

THE INVASIVE PLANT PROBLEM

by Paul Somers, Ph.D.

Alien plants with invasive characteristics threaten native biodiversity in subtle and obvious ways. Dealing with this enormous environmental problem requires collaborative efforts on the part of many agencies and organizations, but it ultimately begins in your own backyard....

Since the colonization of Massachusetts by European settlers, numerous non-native plant species have been brought into the Commonwealth. Many of them were introduced deliberately for their agricultural, medicinal, and/or land-

scaping values. Others arrived inadvertently, hitching rides as seeds in the fur or manure of livestock, in packing materials, in the sheared wool shipped to textile mills for processing, or even in the clothing people wore.



Japanese Knotweed, Polygonum cuspidatum, also known as Japanese Bamboo, grows so rapidly it can cross guardrails and dangerously obscure the view of the road. Inset shows a monoculture infestation dominating a floodplain environment. The species is particularly invasive in such habitats.



*High seed production is typical of many invasive plants, particularly if the seed or the fruit they are packed in is attractive to birds. The distinctive berries on the twisting vines of Oriental Bittersweet, *Celastrus orbiculata*, (right) and the red berries of Japanese Barberry, *Berberis thunbergii*, (above) are typical examples.*

Some of the introductions were failures; either the plants could not establish themselves at all, or they persisted for only a short time in the habitats where they were introduced. These species are considered waifs. They are not important components of our current flora.

Other introduced plants have persisted to become localized or widespread species in the Commonwealth and elsewhere in North America. Some examples of introduced species that have naturalized successfully in Massachusetts include all clovers and vetches found in the state; pasture grasses such as Timothy, Meadow Fescue and Orchard Grass; and Catnip, Self-heal, Morning-glory, Common St. John's Wort, Shepherd's Purse, and Dandelion. These are examples of introductions that have become common in fields, lawns, pastures, roadsides, and other locations where there has been heavy disturbance of the soil and vegetation. They are often weedy in these habitats, but have not become problematic in the more natural surrounding landscapes.

Other weedy introduced species such as Ox-eye Daisy, Queen Ann's Lace, Sheep Sorrel, and Mullein, have demonstrated that they can move into open, natural landscapes such as the sandplain grasslands of Cape Cod and the Islands or the calcareous outcrop communities of the Berkshires. These are important ecologi-

cal areas in Massachusetts because they support many rare, native species, hence the establishment of non-native weeds in them is of particular concern.

Other non-natives — including many aquatic weeds and shade tolerant shrubs and vines with bird-dispersed berries — have spread rapidly into wetland and forest environments, thus affecting many native species with which they compete for available light, water, and nutrients. While many of these introductions — Purple Loosestrife, Yellow Iris and Phragmites for instance — have been warmly accepted by many people because of their innate beauty, scientists have gradually educated us about the negative consequences of their invasive, aggressive behavior in new environments.

Conflicts between invasive and rare species are a great concern to conservation biologists. Early in my career as a Botanist for the Division of Fisheries and Wildlife, I recall joining some local volunteers in search of a rare orchid in a town conservation area. The rare and beautiful *Arethusa* orchid was not to be found. The small boggy habitat of the orchid had been inundated with invasive woody shrubs and vines, changing it dramatically. The orchid had literally been extirpated by aggressive immigrants.



The spread of invasive species is aided by humans in that they are deliberately planted by landowners and gardeners. *Miscanthus sacchariflorus*, has spread down the road. *Aegopodium podagraria*, probably planted originally in a neighborhood. Bottom left, this roadside patch of vegetation is known as Burning Bush for reasons the photo makes plain. Top right, wildflowers include Rose, *Rosa multiflora*, and Autumn Olive, *Elaeagnus*, for their food and cover characteristics, but these have proved to be invasive. Black Swallow-wort, *Cynanchum louiseae*, is a characteristically invasive but it can spread explosively. Below, exotic honeysuckles are also invasive. Choose only native species — or non-native species for planting.





in many ways, but probably none more so than when introduced by government agencies. At top left, an invasive grass, introduced from a single planting. Below it, Bishop's Weed, introduced in a doorway garden, is spreading rapidly through the garden. Invasive Winged Euonymus, *Euonymus alatus* (also known as Burning Bush) was planted by a highway department. Inset photos show species agencies throughout the country planted Multiflora Rose, *Rosa multiflora* (with the white flowers) for decades for erosion control. It proved particularly invasive in old field habitats. Right, a climbing little vine sometimes planted as ground cover, but many varieties look pretty, but are highly invasive. Many are *known* not to escape from cultivation — for

Photos by Paul Somers and Bill Byrne



Analysis of Federal Register data on threats to 958 species listed as Endangered or Threatened in the U.S. reveals that invasive species are implicated in the decline of 42% of the listed species; for 18% they were the major cause, and for 24%, a contributing factor. Even more shocking, in 1998 David Wilcove and others found that competition or predation by alien species affects 49% of imperiled species in the U.S., and further, that imperiled plants are affected more than imperiled animals (57% vs. 39%). They concluded that alien species rank second in terms of major threats to biodiversity, with direct habitat destruction or degradation being the only category of threat ranking higher.

One unintended consequence of the deliberate disturbance of forest ecosystems (logging, road construction, etc.) is the subsequent invasion of these disturbed habitats by non-native plant species that have naturalized into the surrounding landscape. This problem is particularly acute in the northeastern United States, an area that is densely settled and possesses, on average, relatively small units of remaining natural landscape. Following a recent, careful evaluation of label data for the non-native plants documented in Massachusetts by herbarium specimens, botanist Bruce Sorrie concluded that 725 (32%) of the 2,263 species documented in the Commonwealth are naturalized newcomers. The other New England states have alien percentage estimates ranging from 24% (Rhode Island) to 35% (Connecticut). The figure is 31% in New England as a whole.

High non-native percentages are also consistent with specific site inventories done in towns and parklands in eastern Massachusetts in recent years. For instance, Dr. Robert Bertin at Holy Cross College reports that 34% of the 988 plant species present in his recent inventory of Worcester are non-native. In Boston's Middlesex Fells, a 400 ha woodland park established and thoroughly inventoried for plants in 1894, a re-census of the flora in 1993 by Drayton and Primack at Boston University showed that exotic species are increasing in the park at an annual rate of 0.18% — or about one new species every five years. Granted, 22 exotic species have disappeared from the Fells since 1894 — but 36 new ones have appeared!

Investigators are also reporting a simultaneous decline in native species at inventoried sites. Comparing his current flora to that derived from historical specimens from the community, Dr. Bertin concluded that there had been a 17% loss in Worcester's native flora. Similarly, Drayton & Primack (1996) reported that native species had declined from 83% to 74% in the Middlesex Fells flora over the past century. An astounding 133 native species are presumed extirpated; only 28 new ones were observed.

Island habitats where introduced species have competed with native floras provide examples of some of the most serious declines of native species yet documented. In Bermuda, the non-indigenous portion of the flora in 1918 was 65%, while the rich flora of Hawaii was found to be 47% non-indigenous species in 1990. The native flora on Hawaii has suffered tremendously: 800 native species are endangered, and more than 200 endemic species are believed to be extinct.

A recent botanical survey of Penikese Island in Massachusetts conducted by Richard Backus and others revealed that it has the same percentage of non-native species as Hawaii — 47%. Similarly, a recent survey of the Boston Harbor Islands conducted by Ted Elliman for the National Park Service found that 44% of the flora was exotic, and that on many islands the percentage of non-native species exceeded 50%! Continents are nothing more than big islands, and parks like Middlesex Fells are islands of semi-natural vegetation amidst a landscape that is, ecologically, largely alien. We would do well to recognize that isolated fragments of natural landscape, and even large continents, function as islands.

A new list of invasive plants for Massachusetts has been produced through a collaborative effort involving state agencies, conservation organizations, and representatives of plant industries (Massachusetts Invasive Plant Advisory Group 2005). The new list contains 62 species considered to be especially aggressive or problematic in minimally managed habitats in the Commonwealth (8.5% of the 725 naturalized species), plus four other species not yet found in the Commonwealth but deemed "Potentially Invasive" because of their documented invasiveness in nearby states.

Environmental & Economic Facts About Invasive Species

- Experts estimate that invasive plants already infest more than 100,000,000 acres of land in the United States.
- In the United States, about 3 million acres are lost to invasive plants each year (an area about twice the size of Delaware).
- Our natural habitats on public lands are being lost to invasive species at the rate of 4,600 acres a day.
- Already, invasive non-native organisms have contributed to the decline of 42% of our federally listed threatened and endangered species.
- Of the 235 woody plants known to invade natural areas in the United States, 85% were introduced primarily for ornamental and landscape purposes, while another 14% were introduced for agricultural uses.
- Within nearly 200 of the approximately 250 National Parks protecting significant natural resources, non-native plants have been identified as serious threats to those resources.
- Research results suggest that “the increasing dominance of glossy buckthorn in New England pine forest is likely to change the relative abundance of tree species in the forest canopy, and may delay the filling of canopy gaps.”
- In Massachusetts, state agencies spent over half a million dollars in 2001 on the control of nonindigenous aquatic plants through cost share assistance and direct control efforts on state lands. This figure does not include extensive control efforts undertaken by municipalities and private landowners, lost revenue due to decreased recreational boating, fishing, and swimming opportunities, or documented decreases in property values due to infestations of neighboring lakes and ponds by aquatic macrophytes.
- Invading non-indigenous species in the United States cause major environmental damage, public health problems, and cost the nation more than \$122 billion per year; plants are responsible for \$36.6 billion of this figure.
- From 1906 to 1991, just 79 non-indigenous species caused documented losses of \$97 billion in harmful effects.
- Purple Loosestrife now occurs in 48 states and costs \$45 million per year in control and forage losses.
- In the United States, a total of \$100 million is invested annually in aquatic weed control.

In a recent study of Natural Heritage records for regionally rare plants in New England states, Dr. Elizabeth Farnsworth found that 47% of the 81 species she studied had one or more of the newly listed invasive species present at one or more of their population locations. This suggests that these species represent a serious threat to biological diversity in the Commonwealth. At Massachusetts' rare plant sites, it is not uncommon to find from one to six invasive species growing in close proximity to any rare plant population. In floodplain plant communities, where seeds and vegetative parts capable of rooting are easily dispersed by a combination of water and animals, invasive species are especially abundant.

To return New England ecosystems to early seral stages for the benefit of native plant and animal species favoring these conditions, one runs the risk of introduc-

ing or exacerbating the spread of non-native species into or within these systems. This is a major dilemma for land managers attempting to achieve forestry or biodiversity enhancement goals. Many of the region's most notable invasive species are enhanced by disturbance activities related to routine forestry practices (e.g., logging, thinning) or efforts to restore indigenous wildlife and plants through activities such as prescribed burning, bush-hogging, or mowing.

Unfortunately, when provided with habitat disturbance (natural or intentional), invasive plant species compete with the indigenous ones and change the composition of the regenerating forest. In a 1997 Ohio study, researchers found that Amur honeysuckle (*Lonicera maackii*) reduced native tree regeneration by shading seedlings.

It has also been shown that some invasive species can change ecosystem processes such as soil chemistry, hydrology



*The prolific Norway Maple, *Acer platanoides*, a widely planted shade tree, is now invading our forests to the detriment of native species. It's easy to spot this species in the fall, since it holds on to its leaves longer than any of our native maples.*

or fire frequency. Japanese barberry (*Berberis thunbergii*) colonies, for instance, can change soil pH; Phragmites (*Phragmites australis*) can change the hydrology of affected wetlands; and the flammability of Scotch broom (*Cytisus scoparius*) can alter fire behavior in areas where it has invaded.

If it is accepted that invasive plant species can affect forest regeneration and biological diversity in negative ways, the indigenous biological communities of Massachusetts are facing some serious challenges, and much needs to be done. A set of "Strategic Recommendations for Managing Invasive Plants in Massachusetts" was recently produced by the Massachusetts Invasive Plant Advisory Group (MIPAG 2005) and submitted to the Massachusetts Executive Office of Environmental Affairs. These recommendations represent an important step in dealing with the invasive species dilemma in the state and the New England region. The recommendations — which include the list of 66 invasive plant species for Massachusetts — can be found at a number of web sites (www.newfs.org; www.nhesp.org; www.mnla.com; or www.massnrc.org/MIPAG). Other plants will no doubt be added to the MIPAG list

as additional species are evaluated and new threats are identified.

Massachusetts agencies, organizations and citizens need to be proactive in checking the introduction of new sources of invasive species. The Department of Agricultural Resources has set an example with its proposed ban on the importation and sale of species on the MIPAG and Federal Noxious Weed lists. Being cautious about the plant materials one buys or introduces from outside our area of the country is among the best things we can all do.

Educating oneself about which plants are safe to use in landscaping is important. MassWildlife's Natural Heritage & Endangered Species Program has an inexpensive publication entitled *The Vascular Plants of Massachusetts: A County Checklist* which provides information on which species are native and non-native in each of the state's 14 counties. This is one useful tool to see what is native and what is introduced in your area. MassWildlife's Natural Heritage Program also offers a table of native shrubs for use in various environmental settings on its web site, www.masswildlife.org. The New England Wild Flower Society (www.newfs.org) and the Massachusetts Nurs-

ery and Landscape Association (www.mnla.com) have also prepared educational materials to advise consumers on good landscaping choices.

There is a role for everyone in addressing the invasive plant issue. Public and private conservation organizations and agencies need to take a lead role in developing, funding and implementing strategies that will be effective in reducing established invasive plant populations, particularly in areas of ecological importance such as the areas identified by the Natural Heritage & Endangered Species Program for the Massachusetts BioMap (areas critical to the long term protection of biological diversity in the Commonwealth; viewable at the Mass GIS website). Where conservation agencies and organizations already own lands in the BioMap areas, they will need to be especially active in eliminating existing invasive species populations and preventing the introduction of new ones.

The state's Coastal Zone Management agency (CZM) has taken the lead in developing an Aquatic Invasive Species Management Plan to address invasive aquatic species. This has resulted in additional federal funding to assist state agencies in dealing with this increasing problem in both marine and freshwater ecosystems. The Department of Conservation and Recreation's Lakes and Ponds Program is the lead agency for addressing infestations of aquatic species in freshwater ponds (see *MW* # 3, '04) and is the appropriate agency to contact about prevention and control of such problems.

Establishing "Early Detection and Rapid Response" programs is one of the most effective ways to attack the invasive species problem. Such programs are aimed at species that are not yet established in the state, or at least not in some regions of it. For most species, eradication is possible only in the earliest stage of the invasion. Once a species or population is well established, the only option becomes one of controlling its spread, often at a considerable expense.

Everyone can help with detection and reporting, as well as by controlling the spread of invasive plant species in their own backyards and communities. Occurrences of listed invasive species and candidates for listing can be reported

to the Natural Heritage and Endangered Species Program or the Invasive Plant Atlas of New England (IPANE) project. Invasive plant field forms are available from the web sites of both organizations. Such records are very important in mapping the presence, abundance and geographic spread of invasive species.

Documenting new sites for listed invasive species — or reporting an aggressive growth of an unlisted non-native species — can be especially important in triggering a rapid response. The IPANE program has a well organized volunteer network to conduct monitoring actions, and it organizes group management outings in each state. These actions are coordinated by a staff person at the New England Wild Flower Society.

Nearly every land conservation organization is now involved in invasive species education and control efforts. The Nature Conservancy, Massachusetts Audubon, and The Trustees of Reservations are all seriously involved in this effort. Contact any of them for more information, or to volunteer to help with invasive plant projects.

There are many ways to help. Start in your own yard, a local park or natural area. My wife and I pull buckthorn plants when we walk the dog on our property in Ashburnham. Although the buckthorn population was well established, after ten years of pulling and herbiciding, we have eliminated the species from much of the property.

See how many of the listed species you can find in your neighborhood, then figure out what can be done to reduce or eliminate their presence. Many of the listed species can be found in every Massachusetts community. It's not a needle in the haystack situation like searching for a rare plant; invasives can be found nearly everywhere — so join in the effort to curb their spread!

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NOTE: A useful table of websites and other invasive plant documents can be found at www.nhesp.org.