INSTITUTE OF
ECOSYSTEM STUDIES
Education Program
Box R
Millbrook, New York 12545-0178

Newsletter

Volume 22, Number 2
March - April 2005

Calendar

CONTINUING EDUCATION

Spring is a time for new beginnings; if you haven't before, why not try a Continuing Education course? Below is a sampling of class offerings. To receive the complete brochure, please call 845-677-9643, or visit our web site at www.ecostudies.org/cep.html.

Gardening
May 14 (1 Sat.): **Summer Container Gardens**
May 21 (1 Sat.): **Beautiful Food: The Ornamental Vegetable Garden**
May 22 (1 Sun.): **Spring Wild Plant Identification**
June 4 (4 Sat.): **Native Plants**
June 18 (1 Sat.): **A Rose is a Rose- Well Not Always**

Natural Illustration
May 20-22 (Fri.-Sun.): **Wildlife Illustration**
June 5 (4 Sun.): **Watercolor for Beginners**

IES Summer Ecology Day Camp
NOW ACCEPTING REGISTRATIONS

Do your children enjoy exploring the natural world? Would they like the opportunity to perform hands-on experiments and interact with IES scientists? Consider enrolling them in Ecology Day Camp. Campers will get to explore our 2,000 acre property through ecology experiments, hiking, nature art and ecology games. Summer camp consists of 9 one-week sessions from June 27th through August 26th. To reserve a spot that suits your summer schedule, enroll ahead! For information or to register, please call the Education Office at 845-677-7600 ext. 316 or visit www.ecostudies.org.

JUNIOR CAMP COUNSELORS

We are now accepting applications for Junior Camp Counselors for the 2005 Summer Ecology Day Camp. Students entering grades 8 and above may apply for this week-long volunteer opportunity. For more information please call Luanne Panarotti at 845-677-7600 ext. 319.

IES SEMINARS

Free scientific seminars are held at 11am on Fridays in the auditorium from September until early May. Below is a selection of upcoming lectures:

April 22: **"Reproductive energetics of free-ranging Brazilian free-tailed bats: value added knowledge for assessing ecosystem services"** Dr. Thomas Kunz, Boston University
April 29: **"Coevolutionary dynamics of plant-pathogen interactions"** Dr. Jeremy Burdon, CSIRO-Plant Industry
May 6: **"Human-fire interactions in the Alaskan boreal forest: human actions in a regional system"** Dr. Terry Chapin, University of Alaska

SATURDAY ECOLOGY PROGRAMS

Come to our free public programs. Children age 6 and up are welcome with an accompanying adult. Programs are from 1-3 pm and begin at the Gifford House Visitor and Education Center located at 181 Sharon Turnpike in Millbrook, NY. If you have questions, call 845-677-7600 ext. 317.

May 7: **Stream Ecology.** Join IES Educators Stephanie Lane and Sarah Stein on an adventure exploring the creatures that live in local streams. Bring your boots!

THE ECOLOGY SHOP

If you are looking for a unique gift, come to The Ecology Shop. You will find an 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! Open daily until 3:30 p.m. with a free permit (see HOURS).

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.)*
Required free permits are available at the Gifford House Visitor and Education Center until one hour before closing time.

THE INSTITUTE'S ALDO LEOPOLD SOCIETY

Through their generous support of IES research, Aldo Leopold Society (ALS) members invest in ecological understanding. In addition to receiving benefits and discounts, ALS members are invited to special lectures, excursions and science updates. To learn more, call the Development Office at 845-677-7600 ext. 120.

TO CONTACT IES ...

... for research, graduate opportunities, library and administration:

Institute of Ecosystem Studies
Box AB, Millbrook, NY 12545-0129
Tel: 845-677-5343 • Fax: 845-677-5976

Street address: Plant Science Building,
65 Sharon Tpke. (Rte. 44A), Millbrook, NY 12545

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

Institute of Ecosystem Studies
Education Program
Box R, Millbrook, NY 12545
Tel: 845-677-5359 • Fax: 845-677-6455

The Ecology Shop: 845-677-7600 ext. 309

Street address: Gifford House Visitor and Education Center, 181 Sharon Tpke. (Rte. 44A), Millbrook, NY 12545

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

Volume 22, Number 2
March - April 2005

Editor's Note

Spring marks a number of important events at IES. On April 21st, the Institute held its annual Volunteer Ceremony. Volunteers were recognized for their efforts in making the Institute a better place. From potting plants in the greenhouse to assisting with our education programs, during the past year 166 volunteers donated over 7,202 hours of time.

Biennially, the Institute hosts a Cary Conference on an emerging topic in the field of ecology. This year, over 80 distinguished scientists will meet at IES to explore the relationship between ecological health and infectious disease. Look for conference highlights in the next issue of the *IES Newsletter.*

Gardeners will want to mark their calendars for the annual IES Spring Plant Sale, taking place on May 20-22 (see page 3 for hours). The sale will feature an array of botanical offerings, from woody plants to perennials.

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

President & Director: Gene E. Likens
Administrator: Joseph S. Warner
Head of Education: Alan R. Berkowitz
Writer & Editor: Lori M. Quillen
Production Assistance: Pamela Freeman

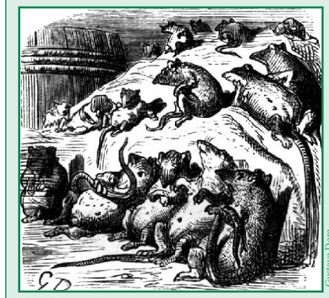
Address newsletter correspondence to:
Public Information Office
Institute of Ecosystem Studies
Education Program, Box R
Millbrook, NY 12545-0178
e-mail: QuillenL@ecostudies.org

Printing: Spectrum Graphics, Poughkeepsie, NY

Undesirable Expatriates: Preventing the Spread of Invasive Animals

Reconsider relocating aquarium fish into your backyard pond. Restrain yourself from ordering exotic pets through the Internet, no matter how interesting they might look in the pictures. And vote for politicians that encourage sound port inspection. Because, according to a recent *Proceedings of the National Academy of Sciences* article by IES Postdoctural Associate Dr. Jonathan M. Jeschke and IES Aquatic Ecologist Dr. David L. Strayer, our best defense in combating invasive animals is ensuring that they don't infiltrate our natural areas in the first place.


The University of Edinburgh


Gustave Dore

Top: European mink have been negatively impacted by species introductions from North America. Bottom: Unintentionally introducted into the U.S., rats cause an estimated $19 billion dollars in damage annually.

Defined by the authors as animals that have established and spread outside of their native range, many invasive species become economic and ecological burdens. Successful invaders can displace native animals through resource competition, predation or disease— ushering in biodiversity loss. Globally, invasive species are the second leading cause of animal extinction, preceded only by habitat loss.

Not all introduced animals become invasive. When moved into a foreign environment, many animals find conditions unfavorable and fail to establish. In an effort to gain insight into how frequently introduced animals become invasive, Drs. Jeschke and Strayer analyzed bird, mammal and freshwater fish introductions between Europe and North America. Jeschke comments, "We focused our study on larger vertebrates because there are better historical records about their introductions, which were often done purposefully for human use."

While motivations vary— some animals make great pets, others have valuable pelts— humans have been moving animals between Europe and North America for hundreds of years. Enterprising furriers imported American mink into Europe, where the animals escaped from captivity and spread prolifically. European mink have been suffering ever since. Other animals have been introduced unintentionally. Rats were stowaways on the first vessels sailing from Europe to North America. They now flourish in urban and agricultural areas, causing approximately $19 billion dollars worth of damage in the U.S each year.

The authors' exhaustive analysis, which drew on data from the 15th century to the 20th century, revealed an unsettling conclusion. For every four animals that made the transatlantic journey, one became invasive. Jeschke notes, "Our data indicate that once introduced, vertebrates have a 25% chance of becoming invasive. This figure, which appears to be true for other animals as well, is significantly higher than the 1% probability that dominates invasive species risk assessments. The 1% probability is based on plant invasions. Introduced animals do not act like introduced plants— they appear to have a much higher invasion success rate."

Given that humans are the primary vehicles for transporting animals across the ocean, it's not surprising that animal introduction patterns between Europe and North America mirror immigration patterns. Overall, a higher proportion of European animals entered North America than vice-versa, with introductions peaking in the 19th century and decreasing thereafter. This decline can be attributed to a reduction in immigration following WWI and increased U.S. regulations on wildlife imports.

Conversely, North American introductions to Europe have been on the rise throughout the 20th century as more Americans immigrate to European countries. In many parts of Europe, regulations on imported wildlife are not as strict

continued on page 3

Modeling Tropical Forests: An Interview with Dr. Maria Uriarte

Lori M. Quillen

Dr. Maria Uriarte uses statistical modeling to understand how human land use and hurricanes shape Carribean forests.

Sporadic weather events can alter the structure of forests. When subject to intense climate conditions, trees face new survival obstacles. The recent tsunami activity in Southeast Asia is testimony to nature's ability to alter the landscape. In many affected regions, such as India, vegetation was stripped from coastal areas. In the tsunami's wake, a range of trees, from mangroves to cultivated bananas, was damaged.

Post-tsunami, will different species become dominant? Will land use patterns influence how forests recover? These are the types of questions explored by IES Postdoctoral Associate Dr. Maria Uriarte. Working with IES forest ecologist Dr. Charles D. Canham, she is developing statistical tools to help understand how forests respond to hurricanes. This summer, Dr. Uriarte will begin teaching at Columbia University. Recently, we discussed her research in Puerto Rico's Luquillo Forest.

Why are tropical forests important?
Tropical forests are being cut down at a rapid rate; understanding their dynamics is crucial to sound management. They contain an estimated 50% of the World's biodiversity and they help regulate the carbon cycle. Fossil fuels release carbon dioxide when they are burned. Increased carbon dioxide levels are linked to climate change. Tropical forests, particularly young ones, have the potential to sequester and store large amounts of carbon.

Why are models useful for understanding forest dynamics?
Forest change is a slow process. Trees often outlive ecologists, making forests difficult to study in real time. Models allow ecologists to simulate how environmental changes, such as invasive species or severe weather events, might impact forest dynamics.

How did the project in Puerto Rico originate?
Charlie Canham developed a model for interpreting how trees grow in response to their neighbors. His neighborhood dynamics model is being used in British Columbia to help develop sustainable forestry. There was an interest in applying it in Puerto Rico's Luquillo Forest, in an effort to understand how hurricanes shape forests. I began working on the project in 2002.

Describe neighborhood dynamics.
I would define it as how trees respond to their neighbors based on their individual characteristics and who is growing near them. Trees are sedentary. If they find themselves growing in an inhospitable environment, they can't relocate. In a forest, the trees growing within a certain radius around a tree often determine its survival success. By looking at the trees growing in this "neighborhood" you can gain insight into dynamic processes, such as growth or survival. For instance, a shade intolerant tree is less likely to survive if it is surrounded by tall trees with dense canopies.

How does the model work?
Forest modeling requires inventorying the trees on a plot and accounting for the variables that regulate their survival. Data are recorded on things like tree size, light availability, species composition, the spatial position of trees within the plot, and so forth. By entering this information into a computer simulator, we can ask scenario-based questions that quantify how different variables impact tree growth and survival. In the case of Puerto Rico, we could ask— what will the forest look like if we have a severe hurricane twice in the next decade?

Tell me about the site you are studying.
We are researching Caribbean forest dynamics on a 16-hectare plot in Puerto Rico's Luquillo Forest. The plot is part of the Smithsonian Institution's Center for Tropical Forest Science, a network of 18 research forests throughout the tropics. By standardizing data collection— trees are mapped, measured and identified in similar ways— the network is generating the research needed to understand the processes driving tropical forest dynamics.

In 1934, the U.S. Forest Service purchased the land that houses the Luquillo plot. Aerial photos taken at that time provide a window into the forest's past. The southern two-thirds of the plot, which is relatively flat, had been extensively logged and farmed. Due to steeper terrain, the northern end of the plot was left relatively intact.

What makes the plot well suited to studying forest dynamics?
Globally, human land use is arguably the most pressing environmental issue facing tropical forests. Decades after human disturbance has ceased, land modification can leave a lasting footprint. We are interested in how human land use impacts the way forests recover from hurricanes, and how hurricanes affect human land use legacies. The Luquillo plot has a rich history of human-induced land use legacies and hurricane exposure.

Good models require extensive survey data. The Luquillo plot has been inventoried three times: following Hurricane Hugo in 1990, in 1995, and in 2000. A second hurricane, Hurricane Georges, struck the forest in 1998. There are 140,000 trees that have been mapped, measured, and identified. Damage sustained from the two hurricanes has also been documented. Very few tropical forests have been surveyed to this extent.

What's the connection between land use and hurricanes?
When humans modify the land, and slow-growing shade-tolerant trees are removed, forest structure is altered. After logging or farming activities cease, shade-intolerant species tend to dominate forests. Their wood is less dense than shade-adapted trees, making them vulnerable to snapping during hurricanes. In the event of a severe hurricane, areas with a history of human land-use will suffer greater damage than areas of undisturbed forests.

How do hurricanes shape tropical forests?
The most obvious effect of hurricanes is broken trees— trees are uprooted, their crowns are damaged, or they are crushed when a neighboring tree falls on them. Immediately after a hurricane there is a lot of damage, but few trees actually die. In the short term, a tremendous amount of debris

continued on page 3

Undesirable, *continued from page 1*

as in the U.S. and Canada. Canadian geese, gray squirrels, and northern cottontail rabbits already populate the European countryside. In the absence of precautions, Jeschke speculates that North American animal introductions may become more common.

The bottom line— vertebrate animals have a high rate of invasion success. Once established, they can act as biological pollutants that result in ecological and economic damages. "The best way to combat invasive species is to prevent them from being introduced. As global trade increases, precautions like port inspection and exotic wildlife regulations are essential. Consumers also need to be educated; many exotic animals that are legal as pets could be ecologically lethal if released into the wild," Jeschke concludes.

Future research by Jeschke will explore why, once introduced, animals are more likely than plants to become invasive. ●

IES Spring Plant Sale May 20-22

Hours: Friday and Saturday, 10am to 4pm; Sunday, 11am to 4pm

Location: The Gifford House Visitor and Education Center

Questions? Call 845-677-7600 ext. 309 or 300

Monitoring Climate Patterns: IES Hosts a New NOAA Weather Station

Tucked away on a field at IES, a state of the art weather station records climate conditions, such as wind and rainfall, hourly. Installed by the National Oceanographic and Atmospheric Administration (NOAA), the station is part of a nationwide monitoring program called the U.S. Climate Reference Network (USCRN). The network consists of over 75 stations throughout the country. Using identical equipment, the stations are collecting long-term weather data that are vital to understanding climate change.

The Institute was selected as a USCRN station host last summer, following a rigorous review process. The organization's location, long-term stability and staff expertise played a role in its selection. Under the direction of Environmental Monitoring Program Manager Vicky Kelly, the Institute has been monitoring climate conditions for over 16 years.

Recently, data from the Institute's USCRN station became available on-line. Wondering how measurements taken on the ground in Millbrook become accessible to the world, almost instantly, on the web? The answer lies in NOAA's Geostationary Operational Environmental Satellites. The weather station transmits measurements to the satellites, which send these data, in near real-time, to the web team at NOAA's National Climatic Data Center in North Carolina.

Weather stations and government agencies have been tracking climate patterns for decades. USCRN is unique in the way it selects its sites and standardizes its equipment. Traditionally, weather monitoring takes place in developed areas, such as airports. Because human modifications, such as blacktop, can alter ground temperature USCRN's sites are in less developed settings. To learn more about the program and to see real-time data, visit the U.S. Climate Reference Network at http://www.ncdc.noaa.gov/oa/climate/uscrn/

Modeling, *continued from page 2*

falls on the forest floor, burying seedlings. In the longer term, gaps in the forest canopy change regeneration patterns.

In the absence of disturbance, canopy gaps are rare in tropical forests. If you go to Panama, for instance, gaps are infrequent events that occur when a tree dies, through age or disease. In Puerto Rico, hurricanes knock over large numbers of trees. Post-hurricane, a lot of light reaches the forest floor. Young saplings, many of them shade-intolerant, vie for a position in the canopy. Only a few are successful; our plot has a high rate of sapling mortality.

What makes gap species more prone to hurricane damage?
Trees that exploit canopy gaps need to grow fast to prevent being shaded out by their neighbors. They grow quickly by producing low-density wood; high-density wood takes longer to build. The problem is, as mentioned earlier, tall low-density trees are prone to breaking. Slow growing, shade tolerant species are much more hurricane-resistant.

What challenges have you faced?
Most forest models have been developed for temperate zone forests, where species diversity is low and forests are well inventoried. Tropical forests have much higher diversity, but we know less about them. In Puerto Rico, 90 of the 140 species on our site are rare, with less than one tree per hectare. You need to survey much more land to come up with a model that provides insight into how rare species respond to environmental changes.

Is modeling limited by technology?
We are working with huge databases. When we model how 140,000 trees respond to a given change, each time the computer simulates the forest it has to account for every tree. These models were not possible 15 years ago; we are able to build them now because computing power has become fairly cheap.

Can models really be predictive?
There are so many factors regulating forest dynamics— it is almost impossible to predict exactly how a single change, such as a rise in temperature, will impact a forest. That said, models help us explore scenarios and organize our thoughts. They force you to be explicit about what you are thinking; you decide on the factors that go into a model and the relative importance they have. Models also provide us with probabilities that scenarios will occur. Many of the things we do in life, from investing to medical decisions, are based on probability.

How did you come to be an ecological modeler?
When working on my PhD, I did a little modeling and quickly became intrigued. Each dataset presents a new challenge, as does generating the equations that drive the models. There are three components to research— collecting data, analyzing data, and writing papers. For me, the most interesting part is analyzing data and writing papers. Spending six months in the forest is not my passion, but if you give me a dataset I can find interesting things.

What advice would you give to a student interested in pursuing this type of work?
Don't be intimidated by math, there is nothing magical about it. Take a lot of statistics and computer classes and be prepared to spend a lot of time in front of your computer. It is a rewarding field for people who like puzzle-oriented problem solving. ●