

Invasive Plant Chokes Parts of the Hudson River

Invasive exotic species can have dramatic impacts on native species abundance, biodiversity and biogeochemical cycles within ecosystems.

Institute scientists have been investigating the ecosystem consequences of invasive species in the Hudson River for the past decade (eg. Strayer et al. 1999, Caraco et al. 2000). Recently, Drs. Nina F. Caraco and Jonathan J. Cole have begun exploring the ecosystem impacts of water chestnut (*Trapa natans*), an invasive aquatic plant. Their work has revealed an important effect – hypoxia (low oxygen) in some parts of

the Hudson River. Hypoxia can alter nutrient and metal cycling and affect the quality of aquatic systems as fish habitat (Caraco and Cole 2002).

Native to Eurasia, water chestnut is a floating-leaved aquatic annual that was introduced into the U.S. for ornamental and medicinal purposes. The earliest North American record of the plant dates back to 1874, when Harvard botanist Asa Gray entered it into his botanical collection. Presently, the plant is found in lakes and rivers from New Hampshire to Maryland, where it forms thick beds that eliminate native plants. In the freshwater tidal Hudson River, it is the second most abundant aquatic plant. It prefers slow moving waters and is found primarily in embayments. Human alterations, such as jetties and islands constructed from channel dredge, facilitate the spread of water chestnut into areas historically occupied by water celery.

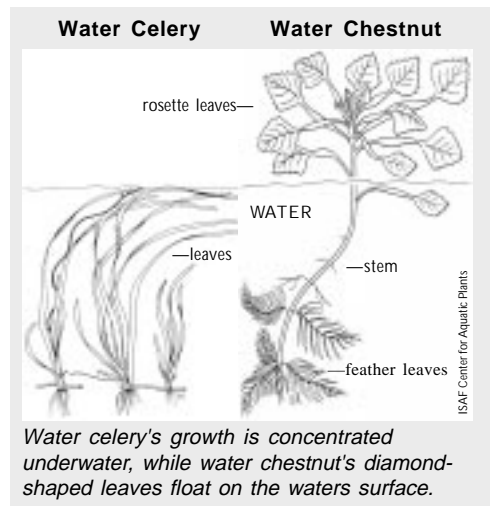
Water celery (*Vallisneria spiralis*), native to eastern North America, is the most abundant aquatic plant in the Hudson River. Its growth differs substantially from water chestnut; it has long ribbon-like leaves that are submerged beneath the water's surface. Aquatic plants with submerged leaves are referred to as submerged aquatic vegetation (SAV). Institute scientists, in collaboration with New York Department of Environmental Conservation and Cornell University,



Dr. Jonathan Cole retrieving a sonde meter from a water chestnut bed in Inbocht Bay, NY. Sonde meters are used to record dissolved oxygen, pH, turbidity, temperature and depth in aquatic systems.

have been investigating the distribution and function of SAV beds in the Hudson River. This work demonstrates that SAV plays a vital role in aquatic systems; healthy stands oxygenate the water column and provide food and refuge to aquatic organisms.

Prior to water chestnut's arrival, there were no large populations of floating-leaved plants on the Hudson River. Caraco and Cole questioned whether invasive water chestnut had the same oxygenating function as native SAV. Aquatic



Water celery's growth is concentrated underwater, while water chestnut's diamond-shaped leaves float on the waters surface.

organisms need oxygen to survive, and waters with high DO levels are considered healthier than waters with depressed levels.

In the Hudson River, water chestnut and water celery occur in distinct beds. Both exhibit peak growth from mid-July to mid-September. During

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Editor's Note

After one of snowiest winters in recent memory, spring is finally arriving at the Institute. Snow piles are melting, cross-country skis are being packed away for the season, and everyone is eager for the colors of spring. To meet that need, IES gardeners are busy preparing the grounds and attending to the perennials that will make their debut in the Gifford Garden and Fern Glen this May.

For those of you planning your summer gardens, be sure to mark the IES Spring Plant Sale on your calendars. The event will take place on Friday and Saturday, May 16 and 17 (10 am to 4 pm) and Sunday, May 18 (11 am to 4 pm).

Interested in learning more about planting? Now is a great time to enroll in an IES Continuing Education course! Developing Summer Container Gardens; Plants for the Landscape: Woody Plants; The ABC's of Mosses; and Landscape Design with Native Herbs are all being offered this spring.

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IES Continuing Education: Come Grow With Us!

Richard Wiesenthal became the Program Leader for the IES Continuing Education Program (CEP) in November of 2001. He is responsible for the program's 85 course offerings, workshops and excursions as well as advising students enrolled in certificate programs. He is personally increasing the coverage of ecological concepts in the courses; since his arrival the program has strengthened its ecological foundations. Richard and I recently discussed the unique nature of continuing education at IES and his ideas for the future.



R-L: Instructor John Deering and Program Leader Richard Wiesenthal

What do students do with certificates from IES? Many of our students are already involved in gardening and landscaping, and an IES certificate gives them a competitive edge. They are able to meet the specific needs of their clients. In today's information age, with numerous garden television shows and websites, savvy customers want to hire people who can provide quality services.

Other students are interested in opening businesses, and want a platform to launch their vision from. Gardening is something

you can enjoy from childhood well into retirement. This makes the program attractive to career-changers and early-retirees who want to start gardening or landscaping businesses. We have a lot of people who come to us and say, "I am going to retire in five years, I want to get my certificate and start a small business." And they do!

Do students get practical experience? Most of our instructors are practitioners in their field. We have instructors who work for The New York Botanical Garden, the Central Park Conservancy, and various land trusts; as well as people who manage private businesses and corporations. Their experience and connections provide students with networking opportunities and help them figure out where they belong career-wise.

The Gardening Certificate involves an internship at IES. Students get the opportunity to work in a garden with one of our professional gardeners. In the Principles of Landscape Design course, instructor Eve Minson had students work on the Rail-Trail, enhancing public space. Field experiences let students apply the information they have learned in the classroom in a real-life situation.

How do the courses instill ecological understanding in the students? Our instructors stress best management practices from an ecological point of view, and our course evaluations ask students to assess what they have learned about sound ecological practices. There is a required ecological

Design I & II and Native Plants to develop the core courses for these new concentrations.

This spring, we are offering our first graduate course, an advanced seminar in landscape design. It is geared toward people who have completed their certificates, we hope that advanced courses will encourage IES graduates to become lifelong learners. The field is constantly evolving, and continued learning is essential to career success.

Have students responded to the new Gardening Certificate concentrations? Very much so, native plants and garden design are hot subjects. The concentrations give people a niche for their interests. People who once might have considered becoming landscape designers are now becoming garden designers. These are people who know plant material, but are also looking at color, form, texture, and sequence. It has even gotten more specific, because now there are garden designers who use only native plants. The biggest indicator of interest – we are currently over-subscribed in garden design!

What sort of backgrounds do students pursuing certificates have? Almost everyone who enrolls in a certificate program has already begun learning from experience. They have planted a flower bed or landscaped a yard, and they want to increase their knowledge base. Learning "right-place right-plant" is an art; it involves soil, sunlight, proximity to other plants, change in climate, etc. Our program turns interest into expertise.

What does the program offer the public? Many people have the desire to connect with nature through working with the land. Our courses in gardening, landscape design, and botanical illustration give people an outlet to fulfill this need. There is nothing north of New York City or south of the Berkshires that offers the breadth of courses found at IES.

Students can take individual classes to enrich their understanding, or they can enroll in formal certificate programs. Currently, we offer a Gardening Certificate and Landscape Design Certificate. Both are well-suited to people that want to turn their passion into a career. Certificates can be completed within 18 months and are very affordable; for less than two thousand dollars students can have a new job option. IES has a strong reputation, and our certificates are recognized in the fields of gardening and landscape design.

Because we have certificate programs, many people assume that they cannot take a course unless they are enrolled in a program. Currently, all of our courses are open to non-certificate students.

How has the program evolved since your arrival? My predecessor had begun revising the Gardening Certificate, but had not enacted any of the changes. In 2001, we began offering concentrations in Garden Design and Native Plants. I worked with the teachers of Garden

The Institute Has a New Website!

On March 31st, the Institute launched a new website. Friends and visitors will find a wealth of information on IES research, programs and activities at www.ecostudies.org. The new navigation structure was developed to make the content more accessible to Internet viewers. We encourage readers to visit the website and provide feedback on the new look. As the Institute's face to the cyber world, we are committed to creating an informative and user-friendly website. Feedback can be addressed to QuillenL@ecostudies.org or LikensGG@ecostudies.org.

Linking Science & Management in South African Parks



Through support from an Andrew W. Mellon Foundation grant, Dr. Mary L. Cadenasso and Dr. Steward T. A. Pickett are helping to forge a link between science and management in South African National Parks. In April, they hosted a diverse group of scientists and land managers from Kruger National Park and South Africa's Marine and Arid Offices.

Front Row L-R: Dr. Steward T. A. Pickett, Guin Zombatis, Hendrik Situle, Ezekiel Khoza, Dr. Hugo Bezuidenhout, Glynn Allard, Andre Potgieter, and Thando Msomi. Back Row L-R: Erin Sizemore, Kirsten Schwartz, Jaques Vanter, Dr. Nic Hanekom, Danie Pienaar, Dr. Mary L. Cadenasso, Uusi Mgonezulu, Abi de Buys, and Howard Hendricks.

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component to each certificate. The Gardening Certificate has an Introduction to Ecology class and the Landscape Design Certificate has a course in Ecological Landscape Design. IES scientists Dr. Peter M. Groffman and Dr. Alan R. Berkowitz and IES Director Dr. Gene E. Likens are among the experts that participate in these courses. Immersion into ecology through top quality researchers is rare, and these courses make our program unique.

Staff scientists also participate in our elective classes. Dr. David L. Strayer lent his aquatic ecology expertise to John Deering's pond restoration workshop. And when renowned water gardener Anthony Archer Willis lectured, Dr. Stuart E. G. Findlay provided insight into wetland and aquatic plants.

Collaborations between instructors and scientists help infuse our courses with current ecological understanding. When teachers have a strong understanding of what IES is about, they are better equipped to convey ecological themes to students.

Future goals for the program?

I want to encourage people to take charge of their education and become lifelong learners. Too often people get certificates, and ten years later they have not been back to learn anything new. This was the motivation behind the establishment of the graduate courses. If you are a gardener or landscape designer- you are a work in progress!

Native plants are a great way to introduce gardeners to ecological thinking. In the future,

it would be useful if there were a plant bed in the Gifford Garden that utilized showy natives. At the last Dutchess County Fair we had a huge amount of interest in our exhibit, which featured a showy display of natives and their cultivars. People were surprised that native plants could be used in a traditional ornamental fashion. The public is slowly learning that a garden does not have to be filled with exotic species to be beautiful.

Lastly, I would like to revise the Landscape Certificate to make it even more ecologically based. As the program grows, we are able to offer courses in native plants, designing with natives, and plant identification. When students understand the ecology of the landscape, they can make more informed management decisions. □

Invasive, continued from page 1

Water celery adds oxygen to the water column, while water chestnut often depletes it. This is due to the growth-habit of water chestnut; a large amount of the plant's biomass is on the surface of the water. When mats form a closed-canopy, very little light penetrates the water column. The plant's underwater feather leaves are unable to perform photosynthetic oxygen production, and DO levels beneath the mats decline.

When plant growth is dense, the DO difference between the species is magnified. Densely vegetated water celery beds have high DO concentrations, while similar water chestnut beds are often hypoxic, with DO levels low enough to stress aquatic organisms. During ebbing tide these beds can become anoxic, literally meaning "without oxygen." The

frequent hypoxia and anoxia measured in water chestnut beds compromise them as habitat for many fish and invertebrates. Only animals that are very tolerant of low DO, such as carp, may be able to use water chestnut beds fully as a habitat.

Currently, there are no safe chemical controls for water chestnut, and manual removal is time and labor intensive. Future research will focus on manipulating water chestnut beds, with the goal of understanding how plant density affects DO levels. Models suggest that partial plant removal (>20%) could eliminate anoxia and reduce hypoxia. Monitoring fish and invertebrate populations during such a manipulation will help determine if bed thinning could be used to improve water chestnut beds as habitat for young fish. □

Caraco, N., J.J. Cole, S.E.G. Findlay, D.T. Fischer, G.G. Lampman, M.L. Pace, and D.L. Strayer. 2000. Dissolved oxygen declines in the Hudson River associated with the invasion of the zebra mussel (*Dreissena polymorpha*). *Env. Sci. Tech.* 34:1204-1210.

Caraco N. F. and Cole J. J. 2002. Contrasting impacts of a native and alien macrophyte on dissolved oxygen in a large river. *Ecol. Appl.* 12:1496-1509.

Strayer, D.L., N.F. Caraco, J.J. Cole, S. Findlay, and M.L. Pace. 1999. Transformation of freshwater ecosystems by bivalves: a case study of zebra mussels in the Hudson River. *BioScience* 49:19-28.

CONTINUING EDUCATION

The Continuing Education Program is now accepting spring registrations. For information, or to request a brochure, call 845-677-9643 or visit www.ecostudies.org/cep.html. Spring semester programs include:

Gardening

April 27 (3 Sun.) Woody Plants for the Landscape
May 17 (1 Sat.) Observe & Adapt: Creating Dynamic Natural Gardens
June 1 (4 Sun.): Garden Design II

Natural Science Illustration

April 25 (1 Fri., Sat., Sun.) Intensive Pen and Ink Workshop: The Art of Pen and Ink Illustration

Biology and Ecology

April 27 (1 Sun., 1 Sat.) Wild Plant Identification

Workshop

June 6 (1 Sun., 1 Sat.) Creating Garden Sculpture

Experience the ECO-ADVENTURE of a Lifetime: Enroll in IES Day Camp!

The 2003 Summer IES Ecology Day Camp consists of eight one-week sessions. Geared to children entering grades 2-4 and 5-7, the camp will run from the week of June 30th through the week August 18th. Students will get the opportunity to explore our 2,000 acre property through ecology experiments, hiking, observation, and nature art projects. Interactions with IES scientists and education staff will provide unique learning experiences! For more information or to register by phone, please call the Education Office from 9:00am to 4:00pm at 845-677-7600 ext. 316.

GREENHOUSE

The Greenhouse is a year-round tropical plant paradise and a site for controlled environmental research. The green house is open daily until 3:30 p.m. with a free permit (see HOURS).

Calendar

IES SEMINARS

Free scientific seminars are held at 11 a.m. on Fridays in the IES auditorium from September until early May.

April 11: Establishing the benefits of undergraduate research in the sciences. Dr. Elaine Seymour. University of Colorado.

April 18: Nitrogen saturation and carbon accumulation in European forest ecosystems. Dr. Nancy Dise. Open University, United Kingdom

April 25: Spatial and temporal controls of carbon cycling in arid and semiarid ecosystems. Dr. Osvaldo Sala. University of Buenos Aires, Argentina.

May 2: Can science and management actually partner each other effectively? Experiences from in and around the Kruger Park. Dr. Harry Biggs. Kruger National Park, South Africa.

May 9: Can C and N be re-coupled in intensively managed ecosystems? Dr. Laurie Drinkwater. Cornell University.

THE ECOLOGY SHOP

New items are arriving every day at The Ecology Shop! Come in and see: locally crafted hand-painted silk scarves; colorful hanging vases of recycled glass; beautiful and functional kitchen utensils crafted from sensitively harvested palm wood; fun kites and adorable plush animals...
Senior Citizens Days: 10% off on Wednesdays.

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, member's rate for courses and excursions, a 10% discount on IES Ecology Shop purchases, and participation in a reciprocal admissions program. Individual membership: \$40; family membership: \$50. Call the Development Office at 845-677-7600 ext. 120.

The Institute's Aldo Leopold Society
In addition to receiving the benefits listed above, members of The Aldo Leopold Society are invited guests at spring and fall IES science updates. Call the Development Office at 845-677-7600 ext. 120.

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... IES website: www.ecostudies.org

SAVE THE DATE!

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Friday - Saturday, May 16 - 17, 2003 from 10 am to 4
pm, and Sunday, May 18, 2003 from 11 am to 4 pm.