs and summer institutes for teachers are such key elements of the study.

Suburban Sprawl and Urban In-filling

Throughout the nation, measures to put the brakes on accelerated development of rural areas have set off firestorms of debate and controversy. Over the last two years, for example, several hundred initiatives to curb the loss of open space have appeared on

ballots around the U.S. They include measures like Maryland’s Smart Growth initiative, measures which aim to preserve forests, wetlands and rural areas and to foster redevelopment of metropolitan areas, especially cities that over the last several decades have experienced population losses and abandonment of commercial and residential buildings. These measures guide growth toward areas where roads and streets, along with underground sewage pipes and stormwater drains, are already in place.

From an environmental perspective, arguments for filling in urban and suburban areas with more built structures might at first seem paradoxical — an unlikely way to protect streams and rivers. For example, vegetated areas protect aquatic systems by slowing and absorbing runoff; conversely, streets and buildings may serve as conduits for speeding rainwater, often laden with contaminants, into stormwater drains and streams. Many planners counter, however, that by in-filling urban centers, we have a better chance to control and consolidate wastes, treating them more efficiently before they drain into the Bay’s tributaries.

While innovative planners around the country are testing techniques for curbing contaminants from urban runoff, employing these techniques widely to improve streams and rivers presents an enormously expensive challenge. To a large extent, the arguments for and against these efforts run up against a lack of “hard” knowledge for predicting their effectiveness, whether they involve diver-



“What we need is a new ecological understanding of how people behave and affect ecological systems.”

sions or streamside tree plantings. For example, what factors matter most for buffering streams against contaminant runoff in order to improve water quality or biological diversity — the number of trees, their spatial configuration, particular species, some combination of these? What is the effect of soil type, of non-indigenous vegetation? Underlying these environmental questions are social issues. What drives changes in the physical landscape are often human choices, based on complex economic, political and cultural factors.

Getting Started on Research

To begin getting a handle on the ecology of a metropolitan area and the relationships with its diverse neighborhoods, says Pickett, “we need to break the landscape components into ecologically differentiated parts.” Rather than focusing on Baltimore as a whole, researchers need to work at a more manageable scale. They looked for a watershed that is small but still large enough to represent Baltimore’s social and cultural diversity and its range of landscapes, from dense industrial and business zones to urban neighborhoods and suburban communities to more sparsely inhabited enclaves.

Gwynns Falls, one of four watersheds in Baltimore, fits these requirements, with just under 360,000 people (1990 census). Its southern end is predominantly residential, commercial and industrial, while the northern part includes agricultural, forested and open space areas, though land is already being cleared for development. According to *The Gwynns Falls Ecological Resource Atlas*, more than 75 percent of the watershed is already developed, with greater than 40 percent of the land covered by impermeable surfaces.

The initial ecological focus is on hydrological processes, the movement of water, nutrients and carbon as they flow from various built and natural habitats into streams and creeks. While Gwynns Falls is the initial focus of research, field sites will eventually be located throughout metropolitan Baltimore. In the long run, says William Burch, they want to know the cumulative effect on the Chesapeake Bay. “That is the bottom line.”

Larry Band, a geographer from the University of North Carolina, is developing computer models that will eventually enable researchers to examine the effects of landscape changes, such as the planting of trees and the installation of drainage systems in catchment areas of Gwynns Falls. Based on approaches that ecologists have developed over the last 20 years, a region is first divided into separate segments or patches, each of which will exhibit different flows of water, nutrients and carbon, depending on the mix in each patch of impervious surfaces, natural land cover, types of soil, storm and sanitary sewer systems. Mathematical models of flows from one patch to another are then linked. Band has begun work by developing models for smaller subwatersheds in Gwynns Falls that will enable researchers to simulate the effects on local streams of changes in surrounding landscapes.

Models are mathematical mimics — they are only as good as the quality of the data that they use. A major effort of the Baltimore Ecosystem Study is to collect long-term data on different configurations of built and natural landscapes, seasonally and over many years in order to better understand how changes to these landscapes affect streams and the rivers they feed. Towards these ends, for example, Peter Groffman of the Institute of Ecosystem Studies began a series of long-term measurements that are comparing how stream banks (riparian zones) in rural and urban areas in Gwynns Falls affect denitrification — a microbial process that converts potentially harmful nitrate

Please turn to page 4

The City, continued

into nitrogen gas and helps cleanse the system of excess nutrients.

“The ability of riparian zones to process water is important,” Groffman says. “In many areas, they have been shown to prevent the movement of pollutants from upland land uses to streams.” Groffman notes, though, that efficiency depends on a number of factors, including the kind of vegetation that grows along a stream bank. Focusing on eight riparian zones — four rural and four urban — he found surprisingly that urban riparian zones *can* support high rates of denitrification, though there was a great deal of variability there, more so than in rural sites. In urban areas, Groffman says, what we have done is to isolate riparian zones; in the long run, he adds, we need to develop innovative ways for reconnecting them.

Groffman’s riparian sites represent only one of the numerous research and monitoring projects already underway. For example, vegetation plots in three Gwynns Falls forests — two in the city and one in a less-developed area in Oregon Ridge — are being monitored to track changes in species of trees, shrubs, vines and herbs over time. In another study, differences in nutrient cycling are being compared in a network of forest and grass plots; meanwhile, urban yards and wetlands will be added to the study.

Neighborhoods and Ecosystems

Human beings affect the structure of ecosystems, says Morgan Grove. “They change the course of a stream, they put trees up and take them down. That affects water, the evaporation from trees, the way that water lands on a roof top, goes in a gutter and down into a drain — and that affects other processes.” Grove, who is with the USDA’s Forestry Service in Burlington, Vermont, is an integral member of the Baltimore Ecosystem Study. He originally came to Baltimore as a Yale graduate student under William Burch and worked with Baltimore’s Recreation and Parks De-



Parks and People Foundation

partment on natural resource management in helping to develop a community forestry program. Like Pickett and Burch, Grove is fervent about actively involving Baltimore communities in the research they are doing. “If we don’t interact with communities, we don’t get to do research,” says Pickett. “We’re doing this work in people’s backyards and parks.” This past summer, William Burch and Vicky Fabiyi organized a training session for researchers that introduced them to the Baltimore communities where they are conducting their research. They focused on the history, demographics and social characteristics of one community in the Gwynns Falls watershed.

A basic premise of the Baltimore Ecosystem Study is that the socio-economic structures of neighborhoods affect local environmental factors — and these in turn affect quality of life. What factors go into the decisions that affect the ecosystem? “People have different lifestyles that are related to class, race, cultural background,” Grove says, “and they may have characteristic ways in which

More Information on the Web

Baltimore Ecosystem Study
<http://baltimore.umbc.edu/lter>

United States Geological Survey
<http://md.water.usgs.gov/BES/>

Gwynns Falls Watershed Ecological Resource Atlas
<http://baltimore.umbc.edu/lter/gfatlas/>

Smart Growth Network
<http://www.smartgrowth.org>

American Forests
http://www.americanforests.org/garden/trees_cities_sprawl/

they affect ecological processes, whether directly or indirectly.” We want to try to understand these relationships, he says, for example, whether power structures in a region result in environmental inequities and, if so, how they occur. If people had a better understanding, he asks, would that affect their behavior in terms of power structures and the kinds of decisions they make?

Trying to answer such questions in a robust, empirical way is what Burch is after. “We’re developing a methodology,” he says, “for systematically



measuring, identifying and describing changes in landuse [along with], housing, rise and fall of services, social bonding” and other traditional social science concerns. Burch then relates these to interactions with biophysical factors. Our aim, he says, is to try to match the ecological studies of patch dynamics with social groups. “This is not a common practice,” says Burch with the air of understatement. “No built environment stays the same,” he points out. “A new generation comes in and changes what the previous one has done. Can we build a predictive capability, he asks, so that people can intervene to minimize those costs, both ecologically and socially?”

Underlying the Baltimore Ecosystem Study is the idea that the value of ecological research does not stop with policy making but that it can serve much broader citizen purposes by involving students, educators and communities along the way. “When kids get involved in studying the real world,” says Pickett, “the examples are fresh and new. Urban ecology gives them a sense that ecology is everywhere.” The Baltimore Ecosystem Study may prove to be a unique model of how long-term support and collaborative research can help people improve the ecological health of the places they call home. ✓

Maryland Sea Grant Joins UMCES

Message from the Interim Director

This year has been one of great change for Maryland Sea Grant. Perhaps the most important change has been the development and implementation of a new administrative, advisory and oversight structure for the program. As of July 1, Maryland Sea Grant receives guidance from the USM Chancellor, the Provost of the College Park Campus and the President of the University of Maryland Center for Environmental Science (UMCES). Furthermore, UMCES becomes the responsible institution for program, replacing the University of Maryland Biotechnology Institute as its administrator.



This new structure, which enjoys the strong support of the USM and the National Sea Grant College Program, provides a clear mechanism for academic and research institutions within the University System and throughout the state to provide guidance to Maryland Sea Grant. Industry, state and federal agencies and other important stakeholder groups are represented as well. We will be providing more details of these advisory bodies to readers of *Marine Notes* over the coming months.

UMCES, led by President Donald Boesch, is a world leader in the study of coastal and environmental sciences. It is the University System of Maryland (USM) institution with the primary mission of research, education and public service related to the environment and nonagricultural natural resources. UMCES has a statutory mandate to “assist the development and coordination of single or multidisciplinary programs and projects on the environment at public and private educational research institutes” and serves as the liaison for the USM with state agencies responsible for marine resource management and environmental protection.

Maryland Sea Grant is now part of a campus composed of the Chesapeake Biological Laboratory in Solomons, Horn Point Laboratory in Cambridge and Appalachian Laboratory in Frostburg. The collective reach of research efforts extends from the air and watersheds of the Chesapeake Bay to estuarine, marine and terrestrial environments worldwide. For more information on UMCES, visit the UMCES website at www.umces.edu.

Maryland Sea Grant will remain on the University of Maryland, College Park campus – a location well suited to our system- and state-wide role. All new grants and contracts, including our omnibus award from NOAA, will now be administered by UMCES as well as our overall financial and personnel operations.

The transition to UMCES enables Maryland Sea Grant to better coordinate our efforts with those of the USM, other institutions statewide as well as with state and federal agencies. It is a terrific opportunity and one that will help guide the evolution of this program. All of us at Maryland Sea Grant wish to express our appreciation to the University of Maryland Biotechnology Institute for its many years of fine support. We look forward to a long and productive relationship within our new administrative home.

Jonathan Kramer
Interim Director
Maryland Sea Grant College

New Bay Agreement

The Alliance for the Chesapeake Bay released in August its recommendations for the new 2000 Chesapeake Bay Agreement, through which state and federal leaders will prioritize issues and direct the restoration effort beyond the year 2000. Along with measures to improve water quality and protect natural resources, the Alliance calls for a shared vision of a "restored" watershed, the promotion of sustainable development, and the continuous improvement of Chesapeake Bay Program governance.

"The Alliance is calling for continued government leadership, but success will require heightened environmental awareness from each of us, to consider how our daily actions affect local rivers and, ultimately, the Chesapeake Bay," said Frances H. Flanigan, executive director.

Across the Bay region, the Alliance for the Chesapeake Bay is making the following major recommendations:

- Develop a vision for the Chesapeake Bay watershed, so that everyone knows what we are trying to achieve and how we will do it.
- Promote sustainable development and manage growth.
- Engage people and develop partnerships.
- Improve water quality.
- Protect natural resources.
- Enhance the governance of the Bay Program.

To see the full list of recommendations, visit www.acb-online.org/nr990827.htm. Flanigan urges citizens, organizations and businesses to voice their support for these recommendations, or to present their own to the Chesapeake Bay Program.

The Alliance for the Chesapeake Bay is currently leading the Chesapeake



apeake Renewal Project, the first-ever comprehensive evaluation of the regional restoration effort, including an evaluation of the goals and mechanisms of the Chesapeake Bay Program. The first phase of the Renewal Project used surveys, interviews and focus groups to gather public opinion from thousands of citizens across the Bay watershed. To see a copy of the Chesapeake Renewal Findings Report published in June, visit www.acb-online.org/renew.htm.

For more information on the Alliance, visit www.acb-online.org or call 1 (800) 662-CRIS.

Gardens to Save the Bay

The state of Maryland is marking the coming millennium with a year-long Celebration 2000 in the arts, education, environment, history, human services and philanthropy. A signature environmental project for the celebration, called *MaryLandscapes*, advocates helping to preserve the Chesapeake Bay through environmentally sensitive gardening. Through a grants program, community groups, nonprofit organizations, municipalities and others received money to plant Bay-friendly gardens in public locations around the state. For a list of the gardens and their locations and to find out more about them, check the web at www.maryland2000.org/projects/marylandscapes/marylandscapes.htm or call 1 (877) MD2-0001.

Publications

Marine Mammals Guide

A new publication, entitled *Guide to Marine Mammals and Turtles of the U.S. Atlantic and Gulf of Mexico*, has been produced by Rhode Island Sea Grant. The attractive 115-page, full-color field guide contains illustrations and information about some 35 whale and dolphin species, as well as seals, manatees and sea turtles. Each two-page spread lists size, color, dive pattern, habitat, life history and other interesting facts about these fascinating sea creatures, from the small harbor porpoise to the giant blue whale.

The guide also includes a glossary and selected reading, in addition to phone numbers to report strandings anywhere along the U.S. Atlantic coast from Maine to Florida and around the Gulf coast to Texas. The guide costs \$25.00 and is available from Maryland Sea Grant. Call (301) 405-6376 or visit the web at www.mdsg.umd.edu/store/catalog.html.

Memoirs of an Oceanographer

In the Wake of a Great Yankee Oceanographer, by Nelson Marshall, Professor Emeritus of Oceanography and Marine Affairs of the University of Rhode Island and Adjunct Professor at the University of Maryland Horn Point Laboratory, is part personal recollection, part history of the scientific field over the last sixty years. The great Yankee oceanographer to whom the title refers is Henry Bigelow, the first director of the Woods Hole Oceanographic Institution, who beginning in the 1930s participated in the rapid expansion of ocean-related research called for by the United States Navy in World War II. This growth and parallel developments elsewhere form the beginnings of oceanography as we know it today, according to Marshall.

End Notes

“His oceanographic research on the Gulf of Maine set the standards for and was an inspiration to many who were to follow,” says Marshall of Bigelow. “Hopefully, my recollections will help to rekindle an interest in our indebtedness to this great and inspiring oceanographer.”

Former COMB Staffer Publishes Novel

Jonathon Scott Fuqua, who worked as an illustrator and multimedia artist for the Center of Marine Biotechnology for several years, has authored a novel, published by Bancroft Press in 1999. Fuqua was one of the producers of *The Chesapeake Oyster*, a multimedia science education CD ROM produced by Maryland Sea Grant.

Set in Baltimore, the coming of age novel is titled *The Reappearance of Sam Webber*. In the story, a young boy's father disappears without a trace and his mother and he are forced to relocate to a tough neighborhood near her job. The novel recounts his life in a tiny apartment in a cold, unwelcoming city as he befriends an elderly janitor — the relationship helps him begin to heal and to confront the racism that surrounds his community and his life.

Says Madison Smartt Bell of the book, “[The author] has a wonderfully detailed and affectionate knowledge of Baltimore, its culture and communities, here expressed in both picture and story...*The Reappearance of Sam Webber* is the sort of novel that can be called ‘heartwarming’ without irony.”

The book is also illustrated by the author with small drawings of Baltimore scenes. Fuqua has written numerous plays, stories and articles and is also an established artist. His book of illustrations, *American Rowhouse Classic Design*, was published by the Stemmer House in 1997. Writer-in-Residence of the Carver Institute, Fuqua teaches classes in fiction writing, literature and art in Baltimore.

Awards

■ **Invention of the Year.** Excess nutrients — primarily phosphorus and nitrogen — that drain into watersheds from agriculture fields can lead to harmful algal blooms and the possible loss of dissolved oxygen, endangering fish and submerged grasses and altering the ecosystems of the watersheds. Algal blooms, including *Pfiesteria*, and the loss of dissolved oxygen have been associated with fish lesions and fish kills in coastal waterways from the Chesapeake Bay to the Gulf of Mexico.

Kristen Hughes, a graduate student researcher in the University of Maryland's Department of Biological Resources Engineering, recently received one of the 1998 Invention of the Year awards from the Office of Technology Liaison for her work on a process to reduce agricultural nutrient pollution. She examined a process that mixes a byproduct generated by a local company with agricultural animal waste (which contains abundant amounts of soluble phosphorus) to bind phosphorus and make it insoluble.

Further research will determine if the resulting mixture can be applied to agriculture fields without adding unwanted nutrients to water that runs off fields and into watersheds. A Maryland company recently signed an exclusive option agreement to the technology and is sponsoring additional university research into the development of Hughes' patent-pending invention.



B. Jones Memorial Award for Excellence in Coastal and Marine Graduate Study. She received the award for her studies in problem solving in sustain-

able development and conservation. Those receiving this award are chosen from a pool of more than 60 qualified nominees by an independent panel of judges. The criteria for evaluation are based on innovative approaches in coastal zone management — helping to maintain coasts and ocean resources and balance the needs of these resources with human use.

Web Sites of Note

■ **Oysters on the West Coast.** An informative website by Washington Sea Grant chronicles the history of oyster culture in Washington state and includes sections on anatomy, a timeline of significant dates, historical photographs and a list of publications and web links: www.wsg.washington.edu/oysterstew/oystermain.html.



■ **Loggerhead Sea Turtles.** A satellite tagging project that gives biologists a rare opportunity to study one of the nation's most endangered marine animals — loggerhead sea turtles — is being carried out by NOAA Fisheries and the U.S. Fish and Wildlife Service in partnership with the Florida Fish and Wildlife Conservation Commission and the Caribbean Conservation Corporation. Scientists will attach satellite transmitters to adult female turtles that have just finished nesting.

School children and others can follow the migrations of sea turtles and learn about the threats they face and how to take part in helping ensure their survival at www.cccturtle.org.

New Blue Crab Book Gets Funding



At the time of his death, L. Eugene Cronin was working on a comprehensive book about the blue crab, *Callinectes sapidus*. He was co-editing the book with Victor S. Kennedy, of the Horn Point Laboratory, University of Maryland Center for Environmental Science. Cronin will still be named as co-editor of

the book, according to Kennedy, who sees the blue crab book as the culmination of Cronin's life-long fascination with the popular crustacean.

During the last year of his life, Cronin had embarked on an ambitious effort to raise funds for the blue crab book, and by the time he passed away had succeeded in raising some \$30,000 from federal, state and private donors. It has been extremely gratifying to see the support offered by industry partners, private foundations and Bay-related agencies.

The book, *The Blue Crab: Callinectes sapidus*, will be published by the Maryland Sea Grant College in the year 2000. It follows *The Eastern Oyster: Crassostrea virginica*, also edited by Victor S. Kennedy, along with Roger I.E. Newell and Albert F. Eble.

Maryland Marine Notes Volume 17, Numbers 5-6 September-December 1999

Maryland Marine Notes is published six times a year by the Maryland Sea Grant College for and about the marine research, education and outreach community around the state.

This newsletter is produced and funded by the Maryland Sea Grant College Program, which receives support from the National Oceanic and Atmospheric Administration. Managing Editor, Sandy Rodgers; Contributing Editors, Jack Greer and Merrill Leffler. Send items for the newsletter to:

Maryland Marine Notes
Maryland Sea Grant College
0112 Skinner Hall
University of Maryland
College Park, Maryland 20742
(301) 405-6376, fax (301) 314-9581
e-mail: mdsg@mdsg.umd.edu

For more information about Maryland Sea Grant, visit our web site:

www.mdsg.umd.edu/MDSG



Maryland Marine Notes (current and back issues since 1995) is also available on the web at www.mdsg.umd.edu/MarineNotes



Maryland Sea Grant College
0112 Skinner Hall
University of Maryland
College Park, Maryland 20742

Address Service Requested

Non-Profit Org.
U.S. Postage
PAID
Permit No. 10
College Park, MD