The History of Invasiveness

by Priscilla Hutt Williams

The story of animal, insect and plant invaders is as old as the world itself. When humankind first began to roam, these beings tagged along. In strange new lands, the human instinct to collect unique specimens was born. So bits and pieces of non-natives came back with them - if indeed, these peoples ever returned to their points of origin.

From the tea-horse trade route in ancient Tibet to the Silk Road trade across Asia, Russia, Arabia and Africa into Europe, humans have moved about in search of economic opportunity. Certain plants and animals have been successfully raised far from their native regions when there were similarities in soil and climate: cotton, indigo, tobacco, rice, silk and wool come to mind along with all our domesticated animals. Other peoples moved to find religious freedom, escape tyrannical regimes, or just to have more living space. Whether intentionally or inadvertently, plants, animals and insects came with them.

By the eighteenth century, the quest began to find plants with beauty and ornament, hardiness, resilience, disease resistance or unusual form or color. Collectors such as our founding fathers, George Washington and Thomas Jefferson, continually sought these qualities in their garden plants while keeping an eye out for species with economic or useful value to the new country. The Dutch collected bulbs from Turkey. The Victorians sent plant explorers around the world to bring back new curiosities. Such searching continues in the field of horticulture with modern day plant explorers like Dan Hinckley and Darrell Probst, as well as woody plant selector and hybridizer Dr. Michael Dirr.

Marseilles fig

Seeds have several ways to travel: they can float, stick, or blow. They can be eaten by animals like birds, pass through their digestive systems, and germinate in place. Bits of some roots or stems can grow readily if cut on purpose or accidentally. Now that we move about ever more widely in the 21st century, the movement of invaders has quickened. Natural controls in the land of origin, such as insect predators, host-specific funguses or herbivores, do not always accompany the invading plants. It may take eons for such controls to “catch up.” Meanwhile, our own native plants have evolved in place with their own control systems intact. And they may not be able to withstand the quickly moving, overpowering characteristics of many invaders.

Bringing the taste for non-native plants home to our own Northeastern United States:

- David Fairchild, plant explorer extraordinaire for the USDA in the early 1900s, had trouble propagating kudzu from cuttings but then had overwhelming success with seeds (he also collected what turned out to be many economically and culturally successful crops such as oranges and avocados)
- E. H. Wilson, Keeper of the Arnold Arboretum in Boston in the 1920s and 30s and a plant explorer in his own right, wrote about shrubs with berries for birds and recommended privet and buckthorn (as well as native viburnums and a host of “good” plants)

(continued on next page)
Good luck. It sounds like a fun project.

Hi Jan,

I am no expert on which kind of animal to use in such a situation, but cows, sheep and goats all come to mind as possible allies in your attempt to manage invasives as well as to do some carbon sequestering and some food production. From my reading and from sources like the Savory Institute and what Jerry Brusetti used to suggest, I would encourage you to look into a mob stocking arrangement with some animals. Pigs will be of some use too. I think the principles are pretty much the same - concentrate your animals in an area for a short period of time and move them on. If it is a ranching species, feed them some hay as needed while they are in the specified small amount of land, and if it is pigs, supplement their range diet with more concentrated feeds. Then move them on to a new area.

Some of the really talented animal husbands raise different species together, though I haven't tried it. It might be better to examine the area, what drains it, and if it is pigs, supplement their range diet with more concentrated feeds. Then move them on to a new area. The principle is pretty much the same - concentrate your animals in an area for a short period of time and move them on. If it is a ranching species, feed them some hay as needed while they are in the specified small amount of land, and if it is pigs, supplement their range diet with more concentrated feeds. Then move them on to a new area.

The first meeting -- a large group, the man who applies glyphosate to Japanese knotweed on the Housatonic River banks spoke way beyond our allotted 3 minutes to argue for the use of glyphosate on knotweed to save native plant life. He referred to 'scientific' papers that testify to the safety and beneficial attributes of glyphosate. He was given a meeting of the Great Barrington Conservation Commission to pitch what he does. At the second meeting in Sheffield, half of the very small group were glyphosate advocates and they did advocate. Since then, the five of us who hope for a ban on glyphosate have not asked for another meeting. We are busy in other ways.

Over the past three decades, The Sheffield Land Trust has financed dairy farms that use petrochemical fertilizer etc. on land planted to GMO corn. The Land Trust has collaborated and claim to save land from development. Atrazine and glyphosate have kept the ground bare. This land drains into the Housatonic River. The fields are in view along Rt 7. One dairy abuts Barrelemows Cobble along the river. Others are out of sight but the entire watershed drains into the Housatonic. Thought for the ocean and the rest of the world has no chance.

Local PR refers to the beautiful 'rural nature' of the town because of Land Trust 'protection' of land. Recently these fields have sent out an increasingly offensive smell from the manure of GMO corn/ meat to feed cows. The Land Trust has easements on home properties, orchard and vegetable farms, dairies and woodlands throughout the town and supports the use of glyphosate on weeds and invasive species on those properties. In 2003, the Land Trust took control of a town Master Plan and prevented the inclusion of information on climate change and minerals and farming in the planning process better and has placed members on official town committees. The directors stopped publishing its list of donors in the 1990s. Both TNC and Sheffield Land Trust buy and sell land. They have easements on off the lands that they have cared for and loved for thousands of years. TNC is one of the BINGOS.

Dorothy

Thanks for your thoughts on invasives and concerns about glyphosate and the groups that promote it. This is indeed a very controversial topic even for many organic advocates. It seems we have gotten so used to having our way with Nature, bending it to our wills, that we have forgotten our proper role on this blessed earth. I hope that the current public health emergency, product of a normal but invasive feature of Nature such as an infectious virus, is teaching us some lessons about a better way to fit in here.

This issue, addressing some of these hard questions of diversity and proper balance, is designed to give readers useful information and perspectives to cope. I hope we continue to deserve your thanks!

Jack Kettredge
We were able to adopt much of the organic farming standards. However, we noticed that there was no mention of invasive plants and how to deal with them. Donald Bishop, one of our number, was charged with researching and writing this section. He was at the time a member of the new MIPAG entity and owner of an organic land care business. With each of the five succeeding editions of the Standards for Organic Land Care, this chapter has had an update. Now entitled “Native, Exotic and Invasive Plants,” this section of the Standards is worth reading (www.organiclandcare.net).

In the nearly 20 years since the writing of the Standards, I notice that clients are now much more aware of which plants are invasive and which are non-invasive or native. There are a few people who request that we leave the invasive plant in place, saying “at least it’s green” or “it screens me from my neighbor.” We work carefully to educate these clients, dropping nuggets of wisdom and leading by example. In time, we will replace those outlying invasive plants with a native alternative.

Most states have watch lists or lists of prohibited plants that are published online for reference. Burning bush, red barberry and Norway maples are no longer propagated and sold by nurseries, at least in this area, but may be available on the Internet from other states. Buyer beware! However, these and other invasive species still grow in many yards.

It is up to us individually to create what Doug Tallamy is calling “Homegrown National Park” of at least 80% native plants in our own backyards, nourishing the caterpillars and the birds that consume them. This web of life is fragile and oh-so important to our own lives.

David G. Fairchild


We Came Over on the Mayflower, Too!
A Timeline of North American Invasive Species

1500s Water lettuce, Pistia stratiotes, introduced, perhaps in the ballast water of ships from Spain or South America.

1539 Feral pigs, Sus scrofa, begin with the introduction of Spanish domestic stock in Florida by Hernando de Soto; whether the release was accidental or intentional is unknown.

1600s Scots pine, Pinus sylvestris, native to Europe and Asia, one of the first trees introduced by early European colonists, perhaps as windbreaks, erosion control, and a source of herbal medicine, lumber, and bedding; needles were used as a bedding known as “pine wool.”

— Purple loosestrife, Lythrum salicaria, native to Europe and Asia, introduced in ballast and likely in livestock bedding, fodder, and perhaps even in sheep fur as soon as colonists began to arrive.

— Yellow toadflax, Linaria vulgaris, native to Eurasia, introduced during colonial times as an ornamental, as a dye, and a medicine. By 1759 John Bartram found it invasive.

1606 Rock pigeon, Columba livia, native to Eurasia, is introduced to Port Royal, Nova Scotia, by French settlers as a domesticated food source. It is likely that many other introductions occurred over the centuries.

1620? Dandelion, Taraxacum officinale, perhaps introduced by English colonists. By 1818, it had spread so much that Amos Eaton, author of the first Flora for the Northern states, thought it native.

1620? Fennel, Foeniculum vulgare, also known as anise, sweet fennel, aniseed, and sweet anise likely arrived on the East coast with the first European settlers. Native to the Mediterranean, it was introduced in California at least by 1880, where it has escaped from cultivation repeatedly.

1620? Lamb’s quarters, Chenopodium album, also known as goosefoot and fat-hen, introduced by northern European settlers as a spring green.

1672 Burdock appears as “The great Clot Bur” in John Joselyn’s list of “Plants as have sprung up since the English Planted and kept Cattle in New-England,” published in London in New Englands Rarities Discovered.

Early 1700s Common mullein, Verbascum thapsus, native to Eurasia, introduced for its medicinal, dyeing, and fish-killing properties. By 1759, it appeared on John Bartram’s list of worst plants introduced by English colonists. By 1815, it had spread so much that Amos Eaton, author of the first Flora for the Northern states, thought it native.

— Dog rose, Rosa canina, native to Europe, Africa, and Asia, introduced by early settlers, who used it as root stock. It can now be found growing wild along roadsides, coastlines, and wet, sandy areas.

— Common yellow oxalis, Oxalis stricta, and creeping wood sorrel, Oxalis corniculata, native to Europe, introduced by early settlers, who knew of their antiscorbutic properties.

— Gray garden slug, Deroceras reticulatum, native to Europe, accidentally introduced in dirt arriving with early settlers. Slugs’ presence confirmed by 1843 near Boston, New York, and Philadelphia harbors, the beginning of a nationwide career as one of our most successful synanthropes.

1727 English ivy, Hedera helix, native to Europe, western Asia, and northern Africa, introduced by European colonists as an ornamental.

1736 Asian or Oriental bittersweet, Celastrus orbiculatus, a vine native to temperate eastern Asia, introduced as an ornamental. Naturalized plants collected in Connecticut in 1916. Now naturalized in 21 of 33 states where it’s cultivated.

1745 Silktree or mimosa, Albizia julibrissin, native to Asia, arrived with early colonists, as a medicinal and a forage plant. Or in 1785 (if you’re from the South) it arrived when the French botanist André Michaux planted it in his botanic garden in Charles ton.

Mid-1700s Woolly mullein, Verbascum thapsus, native to Europe and Asia, introduced to Virginia as a piscicide (the leaves contain rotenone, which can kill fish) and an insecticide.

1756 Norway maple, Acer platanoides, introduced in Philadelphia by John Bartram.

1759 Broad-leaved dock, Rumex obtusifolius, native to Eurasia, listed by America’s first botanist and nurseryman John Bartram as one of the introduced plants “most troublesome” in Pennsylvania.

— Scotch thistle, Onopordum acanthium, Bartram claims, was introduced by a Scots minister who arrived with a bed stuffed with thistlesown, which was soon replaced with feathers, releasing a few thistle seeds into the wild.

— St. Johnswort, Hypericum perforatum, native to Eurasia, listed by Bartram as an ornamental gone invasive and proving poisonous to livestock.

— Oxeye daisy, Leucanthemum vulgare, native to Europe, introduced as an ornamental, made Bartram’s list of invaders, too.

1760s Scotch broom, Cytisus scoparius, native to western and central Europe, introduced as an ornamental by John Bartram.

1769 Domestic pigs released in California.

Late 1700s Chinaberry tree, Melia azedarach, native to Asia, introduced by French botanist André Michaux.

1784 Tree-of-heaven, Ailanthus altissima, an Asian sumac, introduced by William Hamilton in Philadelphia.

1800? Common buckthorn, Rhamnus cathartica, native to Eurasia, introduced near Nova Scotia for planting along fences and for wildlife shelter, widespread by 1900s.

Early 1800s Tamarisk, Tamarix spp., introduced into the US, mostly from Asia, some as ornamentals, some to be planted as wind-breaks or to stabilize stream banks. By the 1990s the smaller deciduous species had invaded most Southwest desert riparian habitats.

— Japanese honeysuckle, Lonicera japonica, a vine native to eastern Asia, introduced to Long Island as an ornamental and ground cover, spreads through the nursery trade. Wildlife managers later use it for erosion control and as winter forage for deer.

1814 Sowthistle, Sonchus spp., native to Eurasia, probably introduced accidentally as an imported seed contaminant, is first reported in Pennsylvania. It is currently found in all states.

from EattheInvaders.org
1817 European green crab, Carcinus maenas, first reported near Cape Cod.

1840 European common periwinkle, Littorina littorea, first described in North America, is thought to have arrived on ballast rocks on ships from Great Britain plying the timber trade, Britain needing imported wood to build ships, having used up all its native trees.

Mid 1800s Tree-of-heaven brought into California during the Gold Rush, mainly by the Chinese; it remains in many ghost towns, long after the miners have gone.

1850 Gold Rush rats: Alien rodents storm San Francisco and Sacramento, T.A. Barry and B.A. Patten write in Men and Memories of San Francisco in the Spring of ’50 (Bancroft, 1873): “The rats of San Francisco and Sacramento in 1850, and up to the middle of the year 1853, were something wonderful. . . . The little, four-footed, rodent devils worked damage only second to the fires of that time. . . . Zinc and tins were nailed about the floors and lower boarding, like sheathing on a ship, and signs assuring ‘rat-proof storage’ were plentiful throughout the eastern US and Canada.

1860 Burning bush, Euonymus alatus, native to northeast Asia, officially named. First dwarf form appears in Springfield, Massachusetts, before 1928. Various cultivars become popular landscape shrubs and roadside hedges, then escape cultivation and necessary. At dusk, the rats ventured boldly out upon the streets, racing and scampering incessantly.

. . . . Pedestrians and new comers felt, as they walked among the countless swarm, a constant apprehension of treading upon the wicked little vermin; nor was the new comer alone so annoyed. We never could cure ourselves at times, of suddenly halting and lifting our hands quickly upward, when some big fellow sprang within an inch of us, or struck us full and heavy, as was not uncommon. . . . A terrier dog, or a good cat, commanded a big price in those times. The captain, cabin-boy, cook, or sailor who chanced to bring with him one of those much-coveted creatures, found solid consolation in separating from his faithful companion of the voyage. “Every dog or cat of them, however, became pois- oned and off duty, on the sick-list very soon, the result of their incessant labors. As time went on, and brought more dogs and cats, the rat commune was thinned out, defeated and reduced to the ordinary number; so that the citizen of today cannot, like the early resident, distinguish the rat of Valparaíso, the rat of Canton or Singapore, the long, white, pink-eyed rice-rat of Batavia, the New York, Boston or Liverpool wharf rat, nor yet the kangaroo rat from Australia—so well known and readily recognized in the days when they held high carnival in our streets, warehouses and dwellings.”

1850s Brown garden snail, Helix aspera, arrives in California when French snail farmers bring escargot to the Gold Rush—a creature that would become a notorious agricultural and horticultural pest, especially in citrus groves.

~1850s Bullfrogs introduced to California to feed gold miners, after they had eaten the native red-legged frogs to near extinction.

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1868 Garlic mustard, Alliaria petiolata, introduced from Europe by early settlers, is first recorded outside cultivation, on Long Island.

1875 Japanese barberry, Berberis thunbergii, introduced via seeds sent from Russia to the Arnold Arboretum in Boston; intended as a substitute for the European barberry, which the early colonists had introduced and used for dyes and jams, after it was discovered to carry wheat rust.

1876 Kudzu, Pueraria montana, introduced at the Japanese pavilion at the Centennial Exposition in Philadelphia, promoted as an ornamental and a forage crop.

~1900 Russian knapweed, Acroptilon repens, introduced to Canada accidentally, along with alfalfa seed imported from Turkestan. Around 1908-1915, it was similarly introduced to California.

Early 1900s Coral bush, Ardisia crenata, introduced from Florida as an ornamental. By 1982 it was found in the wild.

1905 Air potato, Dioscorea bulbifera, introduced to Florida as an ornamental vine and an edible tuber from tropical Asia via Africa; by the early 1970s it is recognized as a statewide pest.

1910 Wild taro, Colocasia esculenta, had initially been introduced much earlier by slaves who had brought corms from Africa, but it did not spread in the wild until promoted by the USDA to farmers as a potato-substitute.

1923 Red Swamp crayfish, Procambarus clarkii, also known as Louisiana crayfish, crawdad, and mudbug, is introduced to Hawaii as a food source for bullfrogs. Native to the south-central United States, and northeastern Mexico, it has been introduced, often deliberately, through much of North America, Europe, Asia, and Africa. Farmed crawdads are now imported into the US from China.

1930s Nutria imported for fur farms, and promoted as “weed cutters,” in Louisiana, Ohio, New Mexico, Washington, Michigan, Oregon, and Utah. Several state and federal agencies release nutria to promote fur trade and control aquatic vegetation. Now found in 15 states, it has been introduced to every continent outside its native South America except Australia and Antarctica.
1930s Red Imported Fire Ant, Solenopsis invicta, identified after Brazilian ships unloaded ant-infested cargo in the port of Mobile, and a 13-year-old boy—a certain E.O. Wilson, as he would later be known—reported the first colony of Red Imported Fire Ant in the US.

1936 (possibly earlier) Cane toad, Bufo marinus, native to northern South America, introduced to Palm Beach County, Florida, in a misguided attempt to control pest beetles in sugar-cane fields.

— Amblyomma rotundatum, a South American tick, suspected to have entered the United States as a parasite on the cane toad, either in the 1930s or in later escapes and releases. The tick is now established in South Florida.

1938 Asian clam (Corbicula fluminea), native to southeastern Asia and Africa and imported to Washington State, possibly as a food source, begins its spread into the nation’s major waterways. Any intake pipe they can clog, they will.

1947-48 Locals introduce nutria throughout east Texas because of its value as a furbearer and reputation as weed cutter.

1950s Green iguana, Iguana iguana, native to Central and South America, found in the Florida Keys, perhaps having stowed away in fruit shipments from Central America.

— Spike-topped apple snail, Pomacea diffusa, native to Amazonia, introduced to southern Texas.

1962 Euell Gibbons publishes his first book, Stalking the Wild Asparagus, celebrating wild foods. Many of his chapters are about invasives.

1962 Northern snakehead, Channa argus, native to eastern Asia, imported for the Asian food market and for the pet industry in the United States, found in the wild in Maine.

1966 New York City parks commissioner Thomas Hoving calls the pigeon, Columba livia, a “rat with wings.” The phrase sticks.

1968 White-winged parakeet, Brotopterus versicolurus, native to the Peruvian Amazon, escapes from its birdcage in south Florida and is sighted by a biologist. Imports of the bird are banned in the 1990s; it colonizes south Florida. Fueled by the seeds of backyard bird feeders, the species reaches the southeastern US.

1969 Little brown bat, Myotis lucifugus, native to eastern North America. An African bee, imported to South America and crossed with a European one to increase its stinging power, is introduced to South America.

1970 Emerald ash borer, Aegosaltis planipennis, an Asian beetle, which likely arrived in wood packing materials used to ship auto parts and other products, identified in southern Michigan.

— Redbay ambrosia beetle, Xyleborus glabratus, native to Asia, detected near Savannah’s Port Wentworth. Thought to have infested wooden packing materials unloaded at the port, it spread quickly along the Georgia coast and into Florida and South Carolina, attacking trees in the laurel family and causing a wilt for which there is no cure.


1998 Two veined rapa whelks, Rapana venosa, native to the Northeast Pacific Ocean, are trawled from the lower James River, Virginia. For decades, the species had been spreading around the Atlantic: 1947, the Black Sea. 1957, the Sea of Azov. 1983, Venice. 1992, England and France. The whelk is likely here to stay: the US Geological Service admits, “There are no known cases of successful eradication of nonindigenous marine invertebrates in the United States.”

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2006 Burmese python, Python molurus bivittatus, first documented in Florida Everglades.

2009 Kudzu bug from Asia first documented in the southeastern US.

help them northward after fishermen dumped the algae overboard.

1990 Africanized Honey Bee, Apis mellifera scutellata, reached southern Texas via South and Central America. An African bee, imported to South America and crossed with a European one to increase its stinging power, the hybrid proved aggressive.

1990 Round goby, Neogobius melanostomus, a fish native to Black and Caspian Seas, is found in the St. Clair River, between Ontario and Michigan. Probably transported in ballast water, it has spread into all five Great Lakes, where it is a threat to many native fish as a voracious eater of eggs. The goby may play a role in botulism outbreaks, killing fish and birds.

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Invasive Species

An invasive species is an organism that is not indigenous, or native, to a particular area. Invasive species can cause great economic and environmental harm to the new area.

Not all non-native species are invasive. For example, most of the food crops grown in the United States, including popular varieties of wheat, tomatoes, and rice, are not native to the region.

To be invasive, a species must adapt to the new area easily. It must reproduce quickly. It must harm property, the economy, or the native plants and animals of the region.

Many invasive species are introduced into a new region accidentally. Zebra mussels are native to the Black Sea and the Caspian Sea in Central Asia. Zebra mussels arrived in the Great Lakes of North America accidentally, stuck to large ships that traveled between the two regions. There are now so many zebra mussels in the Great Lakes that they have threatened native species.

Many invasive species are introduced into a new area on purpose. Scientists are not always sure how a species will adapt to a new environment. Some species do not anticipate the consequences. Even scientists are not always sure how a species will adapt to a new environment.

Introduced Species

Some species are brought to a new area on purpose. Often these species are introduced as a form of pest control. Other times, introduced species are brought in as pets or decorative displays. People and businesses that import these species sometimes thrive because there are no predators that hunt them in the new location. Brown tree snakes were accidentally brought to Guam, an island in the South Pacific, in the late 1940s or early 1950s. No animals on Guam hunted the snakes, but the island was filled with birds, rodents, and other small animals that the snakes hunt. The snakes quickly multiplied, and they are responsible for the extinction of nine of the island’s 11 forest-dwelling bird species.

Many invasive species destroy habitat, the places where other plants and animals naturally live. Nutria are large rodents native to South America. Ranchers brought them to North America in the 1900s, hoping to raise them for their fur. Some nutria were released into the wild when the ranchers failed. Today, they are a major pest in the Gulf Coast and Chesapeake Bay regions of the United States. Nutria eat tall grasses and rushes. These plants are vital to the regions’ marshy wetlands. They provide food, nesting sites, and shelter for many organisms. They also help secure sediment and soil, preventing the erosion of land. Nutria destroy the area’s food web and habitat by consuming the wetland grasses.

Invasive species sometimes thrive because there are no predators that hunt them in the new location. Brown tree snakes were accidentally brought to Guam, an island in the South Pacific, in the late 1940s or early 1950s. No animals on Guam hunted the snakes, but the island was filled with birds, rodents, and other small animals that the snakes hunt. The snakes quickly multiplied, and they are responsible for the extinction of nine of the island’s 11 forest-dwelling bird species.

Some invasive species do great harm to the economy. Water hyacinth is a plant native to South America that has become an invasive species in many parts of the world. People often introduce the plant, which grows in the water, because of its pretty flowers. But the plant spreads quickly, often choking out native wildlife. In Lake Victoria, Uganda, water hyacinth grew so thickly that boats could not get through it. Some ports were closed. Water hyacinth prevented sunlight from reaching underwater. Plants and algae could not grow, preventing fish from feeding and reproducing. Lake Victoria’s fishing industry declined.

Invasive species can also damage property. Small zebra mussels clog the cooling systems in boat engines, while larger ones have damaged water pipes at power plants throughout the Great Lakes region.

Eradicating Invasive Species

Officials have used a variety of methods to try to eradicate, or get rid of, invasive species. The cats on Marion Island were infected with a virus, for instance.

Sometimes other species are introduced to control an invasive species. In Australia, prickly pear cactus, which is native to the Americas, was growing out of control. The cactus was destroying rangeland, where ranchers raised livestock. The government brought in cactus moth caterpillars to eat the cactuses. The caterpillars are natural predators of the cactus.

Introducing insects can be dangerous, however. Sometimes, the insects also damage other plant species—they can become invasive species themselves.

Native to the Indo-Pacific oceanic region, lionfish are quickly spreading throughout the coasts and coral reefs of the East Coast of the United States. Lionfish are voracious eaters and their venomous dorsal spines have helped to protect them so far from any natural predation in the Atlantic. Lionfish are popular in aquariums, but less popular in the Caribbean Sea and the Atlantic Ocean—they are an invasive species that outcompete native fishes for resources.

Other invasive species descended from pets that escaped or were released into the wild. Many people have released pet Burmese pythons into the Everglades, a swampy area of south Florida. The huge snakes can grow to 6 meters (20 feet) long. Pythons, native to the jungles of southeast Asia, have few natural predators in the Everglades. They feast on many local species, including white ibis and limpkin, two types of wading birds.

Invasive Species and the Local Environment

Many invasive species thrive because they outcompete native species for food. Bighead and silver carp are two large species of fish that escaped from fish farms in the 1990s and are now common in the Missouri River of North America. These fish feed on plankton, tiny organisms floating in the water. Many native fish species, such as paddlefish, also feed on plankton. The feeding cycle of the paddlefish is slower than that of the carp. There are now so many carp in the lower Missouri River that paddlefish do not have enough food.

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Chemicals have also been used to control invasive species, but they can sometimes harm noninvasive plants and animals.

Governments are working to educate the public about invasive species. For example, in the United States, international fishing vessels are warned to wash their boats before returning home. This prevents them from accidentally transporting zebra mussels or other species from one body of water to another.

Sometimes, communities approach invasive species like an invading army. Nutria in Chesapeake Bay destroy the natural habitat, as well as cost local governments and businesses millions of dollars each year. Environmental groups, business leaders, and government officials are concerned about the harm done by this invasive species.

Officials at the Blackwater National Wildlife Refuge, in the U.S. state of Maryland, worked with hunters to eradicate the 8,500 nutria in the refuge. Hunters waded into specific areas of the marsh during specific times of the year. They tracked nutria using global positioning system (GPS) equipment and set traps that would kill the rodents. The hunters moved across the refuge in a massive, coordinated, west-to-

east movement. In winter, the ice on Chesapeake Bay prevented the nutria from swimming away. Hunters could shoot them on sight.

The operation took two years, but nutria were eradicated from Blackwater National Wildlife Refuge. The wetland is slowly recovering.

Stowaway Species

Many invasive species first arrive in a new area on huge cargo ships that travel back and forth across the ocean. Ships take on ballast water in their home port. The weight of this water makes the ships stable while they travel across the ocean. When a ship gets to its destination, it releases the ballast water.

Ballast water is teeming with living creatures that were in the water at the port on the other side of the globe. Scientists estimate that between 5,000 and 10,000 species are traveling around the world in ballast water at any given time. The first zebra mussels in the Great Lakes probably arrived in ballast water.

Water hyacinth

Nutria

The Natural Farmer Summer, 2020

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Invasion of the Turnips: They Grew Like Weeds

Some of the obvious die-outs we have witnessed in Connecticut over the last few decades include the complete loss of several tree species including: the Chestnut, the Elm, and Red Pine. These are quickly being followed by the Spruce, the Hemlock, the Birch, the Aspen, the Sugar Maple, and the Oak. Actually, pretty much every tree species in now under significant disease and insect pressures, resulting in very sparse canopies and significant discolorations. “The trees are brown and the sky is white”, being a common condition. Most other plant species also develop significant disease conditions as well. The insect populations have also quickly followed the plant decline, with the decline of early spring pollinator populations on our farm probably approaching 99%, compared to a few decades ago. These earth changes are requiring strength and vigor of new plant species, in order to maintain vegetative cover over soil surfaces. It is not surprising that we are “invaded” by these new plant species, thanks to the earth’s wisdom.

To apply a preservationist approach to such rapidly evolving conditions is a difficult proposition. The earth needs to evolve to maintain its vitality, yet humans at the same time have difficulty letting go of the past. The approach to “invasive weeds” may benefit from this outlook, nature is wise in seeking to protect itself with these plants, yet we humbly ask for assistance in growing some of the plants we desire. This is how we approach farming as well. A gentle, careful approach where human and nature work together to create a living, thriving environment in a powerful symbiotic relationship. This provides the human life with much meaning, to be of benefit to life, as well as giving us plenty to do.

However this humble cooperative approach is rare, and instead we are faced with many who view these plants as an “invasion” – something to be battled against with all the weapons of war. This requires a certain level of arrogance to believe that nature knows not what she does, and that the humans know better. The battle against the enemy, which in this case is nature, is actually a battle against oneself, for when the interconnected web of life is witnessed, the face of the enemy on the battlefield is finally seen as one’s own. For now the battle continues, the enemy continually shifts forms; now an invasive plant, then an insect, a germ, a terrorist, or climate change. The approach is consistently one of war; pesticides, sterilizers, pharmaceuticals, bullets, bombs, and weather modification. The result is more suffering, death and destruction, long into the aftermath, all to the detriment of the forces of life.

Nature, in boundless compassion, constantly holding up the mirror for us to see ourselves.

Bryan O’Hara farms organic vegetables in Connecticut

There was a time, not so long ago, when weeds were just considered weeds. There were no “invasive” weeds. The concept of an invasion of weeds appears to be linked to the human separation from the lessons of nature. A weed is, of course, a plant which a human considers out of place. In nature there are no weeds, only plants covering the earth offering their unique benefits to the forces of life. Nature’s timeline is very, very long. From this perspective, nature can be seen to have little regard for the hurried demands of the human concerns of plants out of place. Weeds, or plants out of place, is a human perspective which is not consistent with nature’s perspective.

As farmers, we are concerned with plants out of place impacting our crops. With decades of experience in annual crop production, it has become very clear that such weeds are a signal from nature about how our agricultural practices are impacting the earth. In this sense the weeds become a mirror for the farmer to look into. Certain weeds can signal soil structure imbalances, some signal nutrient imbalance, some chemical contamination, and so on. When field conditions are well balanced and nature-benefiting agricultural approaches are taken, the farmer is rewarded with minimal weed “interference” and abundant, vigorous crops. Weeds invariably are of benefit to the agricultural field as they are well selected by nature to harness the sun’s energy and provide the benefits of this energy consolidation to the living organisms surrounding them. The weeds provide the soil with a physical cover as well, with all the associated benefits.

Almost invariably there is no bare soil in nature. Soils’ formation, continuance, and development are dependent upon consistent coverage with plants. Nature is very adept at maintaining this condition; farmers, however, are often not as adept. Weeds are nature’s cover crop, often superior to our “cover crop seed blends”, in diversity, vigor, and appropriate ability to bring life to the soil environment. We can assist this life-building process when we are paying close attention and have a willingness to cooperate and interact with nature, this being one of the most uplifting of human experiences. This engaging with natural forces in a cooperative farming endeavor is a humbling and awe inspiring experience when the complexity and interconnectedness of creation is glimpsed. However, oftentimes cooperation with nature in agricultural practices is not the case and farming results in detriment to the life force.

With so many distractions from the earthbound human’s role as caretaker and co-creators in the development and expansion of the living forces, much has deteriorated. Environment collapse is prominent as the impacts of pollution, war, and greed destroy living systems. Some basic examples include, but are not limited to, the air’s gaseous nature is altered by fumes of industry, including much vaporized herbicide. The rain falling through this environment picks up many pollutants and alters the soil environment. The soils themselves are often “treated” to various pesticides. The sun is blotted out by jet fueled chem trials and particulate matter from pollution. Radioactive fallout from nuclear sources, microwaving, electromagnetic disturbances, and far more -- in response to such destruction, nature changes...

The soils alter their biological, chemical, and physical conditions under these influences. Many plants, insects, microbes, and animals cannot survive these changes, resulting in the observed “die-outs” of various species. The mode of decline for these species is often disease or other life-threatening pestilence. Often the disease is blamed for the die-out and humans fail to consider the environmental conditions that were the underlying cause.

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A few years ago the local newspaper sent a reporter to one of our farmers markets for a story. The next day we were pleased to see a local farmer generously offering a taste of delicious wine berries to a curious customer, the wine berry being a less known raspberry relative. We were quite surprised when the next week a regulator from the state department of Energy and Environment (D.E.E.P.) came to inform us that our market was offering illegal berries for sale. Before being dispatched from the market he managed to provide us with a list of numerous plants that had, in legislative darkness, become illegal to cultivate. These included such plants as watercress, valerian, and wine berries, among many others. This legislation declared them “invasive species”. Actually, just previously to this event our local health department had informed us that though we could sell fruits and vegetables we could not give them away without a “sampling permit”. So our front page coverage was actually illegal sampling of illegal berries, but that’s another story.

The idea of being invaded by delicious, illegal berries was very attractive to us, so we set about trying to increase the wine berries on our farm. Unfortunately after years of encouragement the wine berries have absolutely refused to invade and all we have is a tiny patch of hardly productive plants. We have had similar experiences with watercress, and valerian. We can encourage them to grow but they certainly will not invade. Of course most plants are presently struggling in our environment, so this is not really surprising. Though some of the declared plants do seem vigorous enough to continue to thrive, hopefully more of the declared “invasive” plants will prove to be capable under our conditions.

Despite the general environmental difficulties, we have still found the earth willing to provide us with abundant, healthful crops when great care in agricultural approach is applied. This was the case last fall when we were harvesting all the root vegetables for winter storage and sale. The shining stars amidst this abundance were the turnips and winter radishes, with absolutely astounding yields of perfect roots -- the clear definition of a bumper crop. Unfortunately the market conditions for turnips has not fared well over the years, and even though almost all vegetable varieties have increased in consumption, the turnip eaters appear to be dwindling.

This led to charges against this writer of being an excessive Cancerian, in need of the security of many things. The consumption of these raw or pickled vegetables for many health conditions deteriorated. Following this came the realization that raw turnip and radish are primary vegetables for treatment and prevention of colds and flu in many traditions. We found while studying Chinese medicinal approaches that colds and the flu are often considered an excess of the “cool and damp”, and that raw turnip and radish bring balance to this condition. As well, when talking with an African American friend, she related a story from when she was a young girl in which her mother always made her eat raw turnip when colds or flu threatened. Though perhaps this mandatory approach has diminished her enthusiasm for turnip eating, we have, as a family, also appreciated the consumption of these raw or pickled vegetables for many such health conditions.

Now that a more complete view of the great turnip excess of 2019/2020 can be seen, it becomes clear that the earth is still willing to provide in abundance what we most need. Quite a reassurance in these times of darkness. The darkness would have us not continue to create in a loving, cooperative association with nature. Yet the darkness also assists us in evolving, as we can bring an appropriate amount of light to balance the darkness. When we step back and look from above at our situation, we see that nature is clearly ready to continue to help us in this effort. Though many people are prepared for this time, there are still some who are just not ready to eat raw turnips.
Climate Change & Wildlife Health: Direct and Indirect Effects

Climate change will have significant effects on the health of wildlife, domestic animals, and humans, according to scientists. The Intergovernmental Panel on Climate Change projects that unprecedented rates of climate change will result in increasing average global temperatures; rising sea levels; changing global precipitation patterns, including increasing amounts and variability; and increasing midcontinental summer drought. Increasing temperatures, combined with changes in rainfall and humidity, may have significant impacts on wildlife, domestic animal, and human health and diseases. When combined with expanding human populations, these changes could increase demand on limited water resources, lead to more habitat destruction, and provide yet more opportunities for infectious diseases to cross from one species to another.

Awareness has been growing in recent years about zoonotic diseases—that is, diseases that are transmissible between animals and humans, such as Lyme disease and West Nile virus. The rise of such diseases results from closer relationships among wildlife, domestic animals, and people, allowing more contact with diseased animals, organisms that carry and transmit a disease from one animal to another (vectors), and people. Disease vectors include insects, such as mosquitoes, and arachnids, such as ticks. Thus, it is impossible to separate the effects of global warming on wildlife from its effects on the health of domestic animals or people.

Climate change, habitat destruction and urbanization, the introduction of exotic and invasive species, and pollution—all affect ecosystem and human health. Climate change can also be viewed within the context of other physical and climate cycles, such as the El Niño Southern Oscillation (El Niño), the North Atlantic Oscillation, and cycles in solar radiation that have profound effects on the Earth’s climate. The effects of climate change on wildlife disease are summarized in several areas of scientific study discussed briefly below: geographic range and distribution of wildlife diseases, plant and animal phenology, and patterns of wildlife disease, community and ecosystem composition, and habitat degradation.

Geographic Range and Distribution of Wildlife Diseases

In the Northern Hemisphere, global warming has likely played a role in geographic shifts of disease vectors and parasitic diseases that have complex life cycles. For example, the black-legged tick, which carries and transmits Lyme disease and several other tick-borne zoonotic diseases in North America, has been expanding north into southern Ontario and western Ontario and Manitoba, and, more recently, into Quebec and the Canadian Maritime Provinces.

In Europe, a similar northward expansion of the European castor bean tick, which also carries and transmits Lyme disease, tick-borne encephalitis (TBE), and other diseases, has been reported in Norway and Sweden. On both continents, migrating birds carrying feeding ticks are likely the source of long-range expansion of the tick vectors and increasing environmental temperatures have likely permitted the ticks to become established in larger geographic areas.

Scientists also expect changes in disease distribution with changes in altitude. For example, climate warming may lead to year-round transmission of mosquito-borne avian malaria at higher elevations in the Hawaiian Islands, further threatening endangered native Hawaiian birds that have little or no resistance to the introduced disease. Currently, on the island of Hawai‘i, avian malaria, caused by the parasite Plasmodium relictum, is limited to warm er elevations below 1,500 meters (or 4,920 feet). If the higher elevations become warmer as projected, mosquito activity and parasite development in these areas will increase. Conservationists are concerned that climate change may lead to increased avian malaria transmission throughout the year at increasingly higher elevations.

Phenology: Effects on Wildlife Disease

The timing of recurring seasonal biologic cycles of some plant and animal species has already been affected by climate change. The study of these seasonal cycles is called phenology. The timing of biological cycles, such as the arrival of a bird species in the spring and the availability of its preferred food source, is critical for successful breeding and survival. Several studies in Europe show that some migratory birds have changed their migration patterns in response to climate change by arriving earlier than records show historically. Significant population declines were reported recently for bird species that have not responded with earlier arrival, and the population declines have been interpreted as indicating the magnitude, and negative effect, of mismatch between bird arrival time and the onset of plants emerging from dormancy in spring. When an earlier emergence of plants from dormancy is combined with a mismatch in bird arrival time, critical food sources for returning birds might be past the period when they are most nutritious.
Variability in the timing of these biological cycles also can lead to increases or decreases in the risk for infectious disease, particularly diseases transmitted by mosquitoes or ticks. In Europe, transmission of TBE to humans often increases when warmer temperatures in the early spring result in the overlap of feeding activity of virus-infected nymphal and uninfected larval European castor bean ticks. Under these conditions, TBE is more readily passed between ticks feeding on small rodents. The period of viral infection is brief in tick-infested rodents, so when both stages of tick feed at the same time, more larvae and nymphal ticks feed simultaneously, this not only contributes to the successful transmission of the pathogen to larvae, it also results in greater genetic diversity in this zoonotic pathogen (Gatewood and others, 2009). Climate change, by altering seasonal weather patterns, has the potential to affect these natural cycles.

Changing Patterns of Wildlife Disease In nature, pathogens can be transmitted directly between animals or indirectly through intermediate "hosts," such as infected prey or biting insects. Indirect transmission cycles are often affected by environmental conditions such as temperature and rainfall. Higher temperatures associated with climate change may contribute to an increase in pathogens within intermediate hosts and vectors, or increased survival of animals that harbor disease. For example, warmer summer temperatures in the Arctic now allow the lung nematode larvae often found in muskoxen to develop to the infectious stage within the intermediate host, the marsh slug, at a rate that has reduced the parasite’s life cycle from 2 years to 1 year.

Survival of another nematode, the brain worm of white-tailed deer, may also be increased by recently warmer temperatures and milder winters in the north-central United States and southern Canada. The parasite, which overwinters in the snails and is accidentally eaten with plants, causes neurological disease in moose. Moose are already heat stressed by climate change and may be more susceptible to parasitic and infectious diseases, including the brain worm of white-tailed deer.

Changes in precipitation patterns also have a significant potential to affect patterns of wildlife disease through survival of disease agents or vectors and through effects on host parasite relationships. In the example of the brain worm of deer, increased precipitation also may result in increased survival of the snail populations, resulting in more exposure of deer to infected snails.

Community and Ecosystem Changes Determining the effects of climate change on communities and ecosystems is difficult because the effects are likely to be highly variable, and this may be especially true for marine ecosystems. Since the 1980s, coral reefs in the Western Atlantic have suffered massive declines due to disease. It is likely that coral mortalities were initially due to widespread mortality of sea urchins, which allowed algal overgrowth of reefs, followed by environmental degradation and increased coral susceptibility to disease. Since the early 1980s, mass "coral bleaching" has been observed worldwide, especially following the major 1998 El Niño event, and it has been linked to higher sea-surface temperatures and to rising carbon dioxide levels that increase acidification of the oceans, which further weakens the coral structure. Corals are able to survive in nutrient-deficient waters because corals and the photosynthetic algae that live on them support each other. Corals that have lost these algae due to increased water temperature, changes in salinity or pollution may be susceptible to disease, leaving white coral skeletons, referred to as "coral bleaching". Elevated temperatures will likely increase coral bleaching, which can lead to coral die-offs. Corals that fail to recover sufficiently may lead to loss of coral reefs and associated tropical marine life that depend on them for food and shelter. Coral bleaching has already been associated with significant declines in the diversity and popu-

**USDA Website Provides Detailed Info on Invasive Species**

The USDA has prepared a site on invasives which offers Species Profiles that provide general information about species considered to be invasive. It includes the scientific name, common name(s), synonym(s), and general information including where the species is native, when introduced to the U.S., means of introduction, and impact (with citations). The profiles also include distribution/maps/survey status, Federal regulatory status, images, videos, spotlights, and selected highly relevant resources for the species (organized by source).

While not an exhaustive list of invasives, this list covers most of them. The profiles are broken into 3 groups, Terrestrial Invasives, Aquatic Invasives, and Species not Established in the US, as well as an overall list which is sortable alphabetically.

The site is at: https://www.invasivespeciesinfo.gov/species-type

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**Figure 4. Human risk for tick-borne encephalitis in Europe is heightened in some years by slightly warmer temperatures in early spring that are associated with overlapping feeding of infected nymphal ticks and uninfected larval ticks. A slower rise in spring temperatures is associated with nonoverlapping feeding.**
Coral bleaching and declines in the physical integrity of reef systems also are anticipated to lead to further reductions in the complexity of coral reef ecosystems. As a result, local economies that depend on coral reefs for sustenance or tourism could be significantly affected by climate change.

Habitat Alteration

Climate change has caused dramatic changes in several macro- and microhabitats on Earth. While wildlife species are likely to be adaptable, within their physiological limits, in dealing with direct impacts of climate change on temperature and precipitation, their ability to respond to major physical changes in their environment, short of migration, is more limited. Along the Antarctic Peninsula, populations of Adelie Penguins are declining, because coastal ice no longer persists through the winter in many locations. In Antarctica, the Adelie Penguin is commonly a coastal bird found in areas where sea ice persists throughout the winter, because it relies on sea ice for access to feeding areas where upwelling ocean currents contain many krill and fish.

Climate change is also having a detrimental effect on microhabitats. Amphibian and reptilian populations have declined in the lowland forests in Costa Rica in part through the effect of climate change on the humid leaf litter microhabitat of the forest floor. Weather conditions also significantly affect the microclimates for nests and burrows. For example, in sea turtles, elevated temperatures may lead to altered sex ratios or loss of nesting beaches secondary to sea level rises. Temperatures outside the range of those that turtles can tolerate result in the death of the developing sea turtle embryos.

Questions to Ponder about Climate Change

Because of the uncertainty associated with the effects of climate change on the health of wildlife, domestic animals, and humans, we recommend four areas of study.

1. Long-term interdisciplinary projects can help determine climatic effects on biological factors associated with disease emergence, including species abundance, animal interactions and movements, vector populations. How might various physical, social, and economic factors contribute to disease emergence, persistence, and spread?

2. How are threatened and endangered free-ranging wildlife populations currently threatened by disease? How might climate change affect the current situation?

3. How will climate change play a role in the threat of wildlife associated water- or vector-borne diseases for free-ranging wildlife, other animals, and humans?

4. How will climate change play a role in the lives of native peoples who are dependent upon wildlife as a major source of food? Will wildlife population declines or wildlife-associated food-borne diseases threaten native peoples?

Figure 5. Healthy North American bull moose (U.S. Fish and Wildlife Service). Diseased North American cow moose in the final stages of a brain worm infection in St. Louis County, Minn. (Mike Schrage, Wildlife Biologist, Fond du Lac Band).

Figure 6. Extensive coral bleaching on a reef, St. John, U.S. Virgin Islands (Caroline S. Rogers, U.S. Geological Survey).
Invasives are a Threat to Wildlife

by the National Wildlife Federation

“Invasive species”—they may not sound very threatening. But these invaders, large and small, have devastating effects on wildlife.

Invasive species are among the leading threats to native wildlife. Approximately 42 percent of threatened or endangered species are at risk due to invasive species. Human health and economies are also at risk from invasive species. The impacts of invasive species on our natural ecosystems and economy cost billions of dollars each year. Many of our commercial, agricultural, and recreational activities depend on healthy native ecosystems.

What Makes a Species “Invasive”? An invasive species can be any kind of living organism—an amphibian (like the cane toad), plant, insect, fish, fungus, bacteria, or even an organism’s seeds or eggs—that is not native to an ecosystem and causes harm. They can harm the environment, the economy, or even human health. Species that grow and reproduce quickly, and spread aggressively, with potential to cause harm, are given the label “invasive.”

An invasive species does not have to come from another country. For example, lake trout are native to the Great Lakes, but are considered to be an invasive species in Yellowstone Lake in Wyoming because they compete with native cutthroat trout for habitat.

How Invasive Species Spread Invasive species are primarily spread by human activities, often unintentionally. People, and the goods we use, travel around the world very quickly, and they often carry uninvited species with them. Ships can carry aquatic organisms in their ballast water, while smaller boats may carry them on their propellers. Insects can get into wood, shipping pallets, and crates that are shipped around the world. Some ornamental plants are carried into the wild and become invasive. And some invasive species are intentionally or accidentally released pets. For example, Burmese pythons are becoming a big problem in the Everglades.

In addition, higher average temperatures and changes in rain and snow patterns caused by climate change will enable some invasive plant species—such as garlic mustard, kudzu, and purple loosestrife—to move into new areas. Insect pest infestations will be more severe as pests such as mountain pine beetle are able to take advantage of drought-weakened plants.

Threats to Native Wildlife

Invasive species cause harm to wildlife in many ways. When a new and aggressive species is introduced into an ecosystem, it may not have any natural predators or controls. It can breed and spread quickly, taking over an area. Native wildlife may not have evolved defenses against the invader, or they may not be able to compete with a species that has no predators.

The direct threats of invasive species include preying on native species, outcompeting native species for food or other resources, causing or carrying disease, and preventing native species from reproducing or killing a native species’ young.

There are indirect threats of invasive species as well. Invasive species can change the food web in an ecosystem by destroying or replacing native food sources. The invasive species may provide little to no food value for wildlife. Invasive species can also alter the abundance or diversity of species that are important habitat for native wildlife. Aggressive plant species like kudzu can quickly replace a diverse ecosystem with a monoculture of just kudzu. Additionally, some invasive species are capable of changing the conditions in an ecosystem, such as changing soil chemistry or the intensity of wildfires.

Examples of Invasive Species

Asian carp are fast-growing, aggressive, and adaptable fish that are outcompeting native fish species for food and habitat in much of the mid-section of the United States. The huge, hard-headed silver carp also pose a threat to boaters, as the fish can leap out of the water when startled by boat engines, often colliding with people and causing injuries. “Asian carp” is a catchall name for species of silver, bighead, grass, and black carp from Southeast Asia. Voracious filter feeders, Asian carp consume up to 20 percent of their body weight each day in plankton and can grow to more than 100 pounds.

Asian carp were imported to the United States in the 1970s to filter pond water in fish farms in Arkansas and quickly spread across the country. Flooding allowed them to escape and establish reproducing populations in the wild by the early 1980s. Asian carp are swiftly spreading northward up the Illinois River, and are now on the verge of invading the Great Lakes. Once established in an ecosystem they are virtually impossible to eradicate. Adult Asian carp have no natural predators in North America and females lay approximately half a million eggs each time they spawn.

Temperatures in the Great Lakes are well within the fishes’ native climate range. Parts of the Great Lakes, including nutrient-rich bays, tributaries, and other near-shore areas, would offer Asian carp an abundant supply of their preferred food, plankton. Plankton is also favored by non-native fish that are outcompeting native fish species for food and habitat in much of the mid-section of the United States. Asian carp are fast-growing, aggressive, and adapt

Asian carp

The brown marmorated stink bug, Halyomorpha halys, is native to China, Japan, and surrounding countries. They were first discovered in the United States in Pennsylvania during the late 1990s, but no one knows for certain how they were introduced to North America. Brown marmorated stink bug (BMSB) populations are exploding in the absence of their natural predators, and they are quickly becoming a nuisance to people in their homes and to the agriculture industry.

A big problem with BMSBs so far is the infestation of people’s homes. The bugs begin to come indoors, searching for warm, protected areas when outside temperatures turn cooler in the fall. They don’t reproduce inside the home or cause structural damage, but their namesake odor, noisy flying, and teeming numbers can make the BMSB an extreme nuisance throughout the winter, especially on warmer days when they are more active.

BMSBs feed on host plants by piercing the skin and consuming the juices within; the signs of stink bug feeding appear as “necrotic” or dead spots on the surface. They’ve become a significant agricultural pest in the mid-Atlantic region, and other areas could see similar effects if the BMSB’s range continues to expand. A wide variety of plants are known food sources for BMSBs, including ornamental trees and shrubs; fruit crops like peaches, apples, grapes, and pears; vegetable crops like green beans and asparagus; and soybeans and corn.

Zebra mussels and quagga mussels are virtually

Bloomington, the largest city in Indiana and the county seat of Monroe County, is located in the southern part of the state. The city is known for its beautiful natural beauty and a vibrant downtown area. Bloomington is also home to Indiana University, one of the largest universities in the United States. The city is a hub for culture and arts, with a range of museums, theaters, and galleries. Bloomington is also a popular destination for outdoor enthusiasts, with hiking and biking trails, parks, and recreational areas that offer a variety of activities year-round.

The city of Bloomington is situated in the rolling hills of southern Indiana, with the Hoosier National Forest surrounding it. The city is known for its natural beauty, with numerous parks and trails that offer scenic views of the surrounding landscape. Bloomington is also home to Indiana University, one of the largest universities in the United States, which attracts students and scholars from around the world. The university is known for its strong academic programs, including its programs in the humanities, sciences, and social sciences. Bloomington is a hub for culture and arts, with a range of museums, theaters, and galleries that offer a variety of cultural experiences. The city is also home to a number of restaurants, cafes, and bars that offer a range of dining options. Bloomington is a great place to live, work, and play, with a range of outdoor activities and cultural events that make it a vibrant and exciting place to call home.
identical, both physically and behaviorally. Originally from Eastern Europe, these tiny trespassers were picked up in the ballast water of ocean-going ships and brought to the Great Lakes in the 1980s. They spread dramatically, outcompeting native species for food and habitat, and by 1990, zebra mussels and quagga mussels had infested all of the Great Lakes. Now both quagga mussels and zebra mussels have spread to 29 states by hitching rides on boats moving between the Great Lakes and Mississippi River Basins. Artificial channels like the Chicago Area Waterways System facilitate their spread. These man-made channels act like super-highways and are also a pathway for Asian carp, which are currently spreading towards the Great Lakes.

The quagga and zebra mussels blanketing the bottom of the Great Lakes filter water as they eat plankton and have succeeded in doubling water clarity during the past decade. Clear water may look nice to us, but the lack of plankton floating in the water means less food for native fish. Clearer water also allows sunlight to penetrate to the lake bottom, creating ideal conditions for algae to grow. In this way, zebra and quagga mussels have promoted the growth and spread of deadly algae blooms.

Zebra and quagga mussels harm native fish populations, ruin beaches and attach to boats, water intake pipes, and other structures, causing the Great Lakes economy billions of dollars a year in damage. They devastate native species by stripping the food web of plankton, which has a cascading effect throughout the ecosystem. Lack of food has caused populations of alewives, salmon, whitefish, and native mussel species to plummet.

In her five-year lifetime, a single quagga or zebra mussel will produce about five million eggs, 100,000 of which reach adulthood. The offspring of a single mussel will in turn produce a total of half a billion adult offspring. There are an estimated 10 trillion quagga and zebra mussels in the Great Lakes today. Once zebra and quagga mussels become established in a water body, they are impossible to fully eradicate. Scientists have not yet found solutions that kills zebra and quagga mussels without also harming other wildlife.

Additional examples:
• Cogongrass is an Asian plant that arrived in the United States as seeds in packing material. It is now spreading through the Southeast, displacing native plants. It provides no food value for native wildlife, and increases the threat of wildfire as it burns hotter and faster than native grasses.
• Feral pigs will eat almost anything, including native birds. They compete with native wildlife for food sources such as acorns. Feral pigs spread diseases, such as brucellosis, to people and livestock. E. coli from their feces was implicated in the E. coli contamination of baby spinach in 2006.
• European green crabs found their way into the San Francisco Bay area in 1989. They outcompete native species for food and habitat and eat huge quantities of native shellfish, threatening commercial fisheries.
• Dutch elm disease (caused by the fungus Ophiostoma ulmi) is transmitted to trees by elm bark beetles. Since 1930, the disease has spread from Ohio through most of the country, killing over half of the elm trees in the northern United States.
• Water hyacinth is a beautiful aquatic plant, introduced to the U.S. from South America as an ornamental. In the wild, it forms dense mats, reducing sunlight for submerged plants and aquatic organisms, crowding out native aquatic plants, and clogging waterways and intake pipes.

Curbing the Spread
One way to curb the spread of invasive species is to plant native plants and remove any invasive plants in your garden. There are many good native plant alternatives to common exotic ornamental plants. In addition, learn to identify invasive species in your area, and report any sightings to your county extension agent or local land manager.

Regularly clean your boots, gear, boat, tires, and any other equipment you use outdoors to remove insects and plant parts that may spread invasive species to new places. When camping, buy firewood near your campsite (within 30 miles) instead of bringing your own from home, and leave any extra for the next campers. Invertebrates and plants can easily hitch a ride on firewood you haul to or from a campsite—you could inadvertently introduce an invasive to a new area.

Native Plants
Native plants have formed symbiotic relationships with native wildlife over thousands of years, and therefore offer the most sustainable habitat. A plant is considered native if it has occurred naturally in a particular region, ecosystem, or habitat without human introduction.

Exotic plants that evolved in other parts of the world or were cultivated by humans into forms that don’t exist in nature do not support wildlife as well as native plants. Occasionally, they can even escape into the wild and become invasive exotics that destroy natural habitat.

Native plants help the environment the most when planted in places that match their growing requirements. They will thrive in the soils, moisture and weather of your region. That means less supplemental watering, which can be wasteful, and pest problems that require toxic chemicals. Native plants also assist in managing rain water runoff and maintain healthy soil as their root systems are deep and keep soil from being compacted.

Native Plant Finder
Bring your garden to life! Enter your zip code to discover the best native plants, attract butterflies and moths, and support birds and other fauna. Native Plant Finder www.nwf.org/NativePlantfinder/ is an indispensable tool, based on the research of Dr. Douglas Tallamy of the University of Delaware and in partnership with the United States Forest Service. Discovering the native plants where you live can also provide a unique sense of place and heritage for your garden habitat while preserving the natural history of the flora and fauna of your region.
Rethinking The Invasive Species Paradigm

by Jono Neiger

“The discussion about native plants encompasses a remarkable mixture of sound biology, invalid ideas, false extensions, ethical implications, and political usages.”
— Steven Jay Gould, evolutionary biologist, writer, Harvard University, Natural History Museum NYC

An Evolving Perspective on Strengths, Failures, and Co-evolution in the Context of Invasive Plants.
S.J. Gould, Arnoldia, Spring 1998. (Quarterly magazine of Arnold Arboretum, Harvard University)

“There is no biological criterion on which to judge a priori the smaller or greater value of one species against that of another.”
— Lugo, in Biodiversity, E.O. Wilson ed.

You walk through the wood edge of the local park, farm, or neighborhood trail. You see the rampant undergrowth of shrubs with spiny stems and small red berries. Many people have taken an instinctive reaction to these barberry bushes and liken them to invaders on the land that are harming the native species there.

We’ve been hearing for many years about the danger of invasive species. They’re everywhere and causing widespread harm to the environment. And yet, we understand that nature is hugely complex and its hard to grasp all that’s going on with species interactions and besides...everything is changing with all the damage humans are causing to the environment...

The issue of invasive species has permeated our society to where many people fervently believe there are species taking over, causing widespread harm, and that should be eradicated. But many scientists don’t subscribe to these notions but believe that these complex systems are constantly in flux and adapting to the ever present changes. There is no perfection or stability in nature. As they explore the novel ecosystems around us, they ask questions about how they came to be, how they function, and how do they respond to the intense ecosystem changes occurring.

I first came to this issue through my work doing habitat restoration for The Nature Conservancy in the 1990’s. Much of what we did was amazing; replanting forests in flood-prone agricultural land along the Sacramento River in the Central Valley of California. We planted thousands of trees and shrubs. We had a large staff, hundreds of volunteers, and an ecosystem restoration education program. But we also used techniques that continued to disturb the system even as we tried to repair it. We sprayed Roundup with tractor boom sprayers across many acres. We used heavy equipment, brush hogs, and tractors and tilled the soil, increasing the soil disturbance.

I started to have misgivings about the approaches we used and the war we waged with the ecosystem— to save it. I’ve come to believe the process of restoration and land management is as important as the result. It turns out that the ends don’t justify the means. I look at techniques being used in current land management, farming, and landscape work through that lens. In the work, I do on residential properties, community land, farms, campuses, and in urban areas, I look to heal the land, reduce the ongoing disturbance, and to reconnect people to the land and their place on it.

There are many questions that need to be asked about invasion biology and “invasive species” (see sidebar). We need to go into our land work, farm, gardening, with an openness to these questions and a desire to reach new understandings.

Inadequate definitions:

There are currently inadequate definitions for many terms used in the native-invasive debate. A simple definition for Native that gets used often is “A plant or animal that lived in a given area before European colonization”. This is a very arbitrary definition.

Here’s another. “A plant that is a part of the balance of nature that has developed over hundreds or thousands of years in a particular region or ecosystem.”

These definitions are problematic in their ambiguous use of time frames, locations, and vague terms such as “balance of nature” to determine “belonging”.

The nature of species is to move into new areas. The nature of species and how to get rid of them. Words like “invasive” have entered into our common language. There are many books, articles, journal articles espousing the dangers of invasive species and how to get rid of them.

Where are camels native to? In answering this, you might have four different responses; and they might all be right. Camels are native to:

1. The first place you think of when you hear the word ‘camel’ i.e. the Middle East (Arabian camel)
2. In North America, where they first evolved, lived for tens of millions of years, achieved their greatest diversity, and where they became extinct only recently.
3. In South America, where they retain their greatest diversity (llama, alpaca, vicuña, guanaco) or
4. In Australia, where the world’s only truly wild (not domesticated) dromedaries now occur. (feral dromedary and Bactrian camels).

Depending on your criteria for native; where they evolved, where they’ve been the longest, where they are most numerous, or where they are still a “wild” non-domesticated population, you might answer the question, “Where are camels native to?” differently.

Invasive Species Paradigm

by Jono Neiger

Invasive Species Paradigm

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Janzen came to his idea of ecological fitting while studying species in — one species out” kind of tradeoff. Study of island biogeography and ecosystem dynamics has shown that many more species can arrive and find niches without the loss of other species.

Novel ecosystems: These new combinations of species have been given the name novel ecosystems. They are a hallmark of habitat change. In Janzen and other researchers’ and conservationists’ view, species combinations are constantly under change, there’s no fixed formula. Across a landscape there’s often a gradation of species mixtures. New species often find space within an ecosystem and there is no “one species in — one species out” kind of tradeoff. Study of island biogeography and ecosystem dynamics has shown that many more species can arrive and find niches without the loss of other species.

Seed dispersers, needed to help these seeds reproduce, had disappeared until the horse was introduced. These herbivores that could eat and spread the seed. The previous dispersers were the ground sloths, camels, ancient horses and others that disappeared during the megafauna dieoff approximately 10,000-15,000 years ago (probably from climate change, human overkill - or a combination of both). Janzen surmised that the ecosystem lacked a seed dispersal herbivore to replace the lost megafauna. His solution was to reintroduce the modern horse into Santa Rosa National Park, a controversial approach in conservation circles where purity of species introductions is paramount. Bringing in a domesticated and non-native species (though originally evolved on the continent) was ecological heresy. It turns out that the European horse was a perfect surrogate for eating the fruit pulp without chewing the seeds and depositing them on the landscape where they could establish.

In Janzen and other researchers’ and conservationists’ view, species combinations are constantly under change, there’s no fixed formula. Across a landscape there’s often a gradation of species mix with no break between combinations. The idea of a climax forest or ecosystem has been debunked as it’s become clear there’s no settled arrangement. Often there’s a large dose of chance of which seedling is there when a storm takes down a large tree, or the seed mix in the soil after a fire comes through.

Relatively, the idea of ecosystems as complete and full is just as erroneous. New species often find space within an ecosystem and there is no “one species in — one species out” kind of tradeoff. Study of island biogeography and ecosystem dynamics has shown that many more species can arrive and find niches without the loss of other species.

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Seed dispersers, needed to help these seeds reproduce, had disappeared until the horse was introduced.
invasive” is a reason to dislike and remove it. Its mere presence is seen as causing harm. Wild nature, out of our control, is not something modern human society has allowed. Sometimes it doesn’t even need to be a newly arrived species. Poison ivy, grapes, sumac, dandelions, and others can be considered invasive as well. A sad offshoot of this is that children and many people see nature as dangerous; a place where there are bad plants and animals hurting the environment and they may hurt you or your children. We are moving into a period where people are losing their nature connection, and casting some nature as good, and some nature as bad is just feeding this nature disconnect.

One commonly used statistic of invasive species harm is “invasive species are the 2nd leading cause of species extinctions”. This is a factoid from a scientific paper by David Wilcove “Quantifying Threats to Imperiled Species in the United States” printed in the journal BioScience in 1998. This widely cited paper was in fact based on anecdotal and observational accounts by land managers, using limited data. It also included Hawaii, which is a very distinct situation, being an island with species evolved in isolation and then centuries of introductions by humans. The authors expressed the limitations of the data and yet the idea that “invasive species are the 2nd leading cause of extinctions” has gained a life of its own and is repeated often without reference to the source or limitations. A Canadian assessment in 2005 found that invasive species were the least of all factors considered. The biggest factor? Disturbance and removal of habitat by humans.

Harm can also be quantified monetarily. One widely quoted amount comes from a study done by David Pimental, a Cornell professor, in a paper published in 2005. He calculated that invasive species cost the US $120 billion dollars a year. This number is large enough to move federal bureaucracies and research institutions to fund removal campaigns, research, and a massive education campaign against these invaders. Unfortunately when one looks closely at the calculations to get to $120 billion per year it stretches reason and heads quickly towards the absurd and misleading. It includes:

- Crop losses in agriculture (mostly nonnative crops) from weeds ($24 billion/yr).
- Herbicides used in U.S. agriculture ($4 billion/yr).
- Control of species in lawns, gardens and golf courses including pesticides and herbicide use. ($1.5 billion/yr)
- Forage losses and “weed” control on overgrazed range and pasture ($6 billion/yr).
- Cost of domestic cats in damage to U.S. bird population. ($17 billion/yr).

Many of the costs are to industry, including the cost to companies to keep waste outlet pipes heading into waterbodies from getting clogged by zebra mussels. The benefits of these newcomer species aren’t part of the calculation. For instance those zebra mussels clogging the industrial pipes also have been cleaning the Great Lakes and other waterways of human-caused pollution, leading to cleaned up waters (they are filter feeders) and a return of many sport fishing species and commensurate return in the sport fishing industry.

Scientific literature – what are scientists saying?

The conservation and research community is slowly coming around to question the dominant ideas around invasive species. There are reviews looking at bias in scientific studies of invasives, studies of the “real” impact of invasives, and studies of the benefits of these new arrivals. One particular thread is to tease apart whether invasives are the “drivers” or “passengers” of change in ecosystems. Several of these studies have identified, among the complex interactions going on, that invasives often ride in on the changes in ecosystems that we humans have initiated. Its not surprising, but for several decades now, scientists have worked from the presumption of harm, and research has looked to confirm that and focus on methods to remove species.

Reassessing Specific Cases/Species

It’s coming to light that many of the species accused of egregious harm are guiltless and even are bringing benefits to landscapes they are in.
A classic case of this is tamarisk (Tamarix spp.), a shrub introduced into arid southeastern landscapes in the 19th century. They were initially welcomed as an ornamental, and a drought-resistant shade tree. In the 1930’s as drought swept through Arizona, Central New Mexico, and West Texas and they were branded as “water thieves” and then after WWII as nonnative invaders salting the water. For 70 years they were the object of an intensive removal campaign using bull-dozers, chains, herbicides at the cost of tens of millions of public dollars. In the last few years ecologists have found that they utilize water at the same rate as other riparian species and do not add additional salt. (Stromberg, 2009) They are also the preferential nesting habitat of the endangered Southwestern willow flycatcher. This species is surviving and thriving under the vastly changed water regimes in the altered southwestern landscapes. Shouldn’t we recognize that tamarisk has a place as part of restoring those places?

Closer to home, black locust (Robinia pseudoacacia) is accused of being a non-native invader. This suckering nitrogen-fixing tree was certainly here in the region before the last glaciation pushed it out, and was moving steadily northward. Range maps from mid 20th century show it as being present in present day Pennsylvania, but unfortunately not within the borders of Massachusetts and so suspect as a problem newcomer. The label non-native invader comes from its propensity, primarily in the sandy soils of South-east MA and Cape Cod, to spread readily, utilizing its ability to fix nitrogen to colonize the depleted soils; depleted from the land clearing, grazing, and farming activities of people since the earliest human colonists came some 500 years ago. Black locust trees repair the land and bring back fertility through their tenacious growth and nitrogen fixation. They are one of the most resilient and multi-functional trees in the region, providing rot resistant post wood, pollinator support, fodder, high btu firewood etc — but they are outlawed for sale or distribution in Massachusett-s. Earlier settlers through much of the last century relied on these regional resources. The USDA Silvics Manual Vol 2 (1990) outlines the many current and historic uses for black locust: “It is used for fence posts, mine timbers, poles, railroad ties, insulation pipes, ship timber, wooden ship construction, boxes, crates, pegs, stakes, and novelties….. Black locust is widely planted…for erosion control, reclama-tion of drastically disturbed sites, windbreaks, nurse crops, amelioration of sites, honey production, and ornamental use.” Society has changed and so has our preference for the plants around us, but this tree is certainly high on my “best trees” list.

Looking Ahead

What do we do? How can we change our relationship with the world around us and not be drawn into fighting the “battleground of all life”? In the work with landowners, we look for ways to meet their goals while restoring and regenerating the land. Each person is different and can try out different practices like tree planting, selective thinning in woodlands, changes to mowing management and rebuilding soil with compost, microbial inoculation, and encouraging pollinator support plants.

• Incorporate change- Don’t stop the flow Our work on the land needs to work with ecological processes that we are not controlling. Energy is transformed and redirected, not blocked. The work we do must be earth akido. There is a temptation to begin fighting the species that arrive with herbicides or pesticides and causing further disturbance and disruption. Understand the current patterns and flows and on the land and adapt your practices to be more in line with that. i.e. change your vegetation management (mowing, weeding, clearing), water and soil management.

• Learn to Live with Them These new species, naturalized and in many cases already here for centuries, aren’t leaving. We can learn to live with them. When taking a walk or working on the land, notice your reaction to plants; do you feel anger towards these new arrivals? What is coming up inside you like concern for the environment, or concern for the future? And how are these plants and animals part of that concern? How can we transition from anger and pain to healing and forgiveness?

These new combinations of species, our “novel ecosystems,” are responding to ecosystems changes. Long-standing species are behaving differently with new conditions. Lets explore them. Celebrate the new connections being made.

• Understand the context of where you’re working Wherever we live and work we need to deeply investigate the history of the land. We need to under-stand past disturbances, like fire or storm events, successional changes, species arrival, changes to hydrology, terrain and air flows. Human changes are often intertwined with the ecological trajectory, particularly the disturbance history. What kind of changes have humans made and how has the land been managed, altered, or disrupted? Here in New England, there have been centuries of human disturbance. Layers of land clearing, acid rain, fire suppression, forestry, grazing, farming, and more recently development and urbanization have left an utterly changed ecosystem. On a landscape scale, the activities that have left places degraded can sometimes be used to reverse the damage. For instance overgrazed land might be restored by intensive mob grazing. Thinning woods, managing brush, and tree planting can reverse high grading or clear cut management. Reducing the ongoing disturbance should be a priority.

• Urban environments -- altered and not going back Urbanized environments have special conditions to be considered. These environments have long his-tories of change with altered hydrology, soils, and air. Nothing is like it was in the past and the idea of bringing it back to some past condition is a nostalgic notion and unrealistic. A vacant lot in downtown Lowell, MA will not return to the floodplain forest that it once was several hundred years ago before the Merrimack River was channeled and urbanized. What is the best use of the urban Lowell land? What are the ecological functions it can serve where it is, now? How might it serve the residents of the neigh-borhood and reduce their demands for food, water or other goods from far away? Put the lens of an earth healer and food grower on and a whole world of possibility opens up.

• A sensible policy on native and naturalized species We need a sensible policy on naturalized species that allows us to pull back from trying to control everywhere. It may be part “learn to live with them”

A nitrogen fixer, this tamarisk tree has wood which is a homesteader’s dream. Its sale is also outlawed in some places.

More Plants with Multiple Values

Many “invasive species” are actually super beneficial for habitat, ecosystem functions, and food or medicine. Here are two examples: Autumn Olive, Russian Olive, Goumi (Elaegnus spp.)

• Introduced for soil stabilization, ornamental, wildlife value.
• Fixes nitrogen, hardy, drought tolerant, few pests/diseases, disturbance adapted.
• Used to reclaim strip-mined land, wildlife habi-tat.
• Delectable fruit high in lycopenes (cancer re- sistant compound), 8-20x the levels in toma- toes; Fordham, 2001). High in vitamins A, C, E, flavonoids, and essential fatty acids.

Japanese Knotweed (Polygonum cuspidatum)

• Introduced as an ornamental in late 1800’s.
• 2,000 year medicinal history in Asia.
• Edible shoots, high in resveratrol, anti-Lyme, anti-cancer, anti-bacterial compounds.
(Bulher, Healing Lyme, 2005)

Quote: “ Man (sic) is part of nature, and his war against nature is, inevitably, a war against himself.”

Rachel Carson, Silent Spring, 1962

and it may be selective management and removal, recognizing there are specific vulnerable habitats and species that need our intervention, allowing some areas to go through succession, as messy as it looks, and focusing on stabilizing and reducing disturbance.

• Protect and restore diverse, rare, and sensitive ecosystems. Refugia! There are places that need to be protected and carefully managed. These are locations with rare species, specialized and unique habitats, genetic diversity hotspots, and places where research and conservation is ongoing.

• Create and expand habitat corridors Connect isolated habitats through corridors that allow dispersal and movement of species. This is essential as climate change requires movement of plants and animals into new areas.

• Restore ecological function Focus on function and not the name or original loca-tion of a species. This in time of stressed ecosystems
we need species that are resilient and adaptable. We can assist in development of these resilient and productive ecosystems and communities. Utilize deep sustainability, regenerative approaches, and permaculture design.

• Human-assisted species dispersal in response to habitat loss and climate change
  We will need to be active participants in helping species that have become isolated or whose movement can’t possibly keep up with the ecosystem changes we’re dealing with.

In 2010 my wife Kemper and my young son visited the California restoration project that we worked on in the early 1990's. The forests had grown tall, deer watched us from the brush and woodlands we planted. The Sacramento River flowing nearby had breached its banks and flooded through the fields, cutting side channels and depositing woody debris. It was an affirmation that we can get on the right side of nature and become part of the solution. My son walked those fields with us and, I hope, saw a vision for the future where we can help repair the world around us.

Quote:
It would be far better to teach people about the rich biodiversity and ecology around them, and to foster an appreciation for all living things, than to hide behind science while pushing pest control agendas that contribute to more loss of habitat and declining biodiversity.

And surely the most insidious and destructive outcome to be avoided is the fostering of human alienation with nature, or a feeling that we are surrounded by an alien and therefore, unnatural, environment.

Fostering a worldview that some species are good while others are bad sets the stage for a nihilistic society that can never be at ease in, or nurtured by, the natural world.

Vivian Parker, California Indian Basketweaver’s Association (2002)
Creating Native Plant Corridors for Pollinators

by Heather McCargo
photos by Jean English
reprinted with permission from the Maine Organic Farmer and Gardener

Native plant corridors attract pollinators and wildlife to your farm by stretching across your property to connect your piece of native habitat to nearby meadows, wetlands or woodlands. This creates a much larger area for native pollinators to forage, raise young and migrate. Corridors may run along a road, between fields, in a swale or on the edge of a forest, connecting habitats off the property and returning native plants to the parts of the farm not suitable for traditional crops.

This article describes two approaches to creating native habitat corridors: changing mowing habits to favor native species, and planting woody and herbaceous combinations to increase native plant diversity on the farm.

Populations of all native species are in decline across the state. Our human footprint is taking its toll on wild creatures, including pollinators such as bees and butterflies that are so important on the farm for crop pollination. Native plant species each share an evolutionary history with indigenous insects, birds, reptiles, mammals, bacteria and fungi. When native plants are gone, many of these creatures go too, leading to a collapse of ecosystem function. Farmers benefit from the services provided by a healthy ecosystem, such as groundwater recharge; clean surface streams and ponds; pollination; a diversity of birds, spiders and amphibians to eat many insects including crop pests; and beneficial soil fungi and bacteria. Fortunately, when native plants are reintroduced to plant, lay down cardboard or newspaper with a heavy layer of mulch on top. Mulch can be straw, hay, hay crop is at its prime. However, this is not good for fauna all year, divide your corridor into mowing zones. Each year choose a section of the pollination corridor to be the overwintering habitat and leave it un-mown. The rest can be mowed at the end of the season after the flowers have gone to seed. This simple method of changing mowing habits will provide an effective, robust pollinator habitat.

As farmers and landowners, we can bring native plants and the attendant diversity, back into the Maine landscape in a way that works with a farmer’s busy schedule. Many native plants thrive in dry, wet and shady areas that are poor sites for traditional farm crops.

Mowing Regime to Create a Pollinator Corridor

The easiest way to promote a pollination corridor is by changing your mowing regime. Along with forest clear-cutting and urban sprawl, mowing habits impact insect pollinators, birds and other fauna tremendously. In New England, most landowners and municipalities mow their roadides and fields in the middle of the growing season. For hay harvesting, this makes sense, since the hay crop is at its prime. However, this is not good timing for native plant flowering and seed ripening or for the myriad creatures that depend on this critical part of the native plant life cycle. Pollinators, birds and other creatures need more than flower nectar to survive. For much of the year, they are either hidden in a nest or cocoon or are in a different stage of life (think caterpillar before turning into a butterfly). Pollinators need native plants to deposit their eggs, feed their larvae (many of which eat only native vegetation) and for overwintering habitat. Leaves, bark on trees and shrubs, dead woody twigs, dried stems, rotting logs, branch es, and even bare, undisturbed sandy or gravelly ground are all important habitat. When you mow an area, much of this year-round habitat is removed. To provide important food and overwintering habitat for fauna all year, divide your corridor into mowing zones. Each year choose a section of the pollination corridor to be the overwintering habitat and leave it un-mown. The rest can be mowed at the end of the season after the flowers have gone to seed. This simple method of changing mowing habits will provide an effective, robust pollinator habitat.

Planting a Hedgerow of Shrubs and Wildflowers

The second method involves actively reintroducing native woody and perennial plants to create year-round habitat for many of our most important insect pollinators, birds and other creatures. These plants can be added to an area that is now lawn, is not mowed or is located on the shady side of a field that borders a woodland. Much of the work can be done in late fall and early spring when the ground is too wet for planting annual crops. Many of these native plants even produce a harvestable crop.

A couple of months to a year before you intend to plant, lay down cardboard or newspaper with a heavy layer of mulch on top. Mulch can be straw,
spoiled hay, bark mulch, aged wood chips, leaves, seaweed or any organic matter that is available at little or no cost. In a few months, the grasses and other vegetation under the mulch should be smoothed and decayed. This is an effective way to get a weed-free planting area without tilling the soil. A site mulched in late September can then be planted easily the following spring or even a year later.

Bare-root shrubs, trees and perennial species (see sources below) can be planted by slicing through the mulch with a spade. For directly seeding wildflowers, a strip of weed-free organic mulch (as is available from Coast of Maine products) makes a nice seedbed. This can be laid on top of the previous mulch before planting.

A more efficient method for seeding native shrubs and wildflowers is to plant the seeds into nursery beds or pots and transplant a year or two later. (See the bibliography for native seed propagation information). I recommend choosing a minimum of 10 species for your corridor to ensure a diversity of bloom times and vegetation options for the fauna. Note the bloom times to ensure plenty of nectar for pollinators throughout the season. The following native corridor species lists should provide plenty of choices for your pollinator corridor.

**Plants for medium soil in part or full sun**

- Black-eyed Susan – *Rudbeckia hirta, R. triloba*
- Blue vervain – *Verbena hastata*
- Golden Alexander – *Zizia aurea*

**Plants for dry sandy or gravelly soil in part or full sun**

- Shrub
  - *Viburnum dentatum, V. lentago, V. prunifolium*
  - *Artemisia nemorosa*
  - *Berberis thunbergii*
  - *Heuchera sanguinea*

- Perennials
  - *Asclepias syriaca*
  - *Liatris spicata*
  - *Penstemon digitalis*

**Plants for medium to dry and highly acidic soil in sun to part shade**

- Shrub
  - *Amelanchier canadensis*
  - *Corylus americana*
  - *European privet*
  - *Hypericum prolificum*

- Perennials
  - *Antennaria neglecta*
  - *Asclepias incarnata*
  - *Aster novae-angliae*
  - *Bugleweed*

**Plants for dry sandy or gravelly soil in part or full sun**

- Shrub
  - *Amelanchier canadensis, A. laevis*
  - *Cornus alternifolia, C. amomum, C. racemosa, C. sericea*
  - *Corylus americana, C. cornuta*
  - *Craotagus spp.*
  - *Ilex verticillata*
  - *Potentilla fruticosa*
  - *Thuja occidentalis*
  - *Viburnum dentatum, V. lentego, V. nudum, V. trifolium, V. prunifolium*

- Perennials
  - *Anemone canadensis*
  - *Apios americana*
  - *Asclepias incarnata*
  - *Aster novae-angliae*
  - *Geranium maculatum*
  - *Hypericum prolificum*
  - *Asclepias syriaca*
  - *Liatris ligulistylis*
  - *Penstemon digitalis*

**Plants for dry sandy or gravelly soil in part or full sun**

- Shrub
  - *Aronia arbutifolia, A. melanocarpa*
  - *Cornus alternifolia, C. amomum, C. racemosa, C. sericea*
  - *Dianthus caryophyllus*
  - *Hydrangea arborescens*
  - *Ilex verticillata*

- Perennials
  - *Asclepias syriaca*
  - *Geranium maculatum*
  - *Hypericum prolificum*
  - *Liatris ligulistylis*
  - *Penstemon digitalis*
Perennials
Bunchberry – Cornus canadensis
Lapine – Lapinus perennis
Violets – Viola pedata

Plants for wet soils in part or full sun
Shrubs
Mountain maple – Acer spicatum
Fagoda dogwood – Cornus alternifolia
Witch hazel – Hamamelis virginiana
Spicebush – Lindera benzoin
Purple flowering raspberry – Rubus odoratus
Blueberry – Vaccinium spp.
Viburnum – Viburnum alnifolium, V. acerifolium, V. dentatum, V. nudum

Perennials
Wild leek – Allium tricoccum
Wood asters – Eurybia macrophyllus, Symphyotrichum cordifolium
Blue cohosh – Caulophyllum thalictroides
Black cohosh – Cimicifuga racemosa
Goldenseal – Hydrastis canadensis

Nursery Sources
Fedco Trees
Nasomi Farms: the nursery of the New England Wildflower Society
Native Haunts, Alfred, Maine http://www.nativehaunts.com
Prairie Moon Nursery
St. Lawrence Nursery
Wild Seed Project – seeds of Maine native plants www.wildseedproject.net Bibliography
“Attracting Native Pollinators,” by the Xerces Society”
“Bringing Nature Home,” by Douglas Tallamy
“Farming with Native Beneficial Insects,” by the Xerces Society
“Growing and Propagating Wildflowers,” by William Cullina
“Native Trees, Shrubs and Vines,” by William Cullina
New England Wildflower Society plant ID website https://gobotany.newenglandwild.org/simple/

About the author: Heather McCargo is executive director of Wild Seed Project, a 50(c)(3) nonprofit dedicated to returning native plants to the Maine landscape. From 1990-1995 she was the plant propagator at the New England Wildflower Society’s Garden in the Woods. She has written and lectured widely on native plant propagation and horticulture. Contact her at heather@wildseedproject.net. For further information, see www.wildseedproject.net.
by Mark Shepard

When I was asked to write an article on “invasive species”, my first reaction was to sigh and roll my eyes. (Notice that I’ve already placed the term “invasive species” in quotes… sigh!) “I’m being baited”, I thought to myself. “Someone has a political agenda and is trying to get me to make someone angry”.

My inquisitor tried to reassure me that “No!” they did NOT have such an intention, but because of my ecological perspective and my 25+ years of experience in converting ecologically degraded sites (clear cuts, agricultural fields, sand mines, etc.) into ecologically designed food-producing systems, I “might have a perspective that others might find useful”.

Regardless as to which is more true, here we are. I agreed to write this article!

Bamboo

“Invasive species”, we’re told, are causing untold billions of dollars in damages, are decimating native species, are plaguing private and public lands alike, are simplifying ecologies and leading us all in the direction of becoming a planet of “weeds”. Pretty soon they’ll probably join forces with the zombies and obliterate civilization as we know it.

I don’t disagree that highly competitive, rapidly colonizing, non-native plants have observable effects within the natural world around us. I don’t doubt that “invasive” non-natives like Tatarian honeysuckle (Lonicera tatarica) have caused local extinctions of spring ephemerals in many semi-shaded woodlands. I have seen with my own eyes the damage that insects such as Gypsy Moth, the Emerald Ash Borer, and diseases such as chestnut blight (Cryphonectria parasitica) have caused within our natural world. These effects are REAL, and they are changing what nature itself actually IS.

I cannot undo the pain and anger of the losses that I see all around me on a daily basis, but my ability to cope with reality is helped by an understanding that is grounded in observable reality, the study of nature: ecology. This understanding also informs my actions so that when I get up to work in this world, I can limit the number of windmills I joust. An ecological understanding frees up my time and emotional energies so that I can be more effective at what I do, (creating perennial food ecosystems on degraded lands wherever I go!) Hopefully you can find some of what I share to be helpful as well.

One of the most important ecological principles worth knowing about, is the principle of succession. Natural succession, “old field succession” and ecological succession are some other words used for it. It can be summarized simply by understanding that ALL THINGS CHANGE. Period. Always. Your opinion doesn’t matter.

When you look out your back door, the fields or forests, lawns or gardens, or even highways that you see are all somewhere within the cycles of succession. Your own garden on a daily basis begins to sprout “weeds”. These weeds can grow so fast that they rob your crops of water and nutrients, your yields suffer and you may eventually abandon the whole thing. It doesn’t end there, though… The weeds in your abandoned garden, the rank, fast growing mostly annual weeds, don’t quite take up all of the possible niches that could be colonized by life, and some other sort of plant finds a toehold. The first wave of weeds that caused you to abandon your carrots, have changed the conditions. Perhaps they have added more carbon to the soil, or perhaps they have accumulated a particular nutrient from a different soil strata than your carrots, and they have changed the original site conditions to something different. These new site conditions provide opportunities for plants other than what is currently growing there and when seeds or other plant propagules (rhizomes, roots, bulblets, etc) blow in, fall in, are brought in by animals, etc, the plant community changes.

The Eternal Cycle of Succession

sachusetts where I grew up. If you’re reading this article you are familiar with some kind of organism that is considered “invasive”.

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“Invasive species” have been the cause of much alarm within my lifetime and have become almost universally known among folks who are conservation minded and “environmentally aware.” Images galore can be found of Kudzu “covering everything” in the south, oriental bittersweet vines “strangling the canopies” of entire forests in Connecticut, bamboo “taking over” highway medians in the mid-Atlantic states or, quite memorable to me, seeing Autumn Olive for miles and miles along highways and popping up wherever there was a patch of un-mowed pasture in central Mas-
Your garden gives way to annual weeds, the annuals and biennials give way to perennials, especially grasses. Through the years the “old field” that was once your carrot patch, gets invaded by brambles and other thorny shrubs. The raspberries and blackberry canes invading that field even look like the arching backs of sea-serpents as they loop their way into the open areas. Within this increasingly impenetrable thorny thicket you’ll see some trees beginning to raise their heads above the mess. Many of the first trees you’ll see were once fruits or nuts dropped by some squabbling jays, or stashed by a squirrel. If the local pines had a good cone crop the year you abandoned garden, you may see a pure thicket of them growing shoulder-to-shoulder and excluding other plants. Eventually the shade beneath the trees and shrub canopy becomes so great that the grasses can no longer survive.

The conditions have changed. As the trees grow in diameter and height they begin to compete with one another for water, light and nutrients. A large percentage of them begin to die along with the shrub layer which becomes more and more sparse. Your original garden is no longer recognizable. You can now walk beneath the shady canopy on a forest floor littered with leaves and needles. It has become the typical New England “forests” that you can see all around. It may live a LONG TIME!, hundreds or perhaps thousands of years. It is not staying still, however. The “young” forest of 100-year-old oaks, hickories, cherries and pines are gradually being replaced by oaks and hickories with a brushy understory, that is what this place had been for who knows how many millennia. Before the canopy could close and shade out the grass, a fire would come through and re-set the shrubland.

Eventually these old, large trees die and leave a gap in the canopy. Perhaps a hurricane blows through and knocks down 100 acres of this forest. In both cases, the site has been “disturbed”. A site that was a sunny vegetable garden with herbs and flowers and hummingbirds, changed through time to become an old-growth forest which then blew down in the wind and has become a sunny spot once again with exposed soil, not from a plow or roto-tiller, but where massive root systems have been pulled from the ground. Succession has been set back in ecological time to a previous phase. The land and what you see today is NOT the same as it was 50 years ago. It is not the same as it was 200 years ago. It is not the same as when the Europeans first arrived, or when the First Nations first arrived, or when it was covered with ice, or when mastodons browsed in New York, or when that dinosaur first tempted Eve to eat from that tree. This drama has been going on for a LONG time.

What does this have to do with “invasive species”? Well, everything! let’s use Garlic Mustard as an example…

My adventures in SW Wisconsin began in 1995 when I moved to a farm property with the intention of converting it from a row-crops (corn, peas, oats, and hay... soybeans had not really invaded yet) based dairy farm into a perennial, food-producing ecosystem. I had done my research, and had learned that upon European arrival, and for at least the previous 13,000 years or so (based on archeological evidence and based on the biological legacies of surviving plant species) that this place was what could be categorized as Oak Savanna. Roughly the same “actors” are on stage here in WI as there are in the Northeast except that here less rain falls, hurricanes don’t play as much of a disturbance role, fire plays a BIGGER role, as did grazing from large herds of herbivores. If you were to imagine your carrot patch that had become an “old field” that was punctuated by oaks and hickories with a brushy understory, that is what this place had been for who knows how many millennia. Before the canopy could close and shade out the grass, a fire would come through and re-set the shrubland.

Since Oak Savanna was what it WAS, that was what I chose as my ecological model for an ecologically designed farm. I figured that the species that thrived on this site for the last zillion years, through ice ages and global warmings, had a pretty good chance of thriving here again! Instead of fighting the weeds in your carrot patch (I didn’t really mean to get on a kick with the carrots… Sorry, carrots!) I would FARM the weeds… The raspberries, and hazelnuts and plums and grapes and apples, the fungi and the chestnuts. WAIT? Chestnuts?? Yes… Chestnuts and Oaks are both members of the Fagacae fam.

Oriental bittersweet
What has happened here through the years, is that the site has changed. First of all, the site when I arrived in 1995 had changed from the “original.” It was no longer “natural.” A corn field is NOT an Oak Savanna. My attempts to re-creating an agricultural Oak Savanna were taking place on a DIFFERENT PLANET! The atmosphere has more carbon in it than a thousand years ago, the rainfall is less than it was 150 years ago. The soil was contaminated with the residues from 60 years of chemical application and plastic bags from Wal-Mart frequently fly overhead and land on the farm to plug the digestive tracts of cattle who ingest them and die (this has indeed happened here!)

Cattle and a mower are not bison, elk and fire. The species and the system still respond well however, despite the technical differences. Tiny hazelnut shrubs struggled for years within the grassy matrix, chestnuts, apples and grapes all begin to bear. As the shrubland has matured, it has changed character. The dense, hard-packed clay has become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil. (still clay derived and sticky when wet) The blazing hot open fields have become a nice, fertile topsoil.

Autumn Olive

I hope there will still be some carrots growing somewhere…
Continuing Stewardship: Of Presence and Potato Forks

by Mike Bald

Stewardship = Presence… so I claimed four years ago in an article for the Ecological Landscape Alliance. With the passing of another 49 moons, with landscapes under ever more climate stress, and with continuing upward trends in pesticide usage, I wish to revisit that simple notion of Stewardship. I work in the world of invasive species, terrestrial plants more specifically, but everywhere I go, both in-country and abroad, I have asked others to clarify their understanding of these concepts. While platoons of folks have touched on the idea of resource management, caretaking, and connection to nature, I was most deeply struck by two responses: “relationships” and “continuity.” Brilliant.

You may wonder why you’re finding an article on Stewardship in The Natural Farmer. Fair enough, but ask yourself a second question. Wouldn’t it be something if the spirit and principles of organic farming were applied to land management in general? To landscapes and resources everywhere? There are good teachings in the organic movement, as in the world of permaculture, but I submit that the spirit of good stewardship is important not just for our farms and pastures, but also for our woodlands, rivers, schools, our business organizations, and even our lovely backyards.

Stewardship is about relationships: to nature, to self, and to one another in diverse communities. Stewardship is also continuity, positive actions carrying through time and across generations.

I believe farmers and growers grasp these ideas; moreover, they appreciate the dynamic nature of being a person who works the land and builds soil knowledge that the agricultural landscape is a nuanced place, always in transition of some kind. Should you happen to be absent during these endless cycles of transition, you’ll be sure to miss something. Something vital, a signal that perhaps could have served you well. Remember: if a tree falls in the forest, and there is no one to hear it, does it make a sound? I would push the question a little further. If that tree falls in the forest, but no one is listening… what then? Does the sound or anything else that might happen even matter? Presence: it’s all about being there with the senses in full-open position.

A long-term approach to landscape transition forces us to hone our craft, pick up cues and recognize forces at play. We learn that different times demand different responses. We are forced to hone our craft, pick up cues and recognize forces at play. We learn that different times demand different responses. We are forced to hone our craft, pick up cues and recognize forces at play.

We desperately need more presence on the land as we find ourselves even more disconnected from the natural world; climate change has only accelerated fear factors and added to the urgency of that need. Yet in the realm of vegetation management, we continue at all levels to defy nature’s steady push for balance and resilience. We curiously fail to approach the challenge of high-impact invasive species with a cooperative unity, turning to aggressive chemicals as a matter of routine. Such is our mindset in 2020; a cooperative unity, turning to aggressive chemicals as a matter of routine.

Stewardship = Presence… so I claimed four years ago in an article for the Ecological Landscape Alliance. With the passing of another 49 moons, with landscapes under ever more climate stress, and with continuing upward trends in pesticide usage, I wish to revisit that simple notion of Stewardship.

I try to monitor my project sites at least twice a year; this is how I uncovered the magic formula for shrub control. I found that shrub species cannot handle three stress events over two growing seasons. What does that mean? If I absolutely deny photosynthesis by girdling or stump-cutting an autumn olive tree, it will draw from its root reserves and re-sprout. But if I come back and strip that re-growth, it will have to return to the storage vault once more. A second visit to strip sprouts will likely be the end of that individual. Three stress events that allow insufficient time for recovery; this kills off most of the target shrubs while also breaking seed production.

I go into the third growing season having few survivors to track down and two years with no seed rain saturating the soil. If I have begun addressing the immature shrubs while fostering recovery of the natives on hand, I am well on the way to successful site transition.

I prove the point with an informal survey from the Cornell University researchers published an article detailing alternatives to glyphosate for weed control. The article gave short shrift to the techniques of flaming, mentioned only two hand tools, the shovel and the weed wrench, and made no mention whatsoever of solarizing or grazing. This article appears online with the university’s seal of approval; it clearly comes with zeal. Yet, incredibly, there is no mention of the potato fork, the #1 tool many of us use to gently taproot species from the soil. I love the potato fork; I have one for each hand and refer to them by name. With practice one can remove many wild chervil plants while barely disturbing the soil structure. I here submit that no one should write articles on invasive species management if they have never met a potato fork. Nor, even more disturbingly, should they then pretend to possess enough methodology background to lay out a cost comparison. Where’s the data on that? How do you value the full suite of outcomes fostered via the long-term stewardship approach versus the singular focus of short-timeline chemical management? Forget apples to oranges, this is apples to planets. Yet this is what the public sees, this is what we spoon-feed landowners through the extension service and state agencies. Glyphosate is the tool you need folks, cheapest and most effective; that is the message, completely endorsed by our university system.

It gets worse, actually. I have had educators from another university inform me that my project sites are too successful. The work is so thorough (on a half-dozen target species) that there’s not enough to show people from a demonstration standpoint. Odd, considering that I benchmark my sites with before and after photos. In fact, here’s a good “before” photo of mature buckthorn and honeysuckle in a fairly stable woodland.

Giant hogweed dwarfing a propane tank, truly a case of: “Why did we let this happen?”

I have asked others to clarify their understanding of these concepts. While platoons of folks have touched on the idea of resource management, caretaking, and connection to nature.
The above story is no isolated incident from 2019. I encounter similar scenarios routinely, big money steered toward the herbicide approach. Little has seemingly changed since my first looks at the herbicides conference in 2005. Even back then I noticed attendees obtaining pesticide certification credits for their conferencedominated registration. No credits were offered, however. The herbicide professionals were organized and licensed, which is a good thing, but no other management approaches held such appeal. I remember well the day I heard how difficult exotic species can be with devastating economic and ecological impacts. Knowledge like Early Detection and Adaptive Management abounded, but there was no mention of Presence, no acknowledgement of stewardship continuity and community relationships leading the way in landscape revitalization. At my point when I focus on winning the battles with singular high-impact species, the War on Weeds mentality, rather than rebuilding soils and reflecting on our management and an informed read of the landscape. To success, we need to cooperate across boundaries and work strategically, choosing the right tools for the job. To success, we need to cooperate across boundaries and work strategically, choosing the right tools for the job.

The Vermont Youth Conservation Corps members feeling good about their work removing common buckthorn, glossy buckthorn, multi-flora rose, honeysuckle, and autumn olive. These young people are the future landowners, community members, environmental leaders, and scientists that we need. In our present mindset of crisis management with chemical methods, we are not growing resource stewards; in fact the disconnect from nature grows wider every year. How do we reconnect people to cherished landscapes? How do we nourish the soul and even perhaps rehabilitate those who’ve lost their way? Time on the land would nourish the soul and even perhaps rehabilitate those who’ve lost their way? Time on the land would.

No soil disturbance here, and the spiritual pull or magnetic charm of the oak tree now attracts people at all times of year. I find fairy houses and message stones all over this site.

No chemicals... simply no need for them. And now an added value, a meaningful attraction on a once insignificant and overrun forest path.

How can it be that we place such little emphasis on empowering our rising generations and our struggling communities? Why do we TALK about Integrated Pest Management, but choose to fund only chemical approaches? I have seen this, just last year with a fair amount of coin involved. $50,000 was available to execute a chemical treatment program, but alternative approaches were ineligible for funding. No goat grazing, no training of locals and neighbors, no long-term manual control drawing from the local labor force. There was no willingness on the part of the managerial nonprofit to pay volunteers or professionals outside the realm of the herbicide practitioners. Completely disingenuous in my mind... a lost opportunity and a waste of good money. Even with only a few neighbors actively participating, a people-power approach with non-chemical methods would have cost far less than fifty grand. And the takeaway (deliverables) would have included a group of people trained to work safely and capably of preventing the next crisis. Sad to see that antiquated mindset holding people back; time on the land would strengthen the soil and the spirit of the people. Readers of The Natural Farmer also appreciate nutritious food and all the work behind fine culinary creations. We appreciate our farms and the food they produce and the opportunity. In the company of farmers and growers is where I first heard that the farmer’s footsteps are the best fertilizer. Not long after, I decided those same footsteps might also serve as the best herbicide. At a Soils gathering I heard John Kempf firmly (but kindly) remind an audience member that one is not truly on the land if one never gets off the tractor. Thus we come to understand Presence.

Now here are the Vermont Youth Conservation Corps members feeling good about their work removing common buckthorn, glossy buckthorn, multi-flora rose, honeysuckle, and autumn olive.
The stumps are common buckthorn encroaching outwards from the woodland. The flagged apple tree, the cedar, the sumac stands, and sporadic grey dogwood are allowed to thrive in the name of species and habitat diversity. No need for toxics and no need for the mindless application of toxins. If there are viable seeds in the piles, I can smother or pull those easily later.

4. Know the land and what happens upon it. Then be sure you know where the sun is. Know the flow of water as well and where the prevailing winds originate, but sunlight is the driver of plant life. And something quite crucial happens around the 4th of July for many invasive shrub species. Your local calendar is the one to follow, but in Vermont early July is when fruits begin to ripen in their seeds. Until then, any heavy stress event on an invasive shrub pretty much breaks seed production for that growing season. This is why I target the larger, fruiting shrubs earlier in the year. I still pull, cut, flame and girdle all the way into December, and while that work is important over the long term, it does not break the seed cycle. With a four to five year seed life, many shrub species can rebound from an initial, aggressive control effort. I contend that Year Three is often the most difficult year for transitioning sites. Mature shrubs may still be hanging on, new plants are bursting from the soil seed bank, and the installed or favored native species are not yet competitive. Few things are more rewarding than reaching Year Four and seeing the shift gain traction. The bee, dogwood, maples and white pine are accelerating, while the stressed buckthorn and burning bush are fading under the constant pressure.

5. Just this month I discussed with clients how they might execute a harvest or thinning of their woodlands. Imagine an expanse of relatively healthy forest with a weak but opportunistic presence of invasive species lurking within and nearby. Perhaps it’s barberry and bittersweet along property lines or patches of honeysuckle and garlic mustard at trailheads. Yes, absolutely get in ahead of the heavy equipment and begin suppressing exotic species. But equally important is figuring out where and how to start. Brush piles also require energy to produce, more energy to transport, but this always seems to escape conversations on the meaning of “in or near water.”

Regarding the carbon footprint, I see four CO2 impacts directly associated with pesticide usage, but this always seems to escape conversations on sustainability and climate change.

1. Herbicide usage. I maintain we could have achieved reductions over the past two decades had we been chosen to use our brains and problem-solving abilities. Sadly, little has changed in that realm since Got Weeds? has been in operation; I still see county foresters recommending herbicides as the go-to option and consumers thoughtlessly self-interpreting the meaning of “in or near water.”

I see no attention whatsoever to cumulative effects, no understanding that our lands already carry a toxic legacy even while enduring more frequent and severe disturbance events (hurricanes, floods, etc). I see farms and communities struggle with invasive species; they did not directly cause the problem but are left with poor quality hay and public safety hazards. But equally important is figuring out where and how to start. Herbicide usage. I maintain we could have achieved reductions over the past two decades had we been chosen to use our brains and problem-solving abilities. Sadly, little has changed in that realm since Got Weeds? has been in operation; I still see county foresters recommending herbicides as the go-to option and consumers thoughtlessly self-interpreting the meaning of “in or near water.”

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A global collaboration connecting soil, plant and human health

REAL FOOD CAMPAIGN

We believe in REAL FOOD
Food with the vital nutrients we need to prevent & reverse disease, and live our best lives.

We believe in REAL CHANGE
Clean water.
Farm viability.
Ecosystem regeneration.
Climate change mitigation.

REALFOODCAMPAIGN.ORG

What is quality in food?
We don’t know scientifically but together with Grower Partners we can find out. The Bionutrient Food Association has initiated the Real Food Campaign to make the nutritional density of food easily detectable.

In 2012 we had the idea to develop a handheld spectrometer to test food quality. By 2016 it seemed reality was catching up with our vision. In 2017 we built the first generation of our spectrometer. In 2018 we built a lab to test nutrient variation and by 2019 we built the platform to correlate nutrient density with environmental conditions. This is where we need you.

By 2022 we expect to have mass-produced consumer and farmer tools and definitions of quality for 100 crops publicly available along with an open data platform to support growers globally, to increase soil health, crop quality and farm viability.

WE INVITE YOU TO BECOME A GROWER PARTNER

We provide the tools and guidelines for data collection. In order to ensure data privacy we commit that whoever submits has the right to choose how it is used. Participating Grower Partners receive crop analysis of submitted samples, including minerals, secondary metabolites, Brix and spectral signatures. You also receive soil analysis including soil minerals, organic matter, biological activity, pH and spectral signature, food and soil quality markers for the entire community showing how your results stack up and a subscription to FarmOS farm management software.
Noxious wild parsnip plants flower among Christmas trees. How does one work safely here?

So if you truly wish to keep your meadow free of invasive species, try this: return the herbicides for a refund and think about how you might build protective belts around the space. A meadow with bedstraw and bindweed is already suffering, but it can get worse if wild chervil and burdock and others decide to join in. This protective belt approach broadly applies to any economically valued space: hayfields, recreation areas, an orchard. Rather than hiring someone to walk transects back and forth all day, get real about biosecurity at the entrance gates and take steps to clean any equipment that comes and goes. Then, study the perimeter. If you were to allow “the Big Leafies” to establish on the perimeter, then commit to a mowing / scything / grazing regime in a strip along that edge, you would have two belts for control. First is the dense vegetation under which nothing can get started (perhaps encourage pokeweed, elderberries, and bee balm). Second is the tightly mowed grass strip serving as a no-grow zone. Any weeds desiring to central protected space must first penetrate the outer belt with their seed heads and then propel seeds across the mowed strip. Not impossible, but any of us could walk that groomed path and pick out undesirables in the protected interior. Potato fork in one hand, beverage in the other. I promise this is not hard and chopped hay along the edges doesn’t really dry well anyway, so productivity loss is minimal. The most important consideration is to keep the mower blowing from the “clean” space into the “contaminated” outer space. And what about round bales, those big 800 pound marshmallows dotting the hayfields? Why not park them as a protective belt around the hayfield’s most exposed edge? Nothing grows through round bales, so they could double as elements of the biosecurity plan.

A hayfield is protected from the upslope roadway by a wall of burdock and a tightly mowed perimeter strip.

At the bottom of this page is a hayfield protected from the upslope roadway by a wall of burdock and a tightly mowed perimeter strip.

The photo illustrates the protective belts model. The hayfield has value, but the introduction of wild parsnip and wild chervil seed along the roadway is a constant. No worries, allow the burdock to form a wall and maintain the mowing strip. Burdock is not the ideal, not even native and those seed pods are annoying, but anything is better than dangerous parsnip. Morning walkabouts are good exercise and allow the owner to easily proof the field edges. Monitoring made easier. She should probably change direction with her mower though. Mow clean sides first?

Earlier I mentioned the potato fork and its most-favored status among all the tools I carry. Allow me to explain. The best thing about Presence is enjoying the place as if I’m not even there, just feeling it carry on as it otherwise would. I don’t want the tree to have second thoughts about falling just on account of my presence. So I move quietly, thoughtfully, and when people hire me to transition their landscape vegetation, it is much the same. Come in, acquaint, connect, safe the site, perform the task, set the stage for follow-up, and step away. Make it seem as though I was never even there. Solarizing can look a little aggressive with the sheets of plastic, and brush-hogging is equally jarring sometimes. But the potato fork is the ultimate tool for herbaceous weeds. A little pry on two or three sides of the target plant, then a steady lift. Gentle upward pressure with gloved hand on the stem… steady… keep going… and there you go. Out it slides. Lightly shake off soil, inspect the root for break-offs, then onto the drying station. Tamp down the cracks in the soil and clean tools before leaving. I can pull thousands of weeds a day, and other than a certain color or texture now missing from the landscape fabric, it’s almost as if I had not even been there. Just how I like to leave it. The only legacy is cooperative relationships and enduring continuity. That’s how this weed guy manages to be everywhere, all at once and at just the right moment.

Oh look, is that a new moon?

From a different angle, the wild parsnip has been pulled prior to viable seed formation and piled for drying. See the potato fork?

Noxious wild parsnip plants flower among Christmas trees. How does one work safely here?

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Bishop’s Weed infiltrates around rhubarb on editor’s farm in Barre, MA. Although like most invasives Bishop’s Weed is edible, it is only the most tender parts and for a short time in Spring. Otherwise, it is reputed to be a “thug”.

This newspaper contains news and features about organic food and farming in the Northeastern USA as well as a Special Supplement on the arguments pro and con on: Invasive Species.