INSTITUTE OF
ECOSYSTEM STUDIES
Education Program
Box R
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Newsletter

Volume 21, Number 4
July - August 2004

Calendar

CONTINUING EDUCATION

Consider signing up for a continuing education course! Below is a sampling of class offerings, to view the complete brochure please call 845-677-9643 or visit our web site at www.ecostudies.org/cep.html.

Landscape Design
Sept. 22 (6 Weds.): **Graphics**
Sept. 23 (3 Thurs.): **Ecological Landscape Design**
Gardening
Oct. 3 (1 Sun.): **Perennial Propagation Workshop**
Oct. 9 (1 Sat.): **Border Basics for Beginners**
Oct. 17 (1 Sun.): **Old Fashioned Flowers**
Nov. 6 (1 Sat.): **Front Lawn Alternatives**
Workshops
Sept. 11 (1 Sun.): **Landscapes for Learning**
Oct. 30 (1 Sat.): **Bird Conservation**

Tomato Tasting - August 31st!

Tired of grainy supermarket tomatoes that taste like refrigeration trucks instead of summer sun? Interested in encouraging organic gardening and supporting local farmers? On August 31st at 6:30pm IES and Cornell Cooperative Extension will be teaming up with Dutchess County farmers and Culinary Institute of America chefs to host a tomato taste off. Free and open to the public, the event will take place at the Gifford House. For more information please call 845-677-5359.

THE ECOLOGY SHOP

See our unique assortment of nature and gardening gifts. Many items are fair-trade, recycled, or otherwise earth-friendly- so you can feel good about your purchases. *Senior Citizens Days: 10% off on Wednesdays.*

GREENHOUSE

The Greenhouse is a year-round tropical plant paradise and a site for controlled environmental research. Managed using integrated pest management, plants thrive in its pesticide-free environment! The greenhouse is open daily until 3:30 pm with a free permit (see HOURS).

IES SEMINARS

Free scientific seminars are held at 11 a.m. on Fridays in the auditorium from September until early May. Below is the schedule through October 22nd.

Sept. 17: **"Community assembly in time and space."** *Dr. Jonathan Chase, Washington University*
Sept. 24: **"Spectral representation of pattern and scale in ecology**." *Dr. Timothy Keitt, University of Texas at Austin*
Oct. 1: **"Food webs in river networks."** *Dr. Mary Power, University of California at Berkeley*
Oct. 8: **"Eating and not dying: costs and constraints of dietary specialization in mammalian herbivores**." *Dr. Denise Dearing, University of Utah*
Oct. 15: **"Aboveground-belowground interactions: relating macrophyte diversity to wetland ecosystem function."** *Dr. Serita Frey, University of New Hampshire*
Oct. 22: **"Tracking non-native species at the national level in U. S. ecosystems."** *Dr. Laura Meyerson, The Heinz Center*

Two Free Lectures by **Lester Brown**

World Famous Ecologist & Environmentalist

This fall renowned economist-ecologist Lester Brown will hold two lectures on either side of the Hudson River: Oct. 5th at Dutchess County Community College at 7pm and Oct. 6th at SUNY New Paltz at 7pm. Do not miss this opportunity to hear the man the Washington Post describes as "one of the world's most influential thinkers." For more information, call 845-687-8440

HOURS

Summer Hours: April 1 - September 30

Public attractions: Mon.-Sat., 9-6, Sun. 1-6; closed public holidays. The greenhouse closes at 3:30 daily.
The Ecology Shop: Mon.-Fri., 11-5, Sat. 9-5, Sun. 1-5.
(*Please note: The shop is closed Mon.-Sat. from 1-1:30.)*
Free permits are required and are available at the Gifford House Visitor and Education Center until one hour before closing time.

MEMBERSHIP

Join the Institute of Ecosystem Studies. Benefits include subscription to the IES Newsletter, a reduced rate on courses and excursions, a 10% discount on IES Ecology Shop purchases and participation in a reciprocal admissions program. Individual membership: $50; family membership: $60. Interested? Call the Development Office at 845-677-7600 ext. 120.

The Institute's Aldo Leopold Society

In addition to receiving the benefits listed above, Aldo Leopold Society members are invited to special lectures, excursions and science updates. To learn more, call the Development Office at 845-677-7600 ext. 120.

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... for education, general information and The Ecology Shop:

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... IES website: www.ecostudies.org

For information on current IES public events and attractions, visit: www.ecostudies.org/ThisWeek.html.
For garden tips, visit: www.ecostudies.org/gardens.html.

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Editor's Note

Summer is a time when our local environment bursts with color. The Gifford Garden is in full bloom. Be sure to drop by and meander around the carefully arranged flower beds. Nature's wildflowers are also making their seasonal appearance. Among them, the delicate yellow blooms of horse balm in the Fern Glen, pale white meadowsweet flowers in the lowlands and wild bergamot in the old hay fields.

Anyone fortunate enough to have a home kitchen garden knows the rewards of raising fresh vegetables. Those interested in introducing new tomatoes to their plates should consider attending a tomato tasting that IES is co-hosting with the Cornell Cooperative Extension on August 31st. For more information, see page 4.

On the back of the newsletter you will find the first half of the fall scientific seminar list and dates for two free lectures by economist-ecologist Dr. Lester Brown. Mark your calendars!

The *IES Newsletter* is published by the Institute of Ecosystem Studies, located at the Mary Flagler Cary Arboretum in Millbrook, New York.

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More Than Green: Plants Shape the Environment

by Lori Quillen

Roy Gumpel

Dr. Valerie Eviner is investigating plant legacy effects in old fields

On a recent trip to Fulton County, Georgia, a suburban enclave outside of Atlanta, it was hard to ignore the oceans of kudzu at the roadside. The plant carpeted curbs, signposts and the canopies of stately pine trees. When my host commented on the beautiful mats of greenery, I took it upon myself to extol the virtues of native plant diversity and lament the chokehold that invasive exotic species have on human-modified habitats. But my host's initial response was that green is good and these plants provide reliable doses of the color in an otherwise disturbed landscape.

Many of us have a firm grasp on the plants we find aesthetically pleasing. Few of us, however, consider the ecological impacts these plants have on the environments they inhabit. Institute scientist Dr. Valerie T. Eviner is one of these people. What began as a fascination with extreme plants has evolved into a research program exploring how plants alter the environments they grow in. "When hiking, I encountered a tree growing on a rock. Closer observation revealed that the tree was essentially turning the rock into soil, creating its own environment. I was fascinated," Dr. Eviner commented.

Later, work on global climate change reinforced Dr. Eviner's interest in the way that plants alter their environment. Many early studies predicting the ecological effects of global warming did not account for the role of plant communities. "If the temperature rises, we might predict that warmer soils will increase microbial activity and stimulate decomposition. However, if warming temperatures change which plants dominate the community, we might get the opposite effect," Dr. Eviner notes.

Recent findings indicate that plant community shifts can have greater or different ecological consequences than warming alone. Depending on the system at hand, plant-environment interactions can reduce or magnify global change impacts. Because it is not feasible to screen every plant species for its ecological effects, plant traits are used as indicators of how a plant will act in a given environment. For example, a plant that fixes nitrogen, such as a legume, will be better suited to grow on nutrient-poor soils.

Far from passive greenery, Dr. Eviner's research on plant traits explores how plant populations can regulate water availability, soil nutrients and resident animal populations. Plant communities can provide valuable services, such as erosion control, heavy metal removal and improved water quality. In agricultural settings, plant mixtures can reduce pesticide and herbicide dependence.

Currently, Dr. Eviner is working on a framework for predicting how plant species affect ecosystem processes, both alone and in mixtures. Historically, when assessing how plants influenced ecosystems, researchers grouped them by their effects on a specific function, rather than their multiple functions. Dr. Eviner's research on old fields and farmlands has shown that plants that have similar effects on one function can differ greatly in their effects on others. For instance, two grass species can have similar effects on nutrient cycling, but significantly different effects on soil moisture or erosion.

By looking at a plant's suite of traits and functions, instead of focusing on one overriding attribute, Dr. Eviner hopes to predict better plant ecosystem effects. "When you understand the ecosystem effects of plant traits, you can apply this information to sustainable agriculture, global change, restoration and invasive species management," Dr. Eviner comments.

Depending on species type, plants "do" different things, from aerating the soil beneath them to preventing agricultural run-off from polluting

continued on page 3

Limnology: What It Is and Why It Matters

by Lori Quillen

For many, summer is synonymous with getting wet. From kayaking on a river or fishing in a stream to spending lazy days reading by a lakeside, many of us flock to inland water bodies when the temperature rises. While enjoying the water's ebb and flow, we may investigate resident animals, smoothed over stones and the aquatic plants that get entangled in our legs, oars or fishing line. Some of us might even ponder larger questions, such as how the water body we are swimming in was formed or why the fish we are trying to catch are found only in certain locations.

When seeking answers to these and other questions, chances are good that we will draw upon insight provided by limnologists. To gain a better understanding of this field, I posed several questions to Institute scientist Dr. Jonathan J. Cole. As the new president of the American Society of Limnology and Oceanography (ASLO) and a recipient of the International Ecology Institute's Limnology Prize, Dr. Cole is uniquely suited to demystify this important but often misunderstood discipline. One of Dr. Cole's goals, as ASLO President, is to make limnology a household word.

Matt Van de Bogert

Drs. Jonathan J. Cole and Michael L. Pace discussing limnology on Paul Lake in Wisconsin. Not shown, but a valuable participant in their limnological conversations, Dr. Stephen R. Carpenter.

Can you give me a brief definition of the word limnology?

Limnology is the study of inland waters. This includes their physical, chemical and biological relationships as well as the way they interact with their drainage basins and the atmosphere. Just as oceanography is the multidisciplinary study of the oceans, limnology is the multidisciplinary study of inland waters.

Does limnology include inland saline waters?

Sometimes limnology is erroneously equated with the study of freshwaters. It is really the study of inland waters, including saline systems such as brackish marshes. Other inland water sources that people might not readily think of include groundwater and wetlands.

How does it differ from aquatic ecology?

Limnology is broader; in addition to biology and chemistry, it encompasses the fields of geology and physics. Typically taught in university biology programs, limnology often is perceived as having a biological bent. However, many early limnological studies focused on the physics of inland water bodies. The lake heat budget research pioneered by E.A. Birge (1915), America's first limnologist, was clearly about physics. Limnology includes ecology, but it's not the primary focus.

While limnologists are trained in a specific field, such as organic chemistry or population ecology, they often are interested in processes that involve several fields simultaneously. The scope of the discipline is evident in the range of research that limnologists conduct. They include the geology of how lake basins or river channels form, the influence of terrestrial vegetation on lake nutrient cycles and the physics regulating gas exchange across the air-water interface.

How does a multidisciplinary framework influence research?

A chemist might study how organic compounds react with mercury in a lab setting, outside the context of nature. A limnologist would investigate the pathways and chemical reactions that regulate mercury cycling in an inland water body. How does water flow, basin shape or resident aquatic life impact the way mercury moves through a system? When moving from a lab to a natural setting, one must also consider physics, biology and geology.

Broadly trained to start with, limnologists need to educate themselves throughout their careers. Like many oceanographers and other ecosystem scientists, they often work in multidisciplinary groups. Through collaboration, a mix of scientific strengths can be used to address a research question.

Reservoirs provide us with essential drinking water. Are limnology studies conducted on these created systems?

Absolutely. In the past, most limnologists focused their research on what were considered pristine aquatic systems. We've come to recognize that all aquatic systems are subject to human-induced changes. Human impacts can be indirect and distant. Rain falling on a remote lake can be tainted with pesticide or fossil fuel chemicals that originated miles away. In the case of reservoirs, the human hand is large and obvious.

You can't approach the hydrologic cycle without considering reservoirs. These impoundments increase the residence time of water in river systems. Here is something to consider— the 12 largest reservoirs in the world cover an area larger than the 10 largest natural lakes in the world. The new Three Gorges reservoir in China will eventually contain more water in it than Lake Superior!

Early limnologists viewed lakes as self-contained systems. Now, the watershed is considered. What led to this shift?

The idea of lakes as 'self-contained' independent ecosystems, as described in S.A. Forbes' classic work *The Lake as a Microcosm* (1925), was appealing for a long time. Some aspects of limnology can still be approached without investigating surrounding terrestrial ecosystems; some can't. The microcosm view became less useful when limnologists began looking at more open systems, such as streams and rivers, which are intimately and obviously connected to their watersheds.

Even for lakes, it was evident for a long time that terrestrial nutrient inputs, such as nitrogen and phosphorus, fueled the growth of aquatic plant life. As scientists became more interested in exploring open systems, such as hydrology, the microcosm view faded in utility. If one is interested in where a lake's water comes from and goes to, it is impossible to think of a lake as a closed system.

What can limnology tell us about ecological/environmental health?

Aquatic systems are like the canary in the coal mine, they tell us what's going on in the larger

continued on page 3

Limnology, *continued from page 2*

environment. Because humans depend on water, its quantity and quality are relatively well monitored in the World's wealthier countries. Declining river discharge or lower lake water levels provide insight into changes in climate or water use. We pay attention to fish health because humans consume them. Fish trends, such as PCB concentration or cancer incidence, can be used to track the effectiveness of environmental clean up.

We can assess if nutrients from sewage or agricultural fertilizers are causing water quality problems by measuring surface water plankton and deepwater oxygen levels. High nutrient inputs can stimulate plankton growth in lakes. In extreme conditions, plankton can cover the water's surface, blocking sunlight and causing a decrease in underwater aquatic plants. When these algal blooms sink and decompose, they consume aquatic oxygen, making the water inhospitable for fish.

Remote sensing lets us assess plankton cover on large numbers of lakes. Tracking the number and locations of these nutrient-enriched systems is like tracking the numbers and locations of human lung cancer. A lot can be learned from these epidemiological approaches and the patterns they reveal.

Lake sediments accumulate slowly. Clues to past conditions, both in the lake and in the surrounding watershed, often are preserved in these sediments. Our current understanding of how terrestrial plant communities have changed since the time of glacial retreat to the present is drawn largely from research on pollen in lake sediments.

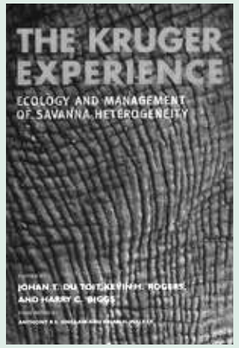
How can limnology inform sound management and policy decisions?

Basic limnological research often reveals environmental problems and trends. Scientific understanding of inland waters informs management decisions such as the restoration of degraded systems, the construction of wetlands and the long-term health of reservoirs.

What is one thing everyone should know about limnology?

The word "limnology" is not as well recognized as it should be, given its importance. Humans can't live without fresh water. Engineering has a very limited capacity to provide new fresh water (as in desalinization of sea water) or to clean up water on either the output side (e.g., sewage treatment plants, agricultural wastes) or the input side (as in filtration of water from reservoirs). Humans have the ability to protect or destroy both the climate system that delivers fresh water and wetlands that maintain it in a usable condition. Given our dependency on this resource, it is in society's best interest to protect fresh water systems. ●

The Kruger Experience Reviewed in Nature



With nearly 2 million hectares of land, a wealth of biodiversity, a turbulent political past and an evolving focus on community-based sustainability, South Africa's Kruger National Park presents a daunting management challenge. In *The Kruger Experience: Ecology and Management of Savanna Heterogeneity*, the contributing authors, including Drs. Steward T. A. Pickett and Mary L. Cadenasso, provide insight into their savannah experiences— from managing fire and allocating water to understanding how riparian corridors function in semi-arid landscapes.

The common thread— how different parts of the landscape interact to form an ecosystem that is more than the sum of its parts. If adaptive management strategies are to be effective at protecting the park, this heterogeneity must be accounted for.

In a book review in *Nature* (3 June 2004, vol. 429, pp 504-505), Dr. Andrew Illius of the University of Edinburgh writes, "The Kruger Experience is not about the experience of being there, which is breathtaking, but about the accumulated experience of the managers and scientists who have worked for a century to conserve and understand it in all its glory." Adding that while, "Most of Africa's great national parks were established at a time when land use was allocated to suit the economic interests of colonial settlers," crude management has been superseded by, "more subtle forms of adaptive management that attempt to recognize the complexities of natural processes within defined conservation objectives."

Plants, *continued from page 1*

nearby streams. When we change what is growing on a site, without considering plant traits, unforeseen ecological changes can be ushered in. Think about plant matter that grows below ground— not all roots are created equal. A root-bound houseplant holds soil better than a carrot. If woody plants with abundant deep roots are removed from a streambed and replaced with plants that have carrot-like taproots, stream stabilization would decrease, resulting in erosion.

Even after they are removed, many plants leave behind what is referred to as a "legacy", meaning that some of their effects remain in the soil. Crop rotation is an example of how humans have benefited from plant legacies. Legumes, such as alfalfa, increase soil nitrogen by capturing atmospheric nitrogen through specialized root bacteria called rhizobia. This nitrogen remains in the soil after the legumes are removed, aiding the growth of other plants. Rotating between legume and non-legume crops was a method of enhancing soil fertility before the advent of chemical fertilizers.

Crop rotation also has important effects on soil erosion and water flow. Root structure tends to either push soil out of the way or hold it together. Depending on the plant, this can provide aeration, drainage or erosion control. With collaborators at the Dutchess County Soil and Water Conservation District, Dr. Eviner is investigating the longevity of legume plant effects on soil erosion and water flow.

When restoring functionality to a degraded system, understanding plant traits is essential. "In ecological restoration projects, there is a tendency to focus on the most pressing problem, such as erosion control. The long-term value of a project will be enhanced if other ecological functions, such as nutrient cycling and water retention, are taken into consideration," Dr. Eviner comments. This approach might require a diversity of plants but it will also minimize future problems, such as establishing an aggressive plant that stabilizes a stream bank at the expense of plant diversity.

When plants are looked at through the lens of their ecological functions, with recognition given to the role they play in shaping the environment they grown in, aesthetic preferences can be put in perspective. This brings us back to kudzu, which currently covers some 4 million acres in the southeastern United States. Once-upon-a-time, the aggressive vine was touted as the botanical savior of the South. Dubbed the "gully mender," its thick mats abated soil erosion. A protein-rich legume, it came with the added benefits of fertilizing poor soils and providing cattle food.

Too much of one thing is seldom good. No one accounted for kudzu's tendency to blanket forest-edge communities, rights-of-way and drainage areas wherever light was sufficient. When my host learned of the plant's ability to smother young trees and topple the stately pines he so admired, he wanted to know why agriculturalists had not picked a better vine. A strong framework for predicting how plant species affect multiple ecosystem functions could help prevent casting another "green curtain" on our natural areas. ●