



**NY Sea Grant Specialist Nordica Holochuck contemplates an infestation of invasive water chestnut (*Trapa natans*) on the Hudson River. Photos this page courtesy of Chuck O'Neill, NYSG**

## *North America's New Form of Biological Pollution: Invasive Species*

almost half of all federally listed endangered species have been negatively impacted by invasive species. Cornell University researcher **David Pimentelle**, pegs the cost of damages from and control of invasives at more than one billion dollars per year in the U.S.

These introduced species are referred to by many names: exotic species, non-native or nonindigenous species, aquatic nuisance species, and invasive species. In reality, these terms are not interchangeable and their misuse can confuse discussions of what to do about their introduction and management. Generally, the terms “nonindigenous” and “non-native” can be used synonymously, meaning “those [species] that have been transported by human activities – intentionally or unintentionally – into a region in which they did not occur in historical time and are now reproducing in the wild” (**Dr. James Carlton**, Williams College). Many non-native species support human livelihoods or

An extraordinary form of pollution is impacting the waters of North America but has, for the most part, been taking place mostly “under the radar” of the general public. This pollution has nothing to do with industrial plants spewing wastes into the air or the water, nor with hazardous waste dumps, power plants, sewage discharges, nor any of the other “culprits” usually associated with pollution. This pollution is in the form of non-native organisms introduced to our waters, and the lands around them, by either natural or human-mediated mechanisms. These species run the gamut from plants (purple loosestrife, *Phragmites* and Japanese knotweed) to familiar animals (common carp, zebra mussels, green crabs, and Asian longhorned beetles) to pathogens (West Nile virus) which affect native and non-native organisms alike.

These non-native species are causing dramatic changes to North America’s aquatic (and terrestrial) ecosystems. At the time of writing, about 5,000 non-native species have established free-living populations in the U.S., 162 of which live in the Great Lakes. Approximately 15 percent of these non-native species have caused severe harm to agriculture, industry, human health, and the environment. **David Wilcove**, of the Environmental Defense Fund, estimates that

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*Invasive species is defined as “...an alien [non-native] species whose introduction does or is likely to cause economic or environmental harm or harm to human health.”*

— *Executive Order 13112*

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**Invasive mute swans (*Cygnus olor*) in a patch of invasive water chestnut (*Trapa natans*) in the Hudson River.**

improve our quality of life (an abundance of agricultural crops and domestic pets fit into this category). Non-native is not, however, synonymous with “invasive.” The key defining point in determining whether an organism is invasive or simply non-native is a connotation of harm in the case of invasives.

The invasive species debate today is clouded and confused because of differing perceptions by differing audiences of the relative harm caused or benefit gained by particular non-native organisms: one person’s weed is another



**A stand of invasive Japanese knotweed, *Polygonum cuspidatum* (a.k.a. *Fallopia japonica*), crowds out all native plant growth beneath it on New York’s Long Island. Photo courtesy of Chuck O’Neill, NYSG**

person’s wildflower or another person’s herbal dietary supplement. Perceptions of relative benefit and harm may also change over time as new knowledge about the organism is acquired, or as human values or management goals evolve.

For a non-native organism to be considered an invasive species in the federal (and most state) policy context, the negative effects caused (or likely to be caused) by that organism must clearly outweigh any beneficial effects. The introduction of many non-native species, such as livestock and food crops, provides benefits to society which greatly exceed any negative effects. However, in some cases positive effects are substantially exceeded by negative effects. Take, for example the popularity of the non-native water hyacinth in outdoor water gardens in the Northeast. While this plant is undoubtedly pretty in such a setting, once the water

hyacinth escapes backyard cultivation into natural areas, its populations can “explode,” completely overwhelming native species in lakes and rivers and having severe negative effects on the native plant and animal life originally living in those water bodies.

While truly invasive organisms make up only a small portion of all non-native species that have been (and might be) introduced into North America, their introduction and unchecked spread can be devastating to natural ecosystems, the economies those ecosystems support, and/or our public health. It is these truly “bad players” that are the target of policy makers and resource managers.

For more information on invasive species, surf on over to the National Aquatic Nuisance Species Clearinghouse’s Web site at [www.aquaticinvaders.org](http://www.aquaticinvaders.org) for information on high profile freshwater and marine invaders or to the National Invasive Species Council’s site at [www.invasivespecies.gov](http://www.invasivespecies.gov) for information on what is being done at the federal policy and management level.

— **Chuck O’Neill**

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**Purple loosestrife has been steadily replacing native species throughout North American wetlands. Artwork by Maxie Buchanan**

## Invasives Have Much in Common

**These organisms share some or all of a number of biological characteristics:**

- ▶ **high abundance in their native range (where they are “picked up” for transit to ecosystems where they are not already present);**
- ▶ **high fecundity rates, allowing them to produce more offspring that survive than die once introduced to a new environment;**
- ▶ **a short generation time, with offspring maturing to a reproduction-capable age very quickly (again, providing a large number of offspring in the receiving habitat);**
- ▶ **polyphagous feeding habits (they can utilize more than one food, allowing them to out-compete native species which might rely on a single food source);**
- ▶ **an ability to occupy diverse habitats (as opposed to many native species which have evolved to occupy only a narrowly defined habitat which, if degraded, can negatively impact native populations);**
- ▶ **high genetic variability (allowing for “plasticity” in adapting to new environments or changes in existing environments);** and,
- ▶ **proximity to a transmittal vector (which can move the organism to its new habitat in North America).**