

Quest Club

# Invasive Species: Flora and Fauna

Thomas Cain, Questor

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## **Introduction**

Emerald Ash Borer. Asian Carp. Dutch elm disease. Zebra Mussels. These are the illegal aliens of the plant and animal world in the United States. They capture headlines because of the enormous cost to the US economy which is currently estimated at more than \$120 billion annually.

The Department of the Interior alone spends more than \$100 million annually to prevent and manage invasive species. This paper sets out to explore the dynamics of ecological systems, the role humans have in altering them, some species of concern to those of us in northeast Indiana, and what can be done to address problems stemming from invasive species.

This paper will limit its discussion to flora and fauna, those Latin terms we use to describe plants and animals. Space and time for this assignment will limit us from much discussion on those smaller organisms such as viruses, bacteria, and fungi, which are also significant components of the ecology that includes plants and animals.

## **Defining Invasive**

Let's take a moment to discuss the term "invasive species". What we personally experience in the world of pests is not always recognized by scientific and governmental authority as an invasive species.

The Federal government, that keeper of the public trust and decider of budgets has official roles in these definitions. Under President Bill Clinton, Executive Order 13112 defines invasive

species as “species that are non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm, or harm to human health. Invasive species can be plants, animals, or pathogens.” The Invasive Species Advisory Committee (ISAC) was formed in 1999 with representation of 13 US government agencies to examine this issue and to prepare recommendations and a plan for US policymakers to use in controlling and managing invasive species. The ISAC has numerous Federal and outside partners who have conducted research into species that have invaded ecosystems all over the country. The ISAC has become the Federal Government’s primary resource used to guide allocation of government resources.

In the ISAC definition, “invasive” is a relative term. Although many species have been introduced into the United States, only those species which cause harm are a concern. Not all “invasive” species are invasive everywhere. What is invasive in New England is not necessarily a problem in the Midwest. For example, Norway maple trees have overtaken native maple and beech forests in Massachusetts, but are rarely seen in wooded areas in Illinois where the climate is less favorable to them. Kudzu, that vine that has eaten the South, has its origins in China and Japan. In its native range and more northerly parts of the US, cold winters kill back its rampant vines, therefore controlling how large it can get. Shorter growing seasons in the north prevent it from flowering and setting seed.

The list of invasives is also constantly changing. New species may benignly exist in an area for many years and spread aggressively only when some environmental trigger is pulled. The hybrid Bradford Pear, with its lovely white clouds of flowers is seen everywhere in spring. It will not

produce berries and seeds without a different variety of Callery pear nearby. For many years, Bradford was the only variety available through nurserymen. In the American business tradition of “new and improved”, we now have Aristocrat Pear and Cleveland Select Pear, among others. Now the stage is set for the Callery pear hybrids to make babies. And do they make babies! Huge numbers of fruits are borne, each with seeds. Birds obligingly eat them and distribute the seeds all over the countryside. The State of Indiana is now recommending against planting more of them and will likely declare them an invasive species.

On the other hand, deer, a native species, have proliferated since human settlement of our region. They have become an enormous pest to local farmers and suburban homeowners who have their crops and gardens eaten by these animals. Yet they are not considered an invasive species. Yes, they are invading our space, but they are the result of a native ecosystem that is out of balance due to human interference with the indigenous system of predators and prey. Removal of wolves and coyotes (the natural predators of deer) along with human settlement, production of new deer food in the form of acres of corn, and lack of human predators caused by a 20<sup>th</sup> century sentimentalization of deer (i.e. Disney’s *Bambi*), have allowed deer populations to explode. Huge problem? Yes. Invasive species? Not by Federal definitions.

Dandelions, the bane of the greens keeper, originated in Europe and were brought over as a food source but have escaped cultivation. They tend not to invade native plant communities where they are outcompeted for light. Instead, they stick around places of human disturbance, such as mown lawns, pastures, and cultivated gardens, where competition from aggressive native plants

is absent. They're considered a weed and a nuisance but are not of much concern as an invasive species.

Sometimes the line between invasive and non-invasive is controversial. Consider the feral Gypsy chicken population in Key West, Florida. As town-dwellers, along with the herd of predatory six-toed housecats of Ernest Hemmingway, they seem to have settled into their new home among the tourists. The nature lovers say they supplant native birds. Others say local development pushed out the native birds and the roosters are just filling an open ecological niche. And that they're charming. And they eat nasty scorpions. And they're fine with that.

Even if it leads to great environmental change a foreign plant or animal does not automatically qualify it as invasive. Soybeans and wheat from Asia are certainly not natives. They don't readily reproduce and invade native systems. They also produce great socio-economic value. The fact that growing them requires destruction and suppression of enormous areas of native plant and animal communities doesn't concern State and Federal agencies. In fact, public policy strongly encourages agricultural production. Humans, not Nature, write the definitions of invasive.

## **Ecological Systems**

Nature does not assign "good" and "bad" values to itself as Humans do. If we are to better understand the role of invasive species in our lives, let's first understand that we humans are part

of an earthly ecosystem, with a rulebook written by Nature. From our scientific observations, we have learned that Nature's rulebook is a complex web of forces and reactions which themselves cause other forces, prompting other reactions in a constant dynamic that is ironically, striving toward stability among all the forces. Alterations in any of these conditions will always result in change to the status quo and whatever level of stability that had previously existed. Now, with the assistance of data collection and computing resources never before available, humans can better understand and even predict these systems so that we can better make choices that are in the interest of our own, or more charitably, other earthly species. However, as humans have not yet even fully explored the existence, let alone the interactions of other species on this planet and have only a start on our understanding of universal forces affecting Earth, Nature still dwarfs humans in its ability to run the show.

So far, we at least understand that when any alteration of an existing natural system occurs, change is inevitable. Something is introduced, a struggle ensues and there is a change to the mix. Witness the virus that causes the common cold. The virus establishes, replicates and overwhelms the current state of the body's defense systems. Eventually, a healthy host's defense mechanisms kick in and overwhelm the invader to restore balance (what we call good health) to the host. However, the host is altered by this process, as it now has developed antibodies to this invader, leaving it less susceptible to invasion by that same virus for some period into the future. The invader has changed the body's ecology.

On a much larger scale, naturally occurring forces of geology (land movements), hydrology (water and its movement), and meteorology (weather changes, both seasonal and on larger

cycles) are constantly changing the playing field for biology on this planet. Sometimes these changes are subtle and slow, as with the current rising average annual temperatures, or the slow erosion of mountain ranges by precipitation and biological activity such as the acids that lichens exude in their colonization of bare rock. Over time, even small incremental changes will eventually result in alteration of a species' habitat and either result in its decline, or, if occurring over enough generations, allow mutations of that species to survive the change and become a new, adapted species. In other cases, especially where cataclysmic changes occur, such as floods, fires, storms, volcanic eruptions, and even asteroids, some species will fail to survive or will live on in another form. The age of the great dinosaurs seems to have ended with an asteroid hit to the Earth, but even so, they appear to have lived on in the form of modern birds, as mammals, once all tiny creatures, filled the niche left by the loss of the dinosaurs.

Most species have developed a means to ensure their species continues on, even if the lifecycle is measured in centuries. Witness the pine forests of the southern and western United States. Adapted to surviving long dry spells better than other species with their resinous sap, they develop large stands where these are the dominant species for centuries. The young of this species do not survive in the shade of the parents, nor is rapid generational succession necessary, since the parent trees can survive for centuries. But when that resinous sap is ignited by a lightning flash, the entire system comes crashing down. Fortunately, the species has evolved a reproductive device, in the form of a pine cone, which protects the long-lived seeds from predators. That protective cone won't release the seeds to germinate until after a fire has destroyed the parent trees and sunlight returns to the forest floor. Preceding generations of pine

parents created an acidic soil from decaying pine needles and this soil acidity deters other species from competing with the new generation of pines.

At the other end of the spectrum, mayflies live as adults for only 1-24 hours during which time they spend all their time mating and producing the next generation. This next generation spends most of its life as a pupae at the bottom of a water body until conditions are right again for them to emerge as adults and start the next generation in a year or so. The spent adults fall back to the water to become dinner for some trout. Nothing is wasted. Everything is recycled. Nature is a very efficient system.

With species survival such a strong force in biology, what we observe in Nature today is the result of a billion struggles between species, their context, and each other. Competition among species is a very strong force in ecological balance. Plants and animals are opportunistic, taking advantage of favorable conditions wherever they can. Most species are interdependent, with one being the food for another, up the food chain. Disruptions and imbalances in the food chain can create both advantages and disadvantages among those species. Established, well balanced ecosystems are the most susceptible to damage caused by change, as competition among species has highly refined the interdependency of these species. Minor disruptions to the species mix can become highly destructive until a new order emerges.

Humans have long been involved in altering ecosystems. Overgrazing by introduced sheep and goats in North Africa and the Middle East turned these areas into deserts centuries ago. England was once heavily forested but due to excessive logging, now has to import its lumber.



As technologies have become more sophisticated, so has our ability to alter native systems.

The San Joaquin and Central Valleys of California, once desert environments, were major producers of the nation's fruits and vegetables, thanks to damming of the Colorado River, sophisticated aqueduct systems, refrigerated rail cars, and Clarence Birdseye's process for flash freezing. The rattlesnakes and jackrabbits are now mostly a memory. Nature is pushing back however, as years of drought and build-up of salts and pesticides in the soils have rendered many areas unusable for crop production.

Humans are very good at protecting our food and ourselves from predators in the ecosystems we inhabit. Humans have successfully branded these competitors as the "bad guys". Dorothy said it best with her "Lions and tigers and bears, oh my!". Of course there's the Big Bad Wolf. And Shark Tank. Predators get all the bad press. Humans have taken the role of predator to the predators, even down to the smallest insects and diseases, provided they do us harm. DDT and mercury, once used to control insects and diseases in food crops were found to harm useful predators like eagles and even other human food, like wild salmon and tuna. The lack of wolves allowed deer populations to rise to become significant pests to our own corn crops.

Most of the change brought by humans to the world environment has been purposeful, for the betterment of humanity. However, technological advances have allowed humans to interact across the globe, bringing unintended hitchhikers with them. Spanish explorers unintentionally brought smallpox with them from Europe, killing most of the indigenous Central American population. At least NASA was careful decontaminating after Moon missions so we didn't bring Moon bugs back to earth. Zebra mussels now clogging power plant water intakes arrived in ballast water from abroad (side note: this is not all bad, as they now eat algae growing from farm

fertilizer runoff that was killing fish in the Great Lakes). Dutch elm disease, Chestnut blight, and emerald ash borer all came on wood imported from abroad, both as veneer logs and in packing crates. There is a threat that Asian longhorned beetles could come to Indiana the same way. Even when introduced, as in the case of these tree pests, they don't always spread rapidly in their new environments. Emerald ash borer only migrates one quarter mile per year. It was first sighted in Detroit in 2002 and reached Fort Wayne (162 miles away) in less than ten years. This was not natural migration, but, rather, by campers transporting infected firewood all over Michigan and Indiana.

### **Northern Indiana Encounters with Invasive Species**

The number of invasive species in the United States is pretty extensive, but since invasives are defined as problems in *local* ecologies, I'll share a few with you that have been altering the nature of our northeastern Indiana landscape and have been depriving us of the rich experience of our native species. Fortunately, there are few animals classified as invasive in Northern Indiana. Let's start with those.

### **Invasive Animals**

#### **Asian Carp**

Initially imported into fish farms in the southern US to clean up the water and eat small snails, they escaped into the Mississippi River system in floods that overtopped the fish ponds and have been spreading northward ever since. Reaching more than 100 pounds, they are voracious feeders of plankton and algae. By doing so, they deprive native fish of

their food sources and native aquatic communities collapse as a result. This means fewer bass and catfish for fisherman. Boaters are at risk in infested waters, as these heavy fish can jump as much as ten feet out of the water and they pack a wallop. Illinois has installed an electrical charge into the water of Chicago's Sanitary and Ship Canal to keep them out of Lake Michigan, and, locally, a levee is being constructed across our local Eagle Marsh, to keep them out of the Maumee River system that empties into Lake Erie. These carp have potential for good eating, described as mild and meaty, but are full of bones to pick through. Could this be dinner, just waiting to jump into your boat?

### **European Starling**

One hundred European starlings were introduced to Central Park in New York in 1890 as part of an effort to introduce all the birds of Shakespeare to the US. Because they find the US environment so hospitable, they have since blanketed much of North America and comprise one third of the world's starlings. This prolific bird competes aggressively with native birds for nesting sites, pushing them out of their native habitats. Leaving lawns unmown and a lot of plant litter on the ground seems to interrupt their foraging of insects from moist soils. This might be a reason to give up on mowing the back 40 and return it to meadow.

### **Feral Pigeons**

These are simply domestic pigeons which have set up housekeeping in undesired locations. With few natural predators in the urban areas where they are commonly found, they breed rapidly and can form large colonies. Their defecations cause expensive cleaning bills for urban building and statue owners. Controls include reducing access to seeds, berries and food litter (especially). The more food available, the faster they breed

(up to 6 times per year). Avian contraceptives and reintroduction of predators, like hawks and falcons, have had some effect. Disruption of nesting sites, including switching of eggs with dummy eggs can also reduce the rate of repopulation. All is not bad here, however. According to Jackson Landers, author of Eating Aliens, they cook up nicely with a bit of red wine to deglaze the pan. He describes it as a nice, fine grained red meat.

### **Wild Boar**

These are primarily domestic hogs that escaped and Russian Boars that were released for sport hunting. This is a mostly Southern Indiana issue, but they are showing up in west central Indiana now as well. In addition to spreading disease to domestic hogs, they tear up forest flora for nesting and wallows and out-consume food otherwise eaten by native deer and other animals. The Indiana Department of Natural Resources considers them a pest and allows any means to hunt them, as they seem to have no other natural predators. Hunters are happy to oblige and chefs find they go well with a nice wild mushroom ragout and a glass of Pinot Noir.

### **Invasive Plants**

For Indiana, most of the notable invasive plants started as ornamental landscape plants. Most of them escaped cultivation because of their ability to produce fruits that are widely spread by mice and birds. Their major threat is to the beauty and biodiversity of our native woodlands and wetlands.

### **Asian Bush Honeysuckles**

Included here are several honeysuckle shrub varieties, first imported from Asia as spring-flowering ornamental landscape shrubs, with attractive red berries in autumn. They were also recommended for wildlife habitat and erosion control. Unfortunately they can form dense woodland thickets which prevent the growth of forest floor wildflowers and young forest trees. There is no biological control for them. They must be cut down and stumps treated with herbicides to prevent resprouting. Since it is easy for birds to drop new seeds, elimination of nearby colonies and continued vigilance in their removal is essential.

### **Autumn Olive**

Introduced to the US from China in 1830 to provide wildlife cover and food, this shrubby small tree forms dense thickets of thorniness that smother out native plant and animal communities, like the bush honeysuckles. They can be killed off like the bush honeysuckles as well. Unlike the bush honeysuckles, the red berry-like fruits are tasty, have more than 18 times the lycopene of tomatoes, are borne prolifically, and are easy to harvest, if you can get past the thorns. The Forager's Harvest website suggests they have potential for commercial production as a valuable human food. If you can't lick 'em, eat 'em?

### **Common Buckthorn**

Another berry-laden shrubby small tree, buckthorn became popular as a landscape plant with the hybrid, columnar Tallhedge and Fernleaf varieties. The attractive berries assure they are spread widely by birds to become impenetrable woodland thickets. Their continued planting is not recommended.

### **Purple Loosestrife**

This lovely purple water's edge plant develops thick cover that crowds out native wetland plants, essential to these areas functioning as fish and frog nurseries. It came from Europe in the early 19<sup>th</sup> century in ships' ballasts and as a medicinal herb, and from its New England point of establishment, has spread across much of the temperate US. Its attractive purple flowers make it a lovely garden plant, but its invasiveness makes it too great a risk to grow ornamentally any longer. The United States Department of Agriculture is introducing four insects that feed on this plant in its native Europe, hoping to slow the spread of this aggressive plant.

The following common landscape plants are showing signs of becoming more invasive.

Biologists predict they may be our next group of invasives.

### **Flowering Callery Pears**

As noted earlier, these are becoming more common in hedgerows and woodland edges, along with Japanese crabapples and common apples.

### **Japanese Barberry**

This spiny, often purple-leaved ornamental landscape shrub can produce large numbers of red berries that birds find attractive to eat, thus widely distributing the seeds.

### **Winged Euonymus**

Commonly known as Burning Bush and valued for its flaming red fall foliage, this large growing shrub can also prolifically produce seeds that produce babies in the woods.

### **Purpleleaf Wintercreeper, English Ivy, Myrtle**

These popular landscape groundcovers are commonly used to carpet shady areas where grass will not grow. Although wintercreeper will seed itself and start new colonies nearby, these plants spread slowly into large mats that smother weeds as well as native woodland plants. What is an advantage to a suburban gardener is not one to native forest floor plants.

### **Crown Vetch**

This lovely purple-flowered member of the pea family has the ability to draw nitrogen from the air, and thus can thrive on poor soils such as found in highway cuts. It became popular among roadway engineers in the 1950s, but has since been found to seed prolifically and spread into native plant communities. It can be killed off with herbicides. The Indiana Department of Transportation is using more native grass and wildflower mixes along roadways now, which they are finding to be even better at erosion control than crown vetch and cost less to maintain than mown rights of way.

These last two are invasive plants brought from Europe with some of the first settlers to the United States and have been pests ever since.

### **Garlic Mustard**

Considered by the Indiana Native Plant and Wildflower Society to be among their ten most invasive species in Indiana, this biennial herb produces a low rosette of leaves its first year, then leaps to four feet tall in its second year when it flowers yellow and produces thousands of seeds. At this stage, it deprives forest wildflowers and tree

seedlings of light and they die out. With a seed viability of seven years, this plant has to be pulled (be sure to get the tap root) or killed with herbicides (very selectively) over many years, religiously, to control and eradicate it. It is edible. The roots have a horse radish-y flavor. The tops, although containing small amounts of cyanide (as does broccoli) can be blanched and made into a pesto with olive oil and parmesan.

### **Canada Thistle**

Introduced into the US in the 1600's, this herbaceous plant with prickly foliage and purple flower clusters forms large colonies of 4' tall plants that smother out other plants, overtake pastures, and invade crops. When pulled, the remaining roots send up even more shoots to intensify the colony. Farmers in our area spend large sums on herbicides to keep it from completely overtaking cultivated lands.

### **Managing Losses from Invasive Species**

Although it can be difficult, if not impossible to put these invasive genes back into their bottles, we can take steps to limit and reverse the damage they are causing to our environment. Not for profit and government agencies widely distribute information on problems with invasive species, how to recognize them and how they can be controlled and managed, if not eliminated. There rarely are silver bullets available to reduce damage to native plant and animal communities. Most recommendations involve a lot of time rooting out problem plants or hunting or sterilizing animals. There is consensus on the following four steps to keep invasive species from continuing their aggression.



## **1. Prevention**

The United States Department of Agriculture aggressively screens biological material coming into the country, but is not everywhere all the time. People who work with international imports can learn techniques to minimize the potential for the release of hitchhiking pests through quarantines and pesticide use. Even simple acts, such as cleaning your car and apparel after visiting remote areas can prevent the spread of weed seeds.

## **2. Early Detection and Eradication**

Government agencies and support organizations want us to keep an eye out for new and potentially invasive species so they can be controlled before they turn into serious problems. County agricultural agencies are good contacts if you suspect you have seen anything on the wanted list. Websites such as that of the Invasive Plant Species Assessment Working Group (IPSAWG) <http://www.in.gov/dnr/4619.htm> can offer recommendations on ways to identify, control, and eradicate these pests.

Government agencies have, at times, been granted police powers to eradicate pests that have the potential for significant damage. The Asian longhorned beetle, which feeds ravenously on Midwestern maple trees, can severely damage the sugar maple forests in our region. In the 1990s, the United States Department of Agriculture eradicated this beetle from some Chicago neighborhoods by removing 1550 trees in neighborhoods where it was found. Considering that wood boring pests such as this beetle cause \$3.5 billion in damage in the US annually, this is a small, but very visible price to pay to protect our forests. The City of Fort Wayne lost the battle with the Emerald Ash Borer and still had to spend more than \$1 million just to remove dead trees from public places.

### **3. Limiting the Rate of Spread**

Invasives can be removed, but vigilance is required, and sometimes the best that can be hoped is to hamper it from becoming a full blown epidemic to the environment. Some species respond to biological controls. *Bacillus thuringiensis* inoculant powder can be distributed on lawns to destroy Japanese beetle grubs that first eat our grass' roots, and then emerge to eat our roses. Fire is effective in burning meadows and prairies to kill woody plants like autumn olive and multiflora rose, leaving native grasses to bounce back. The state of Louisiana has a bounty on nutria, that furbearing rodent that escaped into their bayous in the 1930s, and pays per tail delivered from trappers.

Fort Wayne Animal Control has recently instituted a program to capture, neuter, and release feral male cats to prevent them from fertilizing female cats within their defended territory.

### **4. Restoring and Reestablishing Health of Native Ecosystems**

Sometimes all that is needed is a helping hand from humans to beat back the invaders and restore some balance back to the ecosystem. Eagle Marsh supporters spend volunteer work days out pulling and cutting invasive plants from their wetland preserve so natives can retake the area. Selective deer harvesting can allow native vegetation to recover from overgrazing.

## **Conclusion**

So why should we care about garlic mustard and zebra mussels? Aren't humans and their prosperity more important? These invasive species are merely symptoms of sick ecosystems with humans as the Typhoid Marys, spreading infections of foreign species across the globe. World exploration has caused exchanges of biological materials that would have taken millennia

to occur, if ever. Cats escaping sailing ships now devastate native bird populations in the South Pacific. 19<sup>th</sup> century settlers to our Great Plains hunted buffalo nearly to extinction. In this age of globalization, it is important to understand that there is an enormous risk to the biodiversity of this planet and the loss of species that could benefit humans in ways we can't even imagine. Who would have thought 60 years ago that the bark of the rare Pacific Yew tree would lead to the cancer-fighting drug taxol? Not many years before, bread mold led to the discovery of penicillin. Will we clog our local forests with bush honeysuckle and crowd out the next medical marvel?

Ever since humans first started hunting and gathering, they have been making an impact on ecological systems and changing the distribution of species. That human ingenuity has made mankind one of the most widely distributed of species on the planet. Certainly, we are the species with the greatest impact on Earth's ecosystems. Human activity is widely understood by science to be the cause of the current Sixth Extinction of species. Does that ability to push out other species make us the most invasive species of them all? That depends, of course, on your point of view. The Federal Government wouldn't say so. You might get a different answer from the flora and the fauna.

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