



Charles D. Canham

TURNING FORESTS INTO FUEL

by Sian M. Hunter

Domestic energy debates have featured calls to reduce foreign oil dependency and the greenhouse gases that contribute to climate change. As a result, lawmakers, lobbyists, and environmentalists have turned their attention to forests as an energy source. Currently, all New England states have forest biomass goals in their energy plans.

New research conducted for the Environmental Defense Fund by Cary Institute forest ecologist Dr. Charles D. Canham and colleagues reveals flaws in many current assumptions about forest biomass as an effective substitute for fossil fuels. The findings, detailed in a forthcoming report, call into question the sustainability of available forest resources and the real impact of forest biomass in decreasing carbon dioxide emissions.

One widely-held misapprehension concerns the potential for expanding forestland by converting former farms into tree plantations. Canham estimates that available forest acreage in the northeastern U.S. has reached its apex. Since the 1900s, succession has been reclaiming agricultural land. Presently, forests make up nearly 70% of the northeastern landscape.

Many people, including some in the forestry community, also assume that trees are uniformly old and have peaked in their

carbon sequestration value. Canham's data paint a different picture: due to selective logging, regional forests vary in age and can be expected to store large quantities of carbon for at least the next century.

In calculating the forestland eligible for harvesting, Canham highlights additional problems that have not been factored into many proposals. While only about 5% of regional forestland is legally off limits from harvest, the percentage of ineligible lands may be as high as 30% when physical, legal, economic, and social factors that limit logging are considered.

Two complicating factors in the northeastern U.S. are parcel size and landowner values. Logging operations generally need to harvest at least 20 acres to be cost-efficient, yet many privately-owned parcels are less than 20 acres. And understandably, private landowners often prefer to maintain their woodlands for scenery, hunting, or interests other than biomass harvests.

One of the study's most surprising findings involves the failure to recognize competing claims on forestland. Canham shows that when identifying trees to fuel bioenergy facilities, most states' proposals included accessing resources in neighboring states. For instance, a Vermont study

"Our forests provide a wide range of ecological, economic, and aesthetic benefits."

counts on trees from Massachusetts, New Hampshire, and New York, yet a Massachusetts proposal claims those same resources. Furthermore, Canham finds, these estimates do not adequately acknowledge the logging that currently exists to supply other industries such as lumber and paper.

At present, less than 6% of the energy supplied in the northeastern U.S. comes from woody biomass. Canham estimates that if all forest resources were dedicated solely to bioenergy, as much as 15% of the region's energy requirements could be met. Meeting the goals for sustaining those levels, however, could put unprecedented demand on northeastern forests.

Canham concludes, "Our forests provide a wide range of ecological, economic, and aesthetic benefits. They can also play a role in providing a sustainable energy supply. We just need to be realistic about what that role can and should be, so that we don't end up with legislation and regulations that do more harm than good."

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ECOfOCUS

Ecofocus is published by the Cary Institute of Ecosystem Studies. Our scientists are leading efforts to understand human impacts on air and water quality, climate change, invasive species, and the ecological dimensions of infectious disease. As an independent, not-for-profit organization, the Cary Institute produces unbiased research that leads to more effective management and policy decisions.

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FROM OUR PRESIDENT



Dear Friends of the Cary Institute:

This summer, news reports focused our attention on the blowout of BP's Gulf oil well. Meanwhile, the U.S. Senate failed to act on a climate bill that would have reduced U.S. greenhouse gas emissions and foreign oil dependence. The pace at which we wean our nation off fossil energy may well determine the quality of life for all the world's citizens in the coming decades.

The Cary Institute is working hard to assess the viability of alternative energy options. In the quest for renewables, decision makers have turned their attention to forest biomass as a potential fuel resource. Charlie Canham's recent collaboration with the Environmental Defense Fund, featured on the cover, investigates the role that northeastern forests could play.

Natural gas has also captured regional attention. New York State's decision to impose a moratorium on drilling in the Marcellus Shale will allow exploration of the impacts associated with hydraulic fracturing, a mining process with the potential to compromise local streams and groundwater. With our longstanding expertise in freshwater, the Cary Institute is positioning itself as a leader in these studies.

On many fronts, we are fulfilling our promise to deliver the science behind environmental solutions.

Our science was richly represented at the Ecological Society of America's annual meeting, where Steward Pickett assumed his duties as President-Elect, and Charlie Canham as Secretary. On display was Rick Ostfeld's upcoming book, *Lyme Disease: The Ecology of a Complex System*. And recently, I had the opportunity to share thoughts on soil carbon sequestration in testimony before the President's Council of Advisors on Science and Technology.

The Cary Institute continues to be committed to education and outreach. This past summer, our campus was abuzz with undergraduate researchers conducting field studies, high school teachers participating in science training workshops, and community members engaged in our well-attended weekend programs and public lectures.

On many fronts, we are fulfilling our promise to deliver the science behind environmental solutions. Special thanks to our supporters, large and small. They provide us with the flexibility to tackle time-sensitive projects and connect our scientific output with society.

All the best,

Dr. William H. Schlesinger, President

MY WATER COMES FROM THE HUDSON RIVER

by Sian M. Hunter

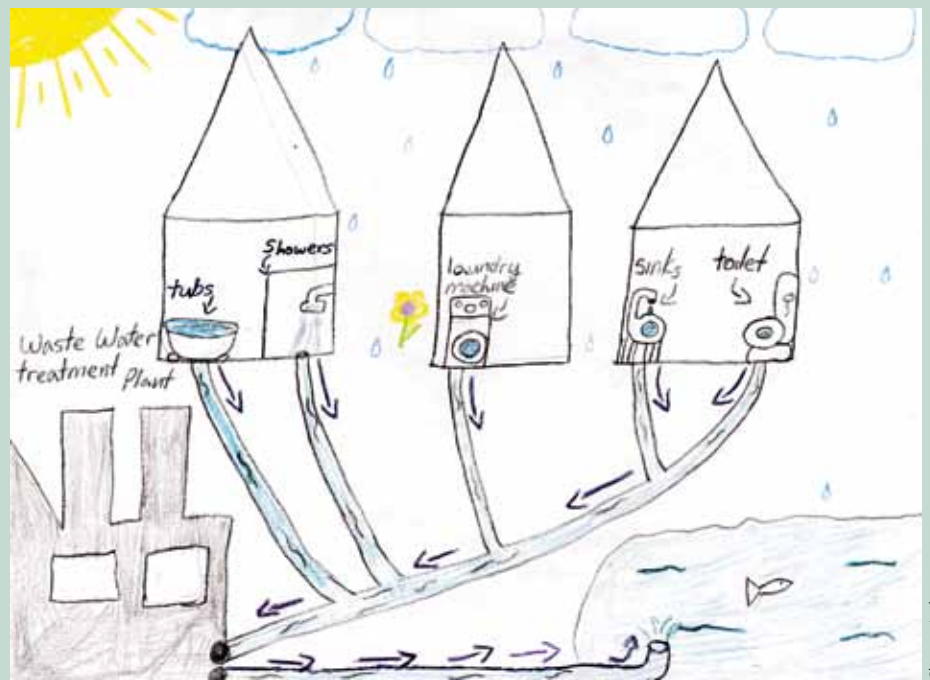
When we think of the water cycle, most of us recall the diagram with arrows that we were taught in third grade. Rain falls on mountains, mountain streams flow to the ocean, sea water evaporates into atmospheric moisture, and the cycle repeats itself. Unless you live on a volcanic island, however, this idealized rendering reflects neither the origin of your local water nor how human development affects the water cycle.

Cary Institute educators Cornelia Harris and Kim Notin are working to develop a lesson plan for fifth graders that teaches a more accurate community-based model. Currently called “the broken water cycle,” their curriculum takes into account human changes to a region’s water system, such as impermeable surfaces that decrease infiltration and increase runoff, depletion of groundwater aquifers, or pumping water long distances across watersheds.

The curriculum was tested in a year-long pilot program with Skip Hoover’s science class at Krieger Elementary School in Poughkeepsie. The effort was launched by asking questions like “Can rainwater get into your bathtub?” The answers they received displayed the eclecticism typical of that age group and ranged from a simple “no” to “yes, if there’s a leak in the ceiling.” By the end of the program, however, the students could describe a much more realistic water cycle that was relevant to their lives in Poughkeepsie.

For students at Krieger, that means starting with the Hudson River, since Poughkeepsie is the southernmost municipality able to source its drinking water above the river’s tidal salt surge. They learned how their drinking water originates from the same river into which wastewater is discharged, and they visited the Poughkeepsie Water Treatment Facility to see how the water was treated to make it safe to drink.

Students learned how impermeable surfaces, such as pavement and roof tops, impact the way rainwater disperses by



Fifth grade student Christine Andino’s representation of the urban wastewater cycle and its connection to the Hudson River.

conducting an experiment in the school’s parking lot. Harris and Notin asked each student to make a map of the permeable and impermeable surfaces in their own neighborhood and then, using Google Maps, extrapolated the percentage of such surfaces in Poughkeepsie and estimated the amount of rainwater that infiltrated or that turned to runoff.

This school year, Harris and Notin will expand the curriculum from Hoover’s classroom at Krieger to all five elementary schools in the Poughkeepsie school district. A place-based curricula, they argue, engages students with locally relevant issues while teaching more sophisticated science concepts than traditional models.

Notin comments, “Reading about the water cycle, or any other natural phenomenon, should be coupled with observations and investigations. Take kids outside and have them pour water on blacktop, or the forest floor. Have

A place-based curricula engages students with locally relevant issues.

them put plastic bags on branches and measure plant transpiration. This is how the water cycle becomes real, and this is how scientific skills can be achieved.” Once gained, these skills can be applied to other local environmental issues.

Their “broken water cycle” module offers a framework that other science educators can adopt. Harris and Notin presented their approach to the National Science Teachers Association and the Science Teachers Association of New York State and received much positive feedback. They intend to publish the concepts and accompanying sample lesson plans in a peer-reviewed journal such as *Science and Children*.

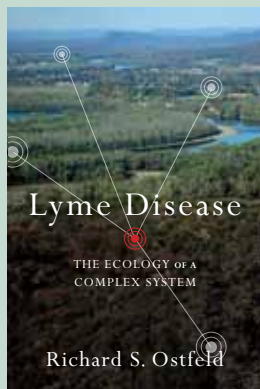
SPOTLIGHTS

OSTFELD TO PUBLISH BOOK ON LYME DISEASE ECOLOGY

Drawing on more than a decade of research, senior scientist Dr. Richard S. Ostfeld investigates connections among environmental conditions and infectious disease in his new book, *Lyme Disease: The Ecology of a Complex System*.

Published this fall by Oxford University Press, the book corrects misunderstandings about tick-borne diseases and shows how human health is closely tied to the ways we manage natural habitats and landscapes.

In addition to increasing our knowledge about Lyme disease, Ostfeld's book offers a model for understanding other emerging infectious diseases such as West Nile virus, SARS, and hantavirus.



ZEBRA MUSSEL RESEARCH TO BE FEATURED IN MUSEUM EDUCATION

During the spring and summer, a film crew from the American Museum of Natural History (AMNH) spent several days with Cary Institute research and education staff. Their goal—to create a short documentary on invasive species that highlights zebra mussels in the Hudson River. The film will be part of a National Science Foundation-funded educational initiative based at the museum.

Museum educators will develop print, video, and internet resources about the zebra mussel invasion, to be used in professional development with teachers, in classroom teaching with students, and in educational outreach opportunities with families. Cary Institute educators Lia Harris and Kim Notin will be consulting on the project; materials will be available on the museum's website this winter.

The collaboration was initiated by Hudson Roditi, an AMNH educator and an alumnus of the Cary Institute's Research Experience for Undergraduates Program (1993). Roditi studied zebra mussels with Dr. David L. Strayer; they co-authored several articles on filtration effects. Roditi also directs the AMNH-affiliated Urban Advantage, a middle-school science program based in New York City that seeks to improve scientific literacy through public education.



David Fischer

CARY INSTITUTE AT ESA

The Cary Institute was well represented at the Ecological Society of America's (ESA) 95th Annual Meeting, held in Pittsburgh, PA in early August. Cary Institute President Dr. William H. Schlesinger organized and moderated a symposium on the environmental impacts of mountaintop removal; he also led a session on scientists as effective public advocates. Distinguished senior scientist Dr. Steward T.A. Pickett, who is president-elect of ESA, organized a workshop on drought, water-ecosystem services, and environmental justice. Seventeen other Cary scientists and staff contributed research findings through posters, panels, and papers.

The Ecological Society of America is the world's largest professional organization of ecologists, representing 10,000 scientists in the United States and around the globe. Since its founding in 1915, ESA has promoted the responsible application of ecological principles to the solution of environmental problems through ESA reports, journals, research, and expert testimony to Congress.

A FOCUS ON COMMUNICATING SCIENCE

Building on the success of a 2009 Cary Conference on "Effective Communication of Science in Environmental Controversies," Dr. Peter M. Groffman recently edited a journal devoted to the topic. Published as a special issue of the Ecological Society of America's journal *Frontiers in Ecology and the Environment*, the papers explore ways in which academic institutions, federal agencies, nonprofits, and citizens can take part in addressing major environmental problems, both collectively and individually. Contributors include scientists, communications scholars, and journalists who participated in the conference.

THE NEWSLETTER IS AVAILABLE ONLINE

The Cary Institute's newsletter is available on our website at www.caryinstitute.org/newsletter.html. If you would prefer to read the newsletter online instead of receiving a printed copy by mail please notify us at freemanp@caryinstitute.org or call (845) 677-7600 x 121.

WHERE WE WORK

URBAN ECOLOGICAL RESEARCH REQUIRES INNOVATIVE METHODS

by Sian M. Hunter

While most ecologists conduct field work in natural settings, Cary Institute scientists have pioneered the inclusion of urban and suburban landscapes in ecological research. The Baltimore Ecosystem Study (BES), founded in 1997 by distinguished senior scientist Dr. Steward T.A. Pickett, is one of two NSF-funded long-term ecological research sites in the world that is based in a city. The BES field site presents unique challenges. Buildings, pavement, and underground sewers create unnatural environments, which impact pathogen circulation, air and water quality, and other environmental variables.

Dr. Shannon L. LaDeau recently joined the BES team. Building on her previous work, which showed that West Nile virus mortality among North American birds was greatest in human-dominated landscapes, LaDeau is now unraveling the mosquito part of the “bird-mosquito-human” transmission equation. Baltimore hosts few of the sixty-two species of mosquito known in the Mid-Atlantic region, but many of those present can transmit West Nile virus to birds and humans.

As her program unfolds, LaDeau is developing solutions to urban fieldwork hurdles. Rural ponds have seasonal

water-level variation, but generally remain wet year-round. In paved neighborhoods, however, urban puddles have a fleeting lifespan—often lasting for less than a week. This is great for mosquito breeding, but terrible for replicating research results. So in addition to puddle surveys, LaDeau uses water traps to attract egg-laying females and identify local mosquito species. By changing the traps weekly, she mimics the behavior of puddles.

Additionally, LaDeau notes, scientists can't just set up experiments wherever they please in urban areas. City regulations, private property restrictions, and human foot traffic are all elements that she navigates in the course of conducting research in this setting.

For LaDeau and the other BES participants, the challenges of urban ecology are simply part of the territory.



Big Stock

Since nearly three quarters of U.S. citizens reside in suburban and urban areas—and metropolitan demographics are growing worldwide—ecologists now realize the necessity of studying cities as habitats. To learn more about BES, visit www.beslter.org.

THE ECOLOGY OF SOUNDSCAPES NEW VISITOR EDUCATION KIOSK ON CARY GROUNDS



Kenneth Schmidt

The Cary Institute has added a new informational kiosk that draws on Adjunct Scientist Dr. Kenneth A. Schmidt's research on songbird soundscapes. Soundscapes are the audible components of a landscape that birds and animals use to make survival decisions, such as where to build a nest and when it is safe to forage.

The kiosk focuses on three species—the veery, the ovenbird, and the worm-eating warbler—and identifies the habitat, vocalizations, nest profiles, and breeding habits of each. It also describes why a tufted titmouse makes a good nesting neighbor, but a chipmunk does not.

Over the next three years, Schmidt will be collaborating with a team of education interns, whose purpose is to communicate the research to the public in an engaging and effective way. They will be updating the kiosk with ongoing research on the ecology of soundscapes.

SUPPORTERS' CORNER

INAUGURAL ECODISCOVERY DAY

Over 250 attendees joined Cary Institute scientists and educators on a gorgeous May day to explore the campus and see research in progress. Thirteen different activities allowed adults to talk one-on-one with the scientists and delighted children with inquiry-based stations. EcoDiscovery Day was made possible through the generosity of thirty-two sponsors. Join us again on May 22, 2011.



Pamela Freeman



Pamela Freeman



Pamela Freeman



Pamela Freeman



Jan Potrichak



Lisa M. Dellwo



Pamela Freeman

BIRD BANDING WITH VISITING SCIENTIST, DR. KEN SCHMIDT

This summer, Aldo Leopold Society Members were given a special opportunity to get up close and personal with songbirds on the Cary Institute's campus. The Saturday morning event included a bird-banding opportunity with Adjunct Scientist Dr. Kenneth Schmidt, a guided bird walk with President Dr. William Schlesinger, and a light brunch. Participants learned how birds use auditory cues from other animals, such as chipmunks, to make nesting and feeding decisions.



Holly Talbot



Lisa M. Dellwo



Mary Moeller



Mary Moeller



Lisa M. Dellwo



Holly Talbot

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Call Vicki Doyle to R.S.V.P. (845) 677-7600 x 203 or doylev@caryinstitute.org



CALENDAR

Upcoming Public Programs

Our Weekend Ecology Programs are a terrific way to interact with our staff and to learn about ecological concepts while exploring our grounds. For more information, visit us online or call (845) 677-7600 x 121.

Saturday, October 23rd at 6:30 p.m.

Full Moon Walk

Join our educators for an evening of moonlight exploration, with a focus on the creatures that come alive after dusk. We will host a walk for adults and a walk for families with young children. Meet at the main campus parking area, located at 2801 Sharon Tpk., (Rte. 44) in Millbrook, NY. Hiking shoes are recommended. R.S.V.P.'s suggested. Contact freemanp@caryinstitute.org or (845) 677-7600 x 121.

Thursday, December 2nd at 7:00 p.m.

Atlantic: A Biography of the Ocean

Simon Winchester, author of the bestselling *Professor and the Madman*, melds history and science to explore how the Atlantic has shaped human society and how our activities, in turn, have left an indelible mark on the Atlantic. The event will take place in our auditorium, located at 2801 Sharon Tpk., (Rte. 44) in Millbrook, NY.

Free and open to the public, our scientific seminars are held on Thursdays at 11 a.m. in the Cary Institute's auditorium. A sampling of offerings is below; a complete list is available online at www.caryinstitute.org.

October 14: Flowering Plants in Tropical River-rapids and Waterfalls: Ecology, Endemism and Impacts. Dr. Thomas Philbrick, Western Connecticut State University

October 21: The Influence of Agricultural Land Use on Stream Ecosystem Function. Dr. Jennifer Tank, University of Notre Dame

October 28: Cold, Dark Isolation: Life is Good for Subglacial Microbes. Dr. Jill Mikucki, Dartmouth College

November 4: Living in the Past: Quantifying the Ecological Memory of Plant and Ecosystem Processes. Dr. Kiona Ogle, University of Wyoming

November 11: The Livestock Revolution and its Impacts on Disease. Dr. Ilana Brito, Columbia University

Scientific Seminar Series

November 18: Restoration Remains an Acid Test: Constraints to Ecosystem and Community Recovery during Grassland Restoration. Dr. Sara Baer, Southern Illinois University

December 2: Microbial Adaptations to Global Change: Linking Microbial Physiology to Ecosystem Functioning Using the Molecular Toolbox. Dr. Matthew Wallenstein, Colorado State University

December 9: Sustainability Science in Forest Landscapes. Dr. Colin Beier, SUNY – ESF

December 16: Supporting Meaning Making in Science: The Role of Scientific Inquiry, Argumentation, and the Use of Evidence in Science Learning. Dr. Katherine McNeill, Boston College

For a complete listing of upcoming events, programs, and videos of past programs visit our website at www.caryinstitute.org/events.html.

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ECOLOGY TRAINING FOR TEACHERS



Comelia Harris



Ecology of the Hudson Valley Region

After school workshops for K-12 teachers will be offered by Cary Institute scientists and educators. Topics will include: Hudson River ecology, invasive species, soil ecology, biodiversity, composting, and sustainable farming. For more information, contact Kim at notink@caryinstitute.org or (845) 677-7600 x 303.

Hudson River Workshops

In collaboration with the Hudson River Environmental Conditions Observing System (HRECOS) the Cary Institute is offering several free Hudson River workshops for teachers. Visit the HRECOS website www.hrecos.org/joomla to register; learn more by contacting Lia at harrisc@caryinstitute.org or (845) 677-7600 x 321.