

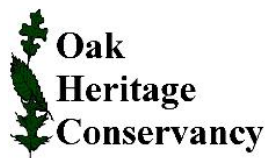
# At the Crossroads – Invasive Species in Indiana

Findings and Recommendations from the  
Indiana Invasive Species Task Force

July 7, 2008



Park Department



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## **EXECUTIVE SUMMARY**

Indiana is the crossroads of America—our waterways, railroads, highways and other transportation facilities are some of the finest in the nation. That distinction as a hub of transportation and commerce means Indiana has more than its share of invasive species problems. Invasive species enter Indiana through both transportation and commerce, and the rate at which invasive species are entering Indiana is increasing rapidly. We are also at a crossroads in time; by taking action now, we can lessen the impact of invasive species to our economy and environment.

Invasive species harm our economy, environment, and human health in many ways. Just one invasive insect, the Asian soybean aphid, has significantly decreased soybean productivity in the US. In 2003 an estimated 300 million bushels were lost to this pest. With today's soybean prices hovering at \$15/bushel this translates into a loss valued at \$4.5 billion nationally. There are dozens of invasive plants, aquatic species, insects, plant diseases, terrestrial animals, and animal diseases that threaten Indiana. Asian bush honeysuckle has invaded forests in every county in the state, significantly decreasing tree regeneration and growth. *Hydrilla* has invaded Lake Manitou in Fulton County, and if appropriate action is not taken it could spread to other waters and result in reduced aquatic biodiversity, recreational opportunities, and fish populations. Emerald Ash Borer is killing ash trees in northern and central Indiana, and will most likely be moved by people south to the vast forests of southern Indiana. Feral hogs are destroying crops and forested land in southern Indiana, potentially carrying brucellosis and pseudorabies, two diseases that have been eradicated in our domestic livestock but could be reintroduced by these animals.

In 2007, in response to the growing problem of invasive species, the Legislative Council of the Indiana General Assembly directed the Natural Resources Study Committee to investigate invasive species issues. Following the guidelines set forth in a resolution introduced in both houses, the Committee created an Invasive Species Task Force made up of individuals from a broad assortment of organizations and agencies with expertise in invasive species issues to provide findings and recommendations for the committee to consider in 2008. This document summarizes those findings and recommendations.

The most cost-effective way to address invasive species is to prevent them from reaching Indiana in the first place. If, despite prevention efforts, invasive species reach the state, early detection programs can help locate and eradicate those invasive species before they become widely established. If invasive species elude early detection and establish and spread in the state, control and management programs to monitor and minimize their negative impacts to the economy and environment will be necessary, but these efforts can be very costly. The sooner we act the more effective and less costly our efforts will be.

The current jurisdictional structure over invasive species in Indiana is basically sound; the Department of Natural Resources, Board of Animal Health, and Office of Indiana State Chemist work to address this important issue. However, communication and coordination between jurisdictional agencies and with affected parties is currently limited and has hampered the effectiveness and timeliness of invasive species efforts. Further, there is a lack of readily accessible information on the current location of invasive species in Indiana, a lack of coordinated outreach and education for the general public and for invasive species practitioners, and limited coordination with neighboring states. Resources dedicated to addressing invasive species in the state are extremely limited and there are inconsistencies in state agencies' policies and procedures on invasive species. Some of the few existing statutes lack clarity which hampers their implementation.

The Invasive Species Task Force here proposes seven recommendations to address these shortcomings, which are further explained in Chapter 3:

**1. Improve coordination and communication between agencies and affected stakeholders through creation of an Invasive Species Council.** While many agencies and organizations are working on invasive species issues in Indiana, there is currently a need for better communication between them. The regulating agencies and affected stakeholders have few opportunities to discuss these issues, which has led to a lack of effective invasive species coordination, inventory and data management, prevention activities, early detection efforts, and control and management activities.

**2. Develop and share information resources to target management in a cost-effective manner.** Everyone agrees that prevention and early detection are the most cost-effective ways to address invasive species, but these strategies depend on knowing where invasive species are in Indiana and where they aren't. Currently, there is no agency charged with gathering and maintaining data on invasive species in Indiana. The ISC will address this deficiency and establish a lead agency for each taxon (plants, insects and plant diseases, aquatics, animal diseases) to develop and maintain a unified data management system for Indiana.

**3. Coordinate with other Midwest state governments as well as regional and federal agencies and other relevant organizations on common invasive species issues to increase consistency and effectiveness of programs.** Invasive species don't stop at Indiana borders, and neither should the communications about invasive species. The Invasive Species Council will reach out broadly to other Midwest states, regional groups, and federal agencies to find and import the best examples of prevention, early detection, and control of invasive species.

**4. Work with agencies and organizations to coordinate a comprehensive education and outreach effort to share new information and best practices, including convening or supporting invasive species meetings.** There are many entities in Indiana that have produced educational products on invasive species, but the products have not been disseminated well to the target audiences, and the lack of coordination between entities has resulted in the independent production of multiple similar products. The Invasive Species Council will coordinate what educational materials are needed, with what message for which audience, and what entity should produce them.

**5. Improve the consistency and efficiency of state agencies' invasive species policies and procedures.** Given the many state agencies and their varied missions in Indiana, it is not surprising that there are inconsistencies in policies and practices on invasive species between them. In some cases, one state agency is actively working to eradicate or control an invasive species that other agencies have deliberately introduced. To assure wise use of state funds, the Invasive Species Council will provide a regular forum for reviewing current state agency policies and practices to identify ways to improve consistency and address any deficiencies.

**6. Allocate appropriate resources to invasive species efforts to improve prevention, early detection, and control and management in Indiana in a cost-effective manner.** There are four specific appropriations recommended; creating an Executive Director position for the Invasive Species Council, establishing an Emergency Invasive Response fund, creating a Terrestrial Invasive Species Coordinator position, and establishing a matching grant program to address invasive plant management across land boundaries in Indiana.

**7. Amend statutory language to allow more effective implementation of invasive species regulations.** Existing statute in Indiana allows the regulatory agencies – Department of Natural Resources, Board of Animal Health, and Office of Indiana State Chemist – to address invasive species in the state. A few changes and additions to statute will simplify implementation of the statutes.

## **Chapter I. BACKGROUND**

### **A. The Task Force**

The Indiana Invasive Species Task Force was created through a resolution sponsored by Representative Kersey and Senator Landske of the Indiana General Assembly. Upon the recommendation of the Legislative Council, the Natural Resource Study Committee moved to “*establish a task force to study the economic and environmental impacts of invasive species in Indiana and provide findings and recommendations on strategies for prevention, early detection, control and management of invasive species to minimize these impacts.*” The task force was directed to “*issue reports and recommendations to the Natural Resource Study Committee when it first meets in 2008. The Natural Resource Study Committee shall then issue a final report with recommendations back to the Legislative Council by November 1, 2008.*” The full text of the resolution, and the list of task force members, may be found in Appendix A.

The 11-person task force represented the wide variety of interests and expertise necessary to address the issue of invasive species. The task force met several times from November 2007 to June 2008 and reached out to many other organizations, agencies, and businesses with vested interests in invasive species for input on the problem of invasive species in Indiana and help with formulating possible solutions.



*Keith Ruble discussing Asian bush honeysuckle control with Invasive Species Task Force (E. Jacquart)*

### **B. A Primer on Invasive Species**

***The problems caused by invasive species.*** Invasive species are a form of biological pollution. Invasions by nonindigenous organisms are of growing concern around the world, and are estimated to cost the United States alone over \$120 billion annually (Pimental et al. 2005). There are many different types of invasive species costs. Zebra mussels, which clog intake pipes of power plants, cost each infested facility an estimated \$3 million annually (Leung et al. 2002) in lost productivity and control activities. In Florida, at least \$3 million is spent each year to control the Australian melaleuca tree, an invasive plant that invades wetlands. In two Californian lagoons, more than \$5 million was spent in the first three years of an on-going eradication program for the seaweed *Caulerpa taxifolia*. Why spend this money? Without management, the populations of these species and their impacts increase exponentially, so the sums of money spent now prevent the need to spend much larger sums of money later. For instance, \$65 million was spent to eradicate Asian Longhorned Beetle from Chicago, but the estimated cost to our forests if action wasn't taken would have been \$350 billion. Unlike chemical pollution, the biological pollution of invasive species can continue to propagate and grow over time, even if the original source of the invasive species is stopped.

To address the issue of invasive species at a national level, President Bill Clinton signed Executive Order 13112 on February 3, 1999 (see Appendix D for the full text of E.O. 13112). It established the National Invasive Species Council (NISC), which is advised by the Invasive Species Advisory Committee (ISAC). It called for the creation of a National Management Plan for invasive species to be created, which was published in January 2001 (available online at <http://www.invasivespeciesinfo.gov/docs/council/mpfinal.pdf>) NISC is the inter-Departmental council that helps to coordinate and ensure complementary, cost-efficient and effective Federal activities regarding invasive species while providing guidance and direction.

***Definitions.*** What is an invasive species? The federal definition established by NISC is “an alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health” (E.O.13112).

‘Alien species’ means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem (E. O. 13112). Such species are also called ‘non-native’ and ‘nonindigenous’, but perhaps the most commonly used term is ‘exotic species’. In Indiana, exotic species are considered to be those species not known to Indiana at the time of the state’s settlement (approximately 1800 through 1860s).

It is important to note the difference between ‘invasive species’ and ‘exotic species’. There are many exotic species in Indiana that don’t cause harm; in fact, several provide benefits to society. Soybeans, peaches, cows, and chickens are all examples of useful exotic species. It is only when an exotic species establishes itself in the new environment and causes economic or environmental harm or threatens human health that it is considered an invasive species.

It is also important to understand that the goal of management programs is not to eliminate every invasive species from Indiana. Action taken against an invasive species depends on how well-established it is in a given area and its potential impacts. For instance, it is neither necessary nor reasonable to eliminate every dandelion, no matter how annoying they may be in our yards. A more realistic goal is to manage invasive species as necessary and appropriate to minimize impacts.

**How do invasive species get here?** Invasive species arrive in many different ways, but the two main ways are through unintentional transportation and commerce in living organisms. Figure 1 details the many ways nonindigenous species, some of which are invasive, find their way into the US.

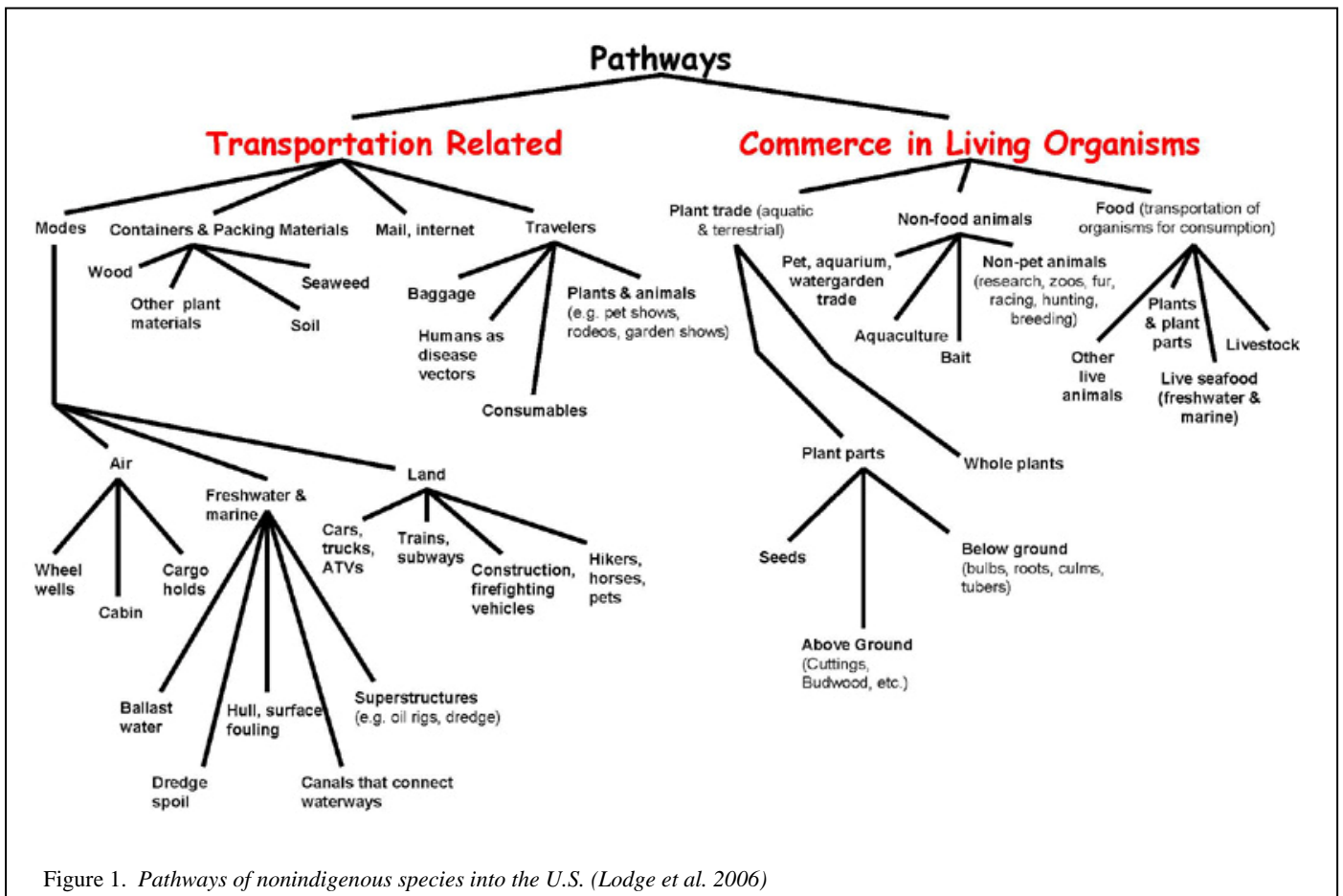


Figure 1. Pathways of nonindigenous species into the U.S. (Lodge et al. 2006)

**Where do invasive species come from?** Invasive species are usually transported during trade with other countries. Those that are able to establish and spread originate in other areas in the world with climates and soils similar to those of the US. The map in Figure 2 is color coded to allow comparison of areas of the world with similar habitats (based on soils, rainfall, temperature, and other variables). Invasive species in Indiana are most likely to have originated in the green-shaded areas.



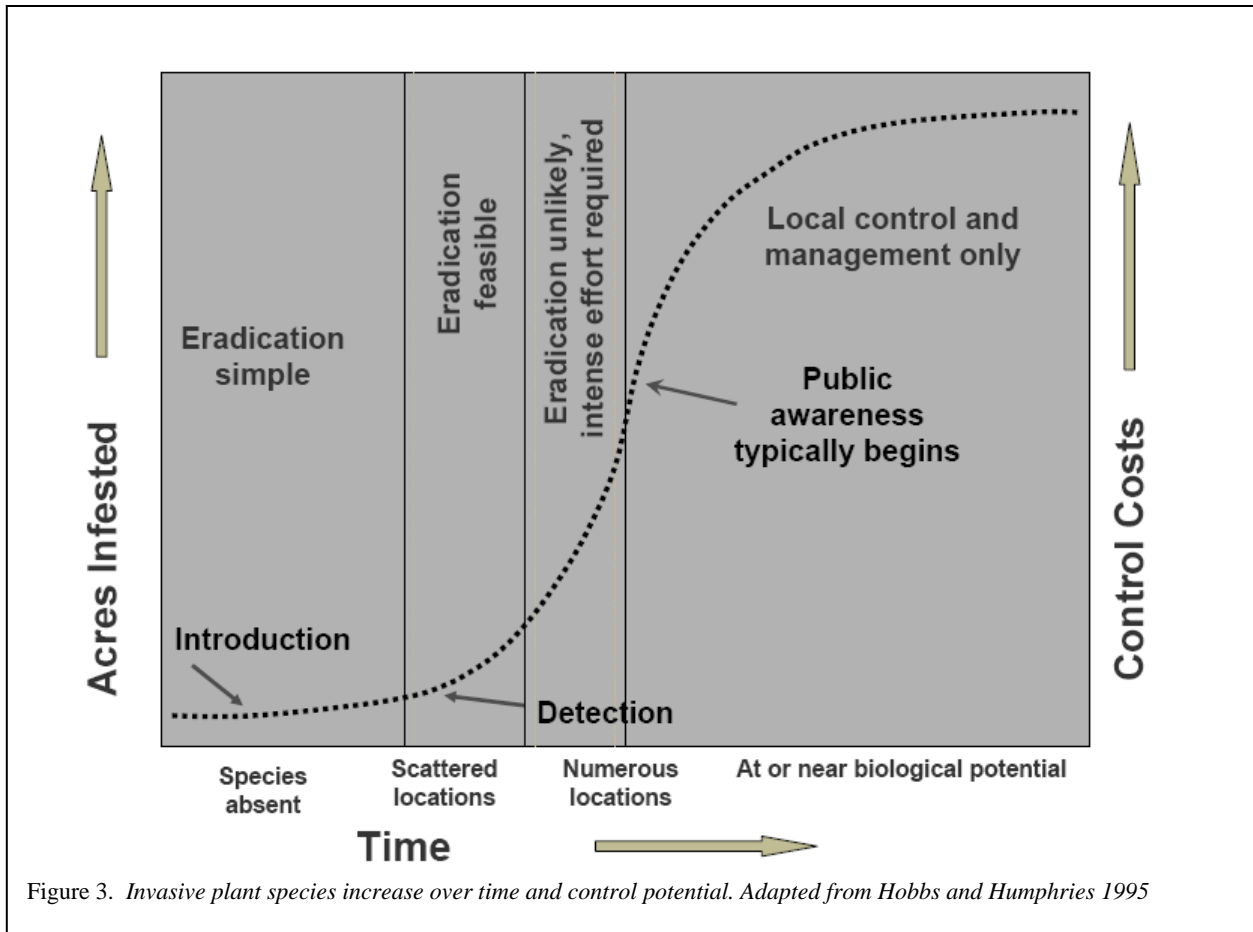
Figure 2. *Approximated map of similar world habitats based on rainfall, soils, temperature, and plant type; Indiana receives nonindigenous species that have potential to be invasive from all of the green-colored areas. (An unpublished, compiled reference used in deliberations by Entomological Society of America, invasive species ad hoc committee, 1998)*

**What are the strategies are used to address invasive species?** There are three main strategies in addressing invasive species. The strategy chosen depends on how well-established the species is. As an example, Figure 3 on the next page shows the progression from when an invasive plant species first appears to when it has filled the entire available habitat.

The first, and most cost-effective strategy, is **prevention** - keep the organism from arriving. A recent study on the weed risk assessment process used in Australia to restrict the entry of invasive species into the country has shown the cost of the program is more than paid for by saving the country the costs of treating those prohibited invasive species (Keller et al. 2007). Removal of invasive species from commerce, plus preventing their transport in vectors like whole wood packaging and ballast water, would greatly reduce the number of invasive species coming into the US.

**Early detection and rapid response** is the second strategy. When prevention fails and a new invader enters a region, early detection and elimination of that species will prevent its establishment and spread, a focused strategy with good potential for success. Having accurate, up-to-date information about the current location of invasive species – where they are, and where they aren't – is critical for this strategy to work.

**Control and management** of the species in question is the third strategy. When an invasive species has spread beyond the ability of humans to eradicate it, managing the species to keep it to levels that minimize its impacts to resources is the best tactic. This is a long-term, often costly, approach.



In summary, invasive species are causing significant economic and environmental impacts to the United States. **Indiana's status as the crossroads of America significantly increases the risk of new invasive species entering the state through transportation and trade.** The next chapter will cover the specific invasive species issues in Indiana and what is currently being done to address them.



**Chapter II. INVASIVE SPECIES IN INDIANA**

**A. Jurisdiction over Invasive Species in Indiana.**

In Indiana, jurisdiction over invasive species is divided between the Department of Natural Resources (DNR), Board of Animal Health, Office of Indiana State Chemist, County Weed Boards, and township trustees. Although the term ‘invasive species’ is a term never used in Indiana statute, terms such as ‘noxious weed’, ‘pest and pathogen’, and ‘exotic mammal’ are used instead and represent most types of invasive species. The table below indicates which agency has jurisdiction over particular invasive species.

Agency	Indiana Code	Authority over:	Defined as:
DNR - Division of Entomology and Plant Pathology	14-24-2-1	Pests and pathogens	An arthropod, nematode, microorganism, fungus, parasitic plant, mollusk, plant disease, or exotic weed that may be injurious to nursery stock, agricultural crops, other vegetation, or bees (per IC 14-8-2-203)
DNR - Division of Fish and Wildlife	14-22-2-3	Wild animals	An animal whose species usually: a. lives in the wild or b. is not domesticated (per IC 14-8-2-318)
Board of Animal Health	15-17-3-11	Animal diseases and pests	“...diseases and pests affecting the health of animals within and in transit through the state and the production, manufacture, and processing and distribution of products derived from animals to control health hazards...”
Office of Indiana State Chemist and Seed Commissioner	15-15-1-14, 18, 20, 25	Noxious weed seeds	Prohibited and restricted noxious weed seeds are listed at IC 15-16-7-2
County Weed Boards	15-16-7-2	Noxious weeds	Canada thistle, Johnson grass, bur cucumber and shattercane
Township Trustees	15-3-4-2 .6	Detrimental plants	Canada thistle, Johnson grass, <i>Sorghum aluumum</i> , bur cucumber and shattercane

The current jurisdictional structure over invasive species in Indiana is basically sound, with the Department of Natural Resources (DNR), Board of Animal Health, and Office of the State Chemist working to address these issues. **However, communication and coordination between jurisdictional agencies and with affected parties is currently limited which decreases the effectiveness and timeliness of efforts to manage invasive species in Indiana.** In part, this limited communication is due to a lack of a clear mandate and forum for jurisdictional agencies to coordinate on invasive species issues. Examples of this concern will be found throughout the remainder of this document. The Task Force’s recommendations in Chapter III focus on resolving this concern.

The following sections cover the different types of invasive species in Indiana – invasive plants (referred to in statute as exotic weeds, noxious weeds, and detrimental plants), insects and plant diseases (referred to in statute generally as pests and pathogens), aquatic invasive species (included in statute as exotic weeds and wild animals), animal diseases (referred to in statute as animal diseases and pests), and terrestrial invasive vertebrates (included under statute as wild animals).

## B. Invasive Plants

**The problem.** When Stanley Coulter wrote the first guide to the plants of Indiana in 1899, he documented several invasive plants from around the world already established in the state. Tree-of-heaven, a fast-growing Asian tree, was found on the bluffs of the Ohio River. Wild parsnip, an agricultural and roadside weed, was already growing in several counties.

As the years passed, these species greatly expanded their ranges throughout the state. Overlease and Overlease in *100 years of Change in the Distribution of Common Indiana Weeds* (2007) compared the range of 245 different non-native plants in Indiana in 1899, 1940, and 2004 to show the progressing invasion of these species into the state. Aside from this valuable publication, little is known on the current location of invasive plants in the state, **as there is currently no agency responsible for tracking invasive plant locations in Indiana.** According to Overlease and Overlease, tree-of-heaven is now in every county in Indiana. This species outcompetes native hardwood trees in some parts of the state, greatly decreasing the economic value of affected forest stands. Wild parsnip can be found in almost every Indiana County, lining roadsides and causing severe skin blistering to those individuals unfortunate enough to touch the plant.

Many new kinds of invasive plants have entered the state since 1899, and the rate of new introductions is increasing. One significant recent arrival is Japanese stiltgrass, an annual grass that was first found in Crawford County in 1994. Since then, it has been discovered in 21 southern and central counties in the state. It is particularly threatening as it can create a lawn in the forest understory that could eliminate all the wildlife habitat and native plants found in Indiana forests.



*Tree of heaven invading forest gap in southern Indiana. This is a three-year old seedling, already twelve feet tall and outcompeting native hardwoods. (J. Seifert)*

Just over the state's borders, other invasive plants are creeping closer to Indiana. In Ohio, mile-a-minute vine, an annual vine that smothers tree plantations and other open areas, is moving downstream along the Ohio River and is expected to make its way to Indiana within the next ten years. Many other invasive plants are spreading their ranges towards Indiana.

**Why do invasive plants do so well?** Invasive plants are successful for a variety of reasons. When these species are brought to the United States, they often are not accompanied by the natural enemies that would keep them under control back in their native environment. This can give them an advantage here because they have less competition. Some invasive plants gain a competitive advantage because they chemically inhibit native plants. For instance, tree-of-heaven exudes chemicals from its roots that slow the growth of native plants in the area, allowing it to acquire more water and nutrients and grow more rapidly. Garlic mustard produces chemicals that kill the native mycorrhizal fungi found on the roots of hardwood trees (Stinson et al. 2006); these fungi are responsible for helping the trees germinate and grow and when the fungi die, the trees are not able to compete effectively with the garlic mustard.

**How do invasive plants get here?** Invasive plants are introduced both intentionally and unintentionally. Some invasive plants come to the United States as products of horticulture. It is estimated that over 80% of the woody invasive plants in the US were deliberately imported into the country for horticultural use, though often the importer was not aware of the risk they posed. Sometimes even the federal and state governments

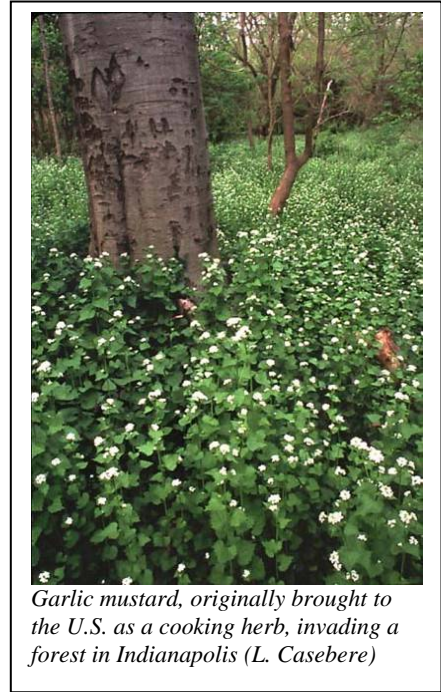
have had a role in spreading invasive species. Autumn olive is an Asian shrub that was once recommended by the USDA Soil Conservation Service (now known as the Natural Resource Conservation Service) for wildlife habitat. Indiana's state plant nurseries grew autumn olive for many years and sold it in 'wildlife packets' to be planted around Indiana. By the late 1970s it was clear that autumn olive was invasive and taking over open fields and pastures throughout the state, so in the early 1990s the state nurseries stopped selling it. Now state agencies, as well as private landowners, spend significant time and money trying to control this once heavily promoted invasive plant. **Better coordination between agencies is crucial to react more quickly and avoid problems like this in the future.**

Another way invasive plants arrive intentionally is as food plants. Garlic mustard was brought into the country in the 1800s by European settlers who used it as a cooking herb and for medicinal purposes. In the mid-1900s it started moving outside of cultivation and into the nation's forests and is now thriving in every county in Indiana.

Other invasive plants, such as Japanese stiltgrass, arrived accidentally in packaging material containing imported goods. Seeds from invasive plants can also be hidden in potted plants that are being brought in for retail sale.

***How do invasive plants endanger Indiana's resources and citizens?***

**Agriculture** – Invasive plants can cause great increases in costs of crop production because of the additional treatments necessary to eliminate them. Pastures and crop land are invaded by Canada thistle, poison hemlock and Johnson grass, bringing farmers increased costs to maintain forage for livestock and to maximize yields of crop land. There are indirect impacts to farmers as well; glossy buckthorn, an invasive shrub in northern Indiana, serves as an alternate host for the Asian soybean aphid, and kudzu, an invasive vine scattered throughout the state, serves as an alternate host for Asian Soybean Rust. Both invasive plants pose a threat to the soybean farmers in the state.



*Garlic mustard, originally brought to the U.S. as a cooking herb, invading a forest in Indianapolis (L. Casebere)*

**Fish and Wildlife** – As more invasive plants move into wildlife habitat, agencies like the DNR - Division of Fish and Wildlife have to spend increasing amounts of limited resources to manage invasive species to maintain quality hunting lands. Thick tangles of multiflora rose have decreased the ability of hunters and other recreationists to utilize land. Phragmites has invaded and degraded many of the wetlands left in the state, decreasing habitat for waterfowl in those wetlands. Species like spotted knapweed can decrease the quality of browse for deer.

**Forests** – Invasive plants can negatively impact our forests. For example, Asian bush honeysuckle can decrease tree growth rates by over 50% (Hartman and McCarthy 2007). Garlic mustard releases a toxic substance into the soil that kills mycorrhizal fungi, which are essential for native hardwoods to establish and grow (Stinson et al. 2006). These plants cause ecological harm to the forest and economic harm to woodland owners who wish to generate income by managing their forests to sell timber. Tree plantations are particularly vulnerable to the effects of invasive plants such as tree-of-heaven and Japanese honeysuckle, which can quickly establish in the plantations and overtake the planted trees, essentially smothering them.

**Biodiversity** – Many rare species in Indiana are threatened by invasive species. Short's goldenrod (*Solidago shortii*) is one of Indiana's rarest plants. Its entire known world-wide distribution was only one area in Kentucky until it was found in Indiana in 2001 near the Blue River in Harrison County. Unfortunately,

despite its remote location, invasive plants were already occupying the area. Crown vetch, an aggressive invasive plant that was commonly planted along roadsides, is found in the area and without control, could eliminate the Short's goldenrod.

Health and Safety – Some invasive plants such as wild parsnip and giant hogweed can cause severe blistering upon skin contact. Tree-of-heaven has cardiotoxins in its sap and exposure to enough sap can cause heart attack-like symptoms.

### ***Existing efforts***

**Prevention** – State regulations can be employed to halt both intentional and unintentional movement of invasive plants into Indiana. However, only a few invasive plant species are regulated by Indiana law. Canada thistle, shattercane, *Sorghum aluumum*, bur cucumber, and Johnson grass are deemed noxious and detrimental species of plants which may not be legally bought or sold in Indiana. In addition, landowners are legally obligated to control them on their properties when found. Multiflora rose was established as a regulated species in IC 14-24-12, and kudzu was regulated through 312 IAC 18-3-16. Three other regulated invasive plants - purple loosestrife, Brazilian elodea, and hydrilla, will be addressed in the aquatic invasive species section of this document.

However, the majority of plants considered by most land managers to be invasive in Indiana – approximately 75 to 100 species - is not regulated, and may still be legally bought, sold and planted in the state.

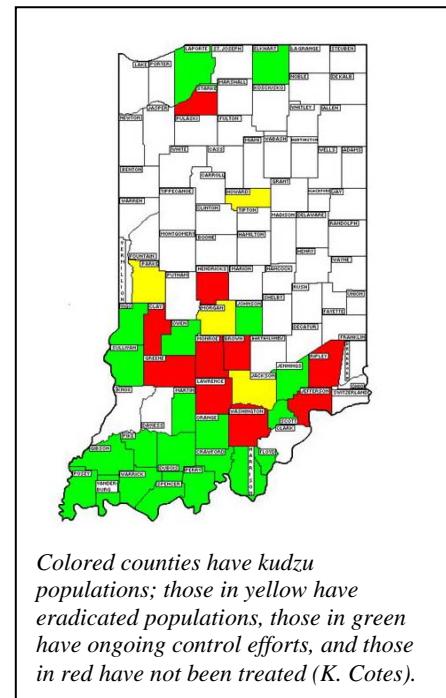
Some agencies are working to prevent the movement of invasive plants from one site to another through best management practices, such as cleaning seeds off the decks of mowers before they are moved from an infested site to a non-infested site, but these are voluntary efforts and sporadic at best.

**Early Detection and Rapid Response** – There are a few projects in Indiana where invasive plant species are being watched for and treated when found in an effort to eradicate them from the state completely. The Cooperative Agriculture Pest Survey collaborated with the DNR – Division of Nature Preserves to search for giant hogweed (*Heracleum mantegazzianum*) in Indiana. This federally regulated noxious weed is found at several sites in Illinois and Michigan but was unknown in Indiana. Through this collaboration, two sites were found in Indiana – one in Kosciusko County and one in St. Joseph County - and both were eradicated.

Another such project focusing on kudzu is coordinated by DNR – Division of Entomology and Plant Pathology. In 2002, the Division began mapping all known sites for this invasive vine in Indiana. Long known as “the scourge of the south”, milder winters are allowing this vine to spread further north in Indiana. Continued climate change may result in greater threat from kudzu and other invasive plants previously limited to the southern U.S. Kudzu is also a concern because it serves as an alternate host for Asian Soybean Rust, a threat to our soybean crops. Initially, the Division expected to find few sites. However, once they asked the public to report sites they were inundated with calls. Eventually, 109 sites totaling approximately



*Blistering caused by skin contact with wild parsnip, a common invasive plant throughout Indiana (L. Lyman).*



*Colored counties have kudzu populations; those in yellow have eradicated populations, those in green have ongoing control efforts, and those in red have not been treated (K. Cotes).*

109 acres were mapped in 35 counties. Over the last few years, available funding has allowed treatment of approximately 10 acres; as funding allows, eradication of kudzu will continue in Indiana.

The kudzu situation illustrates an important challenge agencies face in managing invasive species; **agencies simply do not know where invasive species are, and just as importantly, where they are *not* in Indiana.** Having that information allows managers to determine if it is feasible to eradicate an invasive plant, or whether it is more realistic to prevent it from being moved into uninfested areas. There is currently no state-wide database of invasive plant locations in Indiana; some data exist, but the information is currently housed in many different databases around the state. In the case of kudzu, the public was instrumental in providing information to the state to gather this information; citizens simply need to know where to report it.

**Control and Management** – There are scores of invasive plant control and management projects going on throughout Indiana. Most efforts are small in scope and usually limited to individual land holdings, often relying on volunteers and small grant funds. An example of such a volunteer effort is shown in the text box below. There is generally little coordination between groups doing invasive plant control even in the same area of the state, and little exchange of information regarding the most cost-effective and successful control methods. **Increased coordination and communication of such information would allow groups to better leverage available resources for control and learn about the best methods to control particular species.**

A new movement is underway in southern Indiana to link together those working on invasive plant control and management through the Southern Indiana Cooperative Weed Management Area. This group's mission is to decrease the impact of invasive plants in southern Indiana; they are doing this by connecting private landowners and public land managers across the region and by providing information on which invasive species to watch for and how to control them. This is Indiana's first Cooperative Weed Management Area, a partnership approach that has been recognized by the federal government as the most effective way to approach invasive plant management. **In fact, many of the federal funds now available for invasive plant control are limited to partnership groups such as Cooperative Weed Management Areas.**

Funding for control and management of invasive plants is quite limited in Indiana. There is no funding available for managing the noxious and detrimental plants regulated by County Weed Boards and Township Trustees, and perhaps as a consequence, there is little implementation of these statutes in Indiana. Only a few of the counties in Indiana have ever established County Weed Boards, let alone implemented their authority.

#### Volunteers Save Marott Park from Garlic Mustard

Back in the 1990s garlic mustard got out of control in beautiful Marott Park in Indianapolis. This invasive plant was moving through the forest understory and eliminating the wildflowers that drew visitors in the spring.

In 1992 Ed Paynter and Sandy Miles of the Sierra Club Heartlands Group recruited dozens of volunteers to pull garlic mustard and remove it from the forest. In the early years, they pulled enough garlic mustard to fill sixty to ninety 55 gallon-sized bags. After years of dedicated work, the vigilant volunteers now scour the woods to find any remaining plants.

John Bacone, Director of Nature Preserves and long time veteran of the event said, "Pulling garlic mustard while standing in a profusion of blooming spring wildflowers on a beautiful day was truly enjoyable, and that feeling was enhanced with the knowledge that we were helping save a great place. Without this effort, I am convinced we would have lost this beautiful area."



Sandy Miles and Kira Paynter pulling garlic mustard at Marott Park (D. Miller).

DNR - Division of Entomology and Plant Pathology (DEPP) regulates only two terrestrial invasive plants: multiflora rose and kudzu (regulated aquatic plants will be discussed in the next section). Through the kudzu project mentioned above, approximately \$40,000 has been spent by DEPP and cooperators to control kudzu in Indiana. That is the entirety of funding for regulated invasive plants outside of state lands.

State agencies have greatly increased the funds spent on clearing state lands and waters of invasive plants to protect resources and keep them available for public use. In 2007, the DNR spent an estimated \$2.2 million on invasive plant management on state lands. The Department of Transportation spent an additional \$816,000 on their lands. However, success in invasive plant management relies on control across land boundaries; controlling invasive plants only on state lands cannot be successful as the plants will simply reinvade from private lands.

Small amounts of federal money have been spent on invasive plant management on private lands in Indiana. The United States Forest Service – State and Private Forestry has provided funds to the DNR – Division of Forestry, which has in turn granted approximately \$34,000 to private landowners for invasive plant control around state forest lands in 2007. The Natural Resources Conservation Service provided just over \$250,000 to private landowners in 2007 to control invasive plants through the Wildlife Habitat Incentives Program.

As invasive plants have continued to spread through the state, private land trusts have greatly increased the amount of time and money spent on their management. A survey of land trusts in Indiana found that they spent \$588,000 on invasive plant management in 2007, a significant sum for small not-for-profit organizations.

While at times the battle against invasive plants seems like an uphill fight, controlling invasive plants in our forests, prairies, wetlands, and farmlands is essential to minimize the negative effects these invasive species have on productivity, diversity, wildlife habitat, and human health.

### C. Aquatic Invasive Species

**The problem** Probably the first aquatic invasive species to enter the United States and Indiana was the common carp. The U.S. Fish Commission imported common carp from Germany in 1877 to establish a potential food source and by the early 1880s this species was stocked in farm ponds, frequently escaping into open waters by means of floods and dam breaks. Phragmites and purple loosestrife, two plant species that invade wetlands, have been in the state for decades and are both now found in the majority of counties. Curlyleaf pondweed and Eurasian watermilfoil, two submersed invasive plants that entered the Midwest in the 1930s and 1950s respectively, have invaded lakes throughout the state.



*Sea lamprey, an invasive species that devastated the lake trout population in the Great Lakes (EPA photo).*

Zebra mussels were first discovered in 1988 in Lake St. Clair, likely the result of ballast water releases from transoceanic ships. They quickly spread to all of the Great Lakes; first found in Indiana near Whiting in 1989, they have now spread to all major waterways and lakes in Indiana. Bighead and silver carp from Asia escaped southern U.S. aquaculture farms in the 1980s and are now found in the Ohio, Wabash, Tippecanoe and other larger Indiana rivers up to at least the first dam they encounter.

Potential aquatic invasive species include: Viral Hemorrhagic Septicemia (VHS), probably the greatest threat to sport fish populations from a pathogen standpoint; black carp, an aquaculture species used for snail control, poses a tremendous threat to our native mussel populations since they prey on mussels; and water chestnut and European frogbit, two aquatic plants found in the northeast U.S.

**Why do aquatic invasive species do so well?** Indiana waters and wetlands are generally rich with nutrients, enabling the invasive species to grow quickly. As with all invasive species, the lack of predators that keep these organisms in check in their native regions allows them to spread rapidly.

Invasive fish and mussels usually begin reproducing at a young age and grow quickly. For instance, zebra mussels are capable of reproduction in their second year and a single female can release 1 million eggs annually. Common carp, the first invasive fish introduced into the U.S., is capable of reaching at least 10 inches in its first year. Thus Indiana's most abundant predator, the largemouth bass, has a very short period of time to feed on young carp.

Aquatic invasive plants often out-reproduce native plants. A single purple loosestrife plant is capable of producing 2.7 million seeds per year. Aquatic invasive plants generally grow in conditions where native plants cannot or they begin growing earlier and shade out the natives preventing their growth. Curlyleaf pondweed, for example, germinates in the fall, persists and commonly expands under ice cover, and quickly grows in the spring well before most native plants. Hydrilla can grow to depths that receive just 1% of natural sunlight. No other aquatic plant is able to grow in such low light.

**How do aquatic invasive species get here?** Ballast water releases into the Great Lakes have unintentionally brought a large number of foreign species and some of those species have proven to be invasive. Particularly threatening aquatic invasive species introduced into the Great Lakes through ballast water releases include zebra and quagga mussels, round goby, ruffe, and spiny and fishhook water flea.

Manmade canals and waterways can also allow invasive species entry. Sea lampreys were originally excluded from the upper four Great Lakes due to Niagara Falls blocking their upstream migration. When the Welland Canal was built to allow ships to bypass Niagara Falls, sea lamprey were able to follow this

manmade waterway and establish in new habitats. The sea lampreys began invading the upper Great Lakes in the 1920s and quickly devastated the lake trout population. They are still present in Indiana's portion of Lake Michigan and its tributaries.

After aquatic invasive species have been introduced into a region by another vector, aquatic recreation activities commonly spread aquatic invasive species even further. Zebra mussels quickly spread from the Great Lakes to inland Indiana lakes and streams from boats visiting infested waters and accidentally transporting larval mussels on equipment. Plants such as Eurasian watermilfoil and hydrilla can be easily moved by boat trailers to uninfested waters.

The aquarium and water garden trades are mostly composed of non-native species. While many of the plants and fish in trade are suited to tropical and sub-tropical climates, some can survive and thrive in Indiana waters and a number of them are already proven invasive in the region. Brazilian elodea, probably the most popular aquatic plant in trade due to its ease of care, has proven to be highly invasive in Indiana lakes and ponds. Snakeheads, a fish that made headlines in Maryland waters a few years ago, were once popular aquarium species until the federal government listed them as injurious species due to the threats they pose on native fishes. Plants and fish from aquaria and water gardens are commonly released into Indiana waterways because the former owners do not want to euthanize their unwanted pets or discard plants in the trash. Some aquatic invasive plants like purple loosestrife and yellow floating heart are even intentionally planted in natural waters and wetlands due to their attractiveness.

### ***How do aquatic invasive species endanger Indiana's resources and citizens?***

**Aquatic Recreation** – Aquatic invasive species greatly decrease the recreational use of lakes and rivers by Indiana residents. Dense invasive vegetation can seriously impact an angler's ability to fish. Abundant vegetation can also create an imbalance in the fish population as the predators can have a difficult time foraging for prey in dense weeds, resulting in a poor quality fishery. Recreational boating is hampered on waters where there are dense beds of aquatic invasive species. Dense aquatic vegetation can make swimming dangerous, and has been implicated in some drownings. Invasive wetland plants such as purple loosestrife and phragmites make wetlands inhospitable to hunters; waterfowl likewise do not find the areas attractive.

In some areas where Asian carp are particularly abundant, like the Illinois River, they can reach 90% of the fish biomass, thus reducing or displacing desirable sport fish. Silver carp, which can easily reach 30 pounds or larger, will leap out of the water when agitated by a boat motor. Many boaters on Midwest rivers have been struck by these "flying fish."



**Diversity of Aquatic Life** – Invasive aquatic life can decrease the diversity and/or abundance of native flora and fauna. Fish and other animals that rely on water or wetlands prefer a variety of plants for cover. Most invasive plants create a monoculture of the invasive species and exclude desirable native plants. This in turn makes the area less habitable for fish and wildlife. Some invasive fish and mussels can be large consumers of plankton; zebra and quagga mussels can each filter planktonic algae from up to one liter of water per day. When there are thousands of zebra mussels per square meter, there can be a dramatic reduction in the base of the food chain.

**Industrial Water Use** – Dense aquatic invasive plants and zebra and quagga mussels both threaten industrial uses of water. Aquatic vegetation can block intakes unless expensive control programs are in place to prevent nuisance levels of invasive plants. Zebra and quagga mussels anchor themselves to the hard interior of intake pipes, completely clogging the pipes.



Flood Control – Invasive plants can grow so dense that flood control is a concern. Reed canary grass can grow completely across small drainages, slowing water flows during storm events and contributing to flooding of homes and farm fields. Florida spends approximately \$20 million each year to control hydrilla, primarily to allow the water to flow off the flat landscape and reduce flooding.

Bioaccumulation of Toxins – Due to zebra and quagga mussels' ability to filter large amounts of water, they also take in a large amount of toxins. Zebra and quagga mussels filter naturally-occurring botulism from the water. Because these invasive mussels are so small, round gobies, an invasive fish, are able to eat them, and birds, in turn, eat the gobies. This chain of toxin concentration has been implicated in the deaths of thousands of migratory birds along the Great Lakes.

### Existing efforts

**Prevention** – There are only three aquatic plant species that cannot be legally sold in Indiana: purple loosestrife (IC 14-24-12), Brazilian elodea (312 IAC 18-3-20), and hydrilla (312 IAC 18-3-21). All other aquatic plants may be freely sold including a number of proven invasive species. There are ten species of fish that are not allowed to be possessed alive in Indiana (312 IAC 9-6-7). Zebra and quagga mussels and Asiatic clams are also regulated at the state level (312 IAC 9-9-3). Nearly all aquatic invasive species regulated in Indiana are the result of reaction to an existing invasion, rather than a proactive step to prevent invasion.

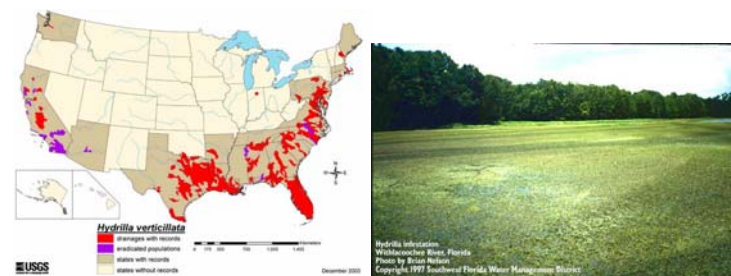
**To be effective at preventing future invasions, actions need to be proactive rather than reactive.** Screening the organisms predicted to come in through trade and regulating those that have a high probability of becoming invasive in our state is the most cost-effective procedure. In 2006, an aquatic plant work group was established by DNR – Division of Fish and Wildlife in Indiana, including representatives from the water garden industry, aquatic vegetation control experts, conservationists, and Illinois-Indiana Sea Grant. The group has been working to develop a screening process to evaluate aquatic plants in trade in Indiana in an effort to restrict those that could cause significant environmental harm. Similar screening tools could be developed for other aquatic taxa.

Currently there are no state or federal standards applied to ballast water, yet ballast water is the vector most responsible for exotic organisms entering the Great Lakes. Indiana prefers a federal approach to regulating

### An Unpleasant Surprise

In August 2006 the DNR – Division of Fish and Wildlife was surprised to find a new invader in Lake Manitou (Fulton County). Hydrilla, regarded by many as the most invasive submersed aquatic plant in the world, had for the first time found its way to the Midwest (see range map below). Well established in the southern and eastern states, hydrilla was recognized as a potential threat to the Great Lakes region, but no early detection surveys for it had been implemented in Indiana. It was very clear from the large distribution of the plant in the lake that this invasion had occurred at least a few years prior to 2006.

Hydrilla has the ability to grow so densely that fish populations can be harmed, water quality negatively impacted, and recreational water uses all but eliminated; thus, the DNR took this threat very seriously. They immediately implemented actions to contain and eradicate hydrilla from Lake Manitou. Since October of 2006 access has been restricted to prevent transient boaters from transporting hydrilla to another body of water. Surveys for hydrilla in nearby waters in 2006 and 2007 have not documented that the plant has spread beyond Lake Manitou. The lake is being treated to eradicate hydrilla, but it may take five or more years before eradication is achieved. While eradication costs for this one lake may approach \$2 million, the cost of doing nothing and allowing the plant to spread would be far greater.



Map showing range of hydrilla in U.S., with the one Midwest location at Lake Manitou (U.S.G.S.) and a photo of a lake infested by hydrilla (Brian Nelson, Southwest Florida Water Management District).

ballast water in an effort to reduce confusing and possibly conflicting regulations among the several Great Lakes states.

Outreach and education can be effective in preventing introductions or spread of invasive species. Indiana is a partner in the national “Stop Aquatic Hitchhikers” campaign. This campaign describes simple best management practices aquatic users should perform to reduce the chance of moving fish, plants, mussels, and pathogens during their activities.

Early Detection and Rapid Response – Efforts to detect new invasions are limited in Indiana. Most discoveries are reported by public observations rather than active survey efforts. Even when aquatic invasive species data are collected, **there is no single location where the data are stored, making it difficult to determine an accurate distribution of each organism.** Since the discovery of hydrilla in Lake Manitou in 2006, DNR has had an active detection program in the area to determine if hydrilla had spread before lake access was restricted. Approximately 70 lakes within 60 miles of Lake Manitou have been surveyed in 2006 and 2007 in an effort to detect hydrilla; so far, no additional infestations have been found.

Rapid response activities have been restricted to plant control, namely for hydrilla and Brazilian elodea. Rapid response projects are geared at newly introduced species where eradication is a realistic expectation. Implementation of a hydrilla eradication program at Lake Manitou began just weeks after the discovery and included evaluation of the full extent of the plant’s range in Lake Manitou, access restrictions to contain the plant, and a chemical control plan. In order to move quickly, however, funding had to be taken from other programs within the DNR, greatly impacting those programs.

A Brazilian elodea rapid response plan was much slower to develop at Griffy Lake; however, once it began treatment was very effective and the chances for total eradication are promising.

**To be able to have a rapid and effective response to new invaders that threaten critical resources, an emergency response fund needs to be established for projects like the hydrilla eradication.**

Control and Management – When addressing well established aquatic invasive species, the main focus is generally to reduce the invasive species to a level that minimizes their negative impacts to an acceptable level. An excellent example of this is purple loosestrife biological control (see text box on next page). The biological control insects used to control purple loosestrife will never eliminate the plant, but they will keep the loosestrife population to a low level so that more desirable native species can reestablish. The success of this project has saved dozens of land trusts, municipalities, Lake Owners’ Associations, and private landowners from having to chemically control purple loosestrife on their land. At an estimated cost of \$500/acre/year for chemical control, this effective biocontrol has resulted in savings of many thousands of dollars each year.

This success story happened for two reasons. First, DNR – Division of Entomology and Plant Pathology worked with the appropriate federal authorities to allow the purple loosestrife biological controls to be established in Indiana. However, the only reason the biological control beetles were released on a wide scale in Indiana is because a DNR – Division of Nature Preserves Regional Ecologist for northeast Indiana saw the need for this biocontrol project to be implemented across the landscape and voluntarily took on the unpaid overtime needed to make it happen. He worked with others in Division of Nature Preserves, IL-IN Sea Grant and other organizations to implement this cost-effective project across the landscape of Indiana.

There are other biological control agents that could be used to control invasive plants in the state (such biological controls exist for spotted knapweed and leafy spurge, and are being developed for garlic mustard

and phragmites), but there is currently no one within the DNR responsible for implementing biological control of invasive plants.

The Lake and River Enhancement (LARE) is a state program funded by boat taxes that assists in funding invasive aquatic plant control projects. It is generally aimed at reducing nuisance Eurasian watermilfoil and curlyleaf pondweed populations to a low level so that individual lake associations can then more effectively manage the plants with what is usually a limited budget. While eradication of well established aquatic invasive species is typically not feasible from even a particular body of water, let alone the entire Indiana waterscape, there are occasions where eradication attempts take place on a body of water. At times common carp populations are so high that there are few management options available to correct the situation besides total fisheries eradication from the lake and its watershed. When properly planned, these projects can eliminate carp from a watershed. There are very few control and management options available for invasive fish species in our large rivers. Even if we could eliminate all Asian carp from our rivers, they would quickly repopulate the rivers from downstream sanctuaries.

#### Tiny Beetles Knock Back Invasive Plant

Purple loosestrife started taking over wetlands in Indiana in the 1940s, and rapidly expanded to fill many of Indiana's wetlands by the 1970s. While it may look pretty, it displaces native plants and eliminates wildlife habitat. So the Division of Nature Preserves started to control it with herbicide in the 1980s. More and more time was spent every year spraying areas to get rid of the loosestrife, not just by Division of Nature Preserves, but by many other land managers around the state. However, spraying only limited the spread of this invasive plant; it didn't really reduce the amount of wetland infested. That meant the same areas were treated year after year after year.

If you spend that many days crashing around in wetlands in Indiana summer heat wearing chest waders and a backpack sprayer with only modest success, you conclude that there has to be a better way. And that better way turned out to be bugs. Indiana DNR became a partner in a North American wide effort to introduce European insects to control purple loosestrife. Rich Dunbar, Division of Nature Preserves' Regional Ecologist for northeast Indiana worked to release carefully screened beetles from Europe to control purple loosestrife starting in 1994. Since that time he has coordinated the release and monitoring of these beetles at dozens of sites around the state. Success has varied by site, but there have been dramatic reductions in purple loosestrife from both the leaf eating beetles and the root-mining weevils (see photographs) that have allowed native wetland plants to recover and thrive.



Photo of purple loosestrife biocontrol release site southwest of Plymouth in August 2001 (left) and August 2007 (right). Biological controls were released at this site between 1994 and 2001 (R. Dunbar).

Limited personnel are devoted to aquatic invasive species in Indiana. The only staff person addressing all of the issues revolving around aquatic invasive species is the Aquatic Invasive Species Coordinator with the Division of Fish and Wildlife. This position was established in 2005 and has allowed the DNR to have one person focus solely on aquatic invasive species issues. The mission of the program is to preserve and protect natural resources by preventing aquatic invasive introductions and reducing negative consequences of the exotic species. An important facet of the position is to educate the public about native resources and the need to prevent the establishment of invasive species since the introduced species can damage the ecological balance, reduce recreational opportunities, and are an economic drain. One particular challenge is trying to coordinate and assure that all state agencies have similar policies and practices in place that will prevent the dispersal of aquatic invasive species

**Coordination with regional partners is important to prevent the introduction and spread of aquatic invasive species.** Indiana lies within two major watersheds, the Great Lakes watershed and the Mississippi watershed. Due to the differences in aquatic invasive species issues occurring in the two basins, Indiana participates in both the Great Lakes Panel on Aquatic Nuisance Species as well as the Mississippi River Basin Panel on Aquatic Nuisance Species. Both Panels make recommendations to the national Aquatic Nuisance Species Task Force.

#### D. Insects and Plant Diseases

**The problem.** Invasive insects and plant diseases have plagued our country since colonial times. In Indiana, the Office of State Entomologist was established at Purdue University in 1899 to address this threat. An early example of invasive insects is the San Jose scale outbreak in the late 19<sup>th</sup> century. This serious pest of fruit trees was introduced into California on nursery stock shipped from Asia. Concern about this exotic pest resulted in the development of Indiana's nursery inspection program, which provides inspections of Indiana-produced plants that are commercially marketed and continues today within the DNR – Department of Entomology and Plant Pathology.

Since then, a multitude of invasive insect and plant diseases of agricultural, forested and urban environments have reached Indiana. Among the more conspicuous arrivals were Chestnut Blight and the European Corn Borer in the 1920s; Japanese Beetle and Dutch Elm Disease in the 1930s; Oak Wilt in the 1940s; Butternut Canker in the 1950s, cereal leaf beetles on small grains and Alfalfa Weevil in the 1960s, Gypsy Moth and Western Corn Rootworm in the 1970s; Mexican Bean and Colorado Potato Beetles in the 1980s; Pine Shoot Beetle and the Western Corn Rootworm variant in the 1990s; and Asian Soybean Aphid, Asian Soybean Rust and the Emerald Ash Borer since 2000.

The European Corn Borer was an early agricultural pest believed to have been accidentally introduced into the US in shipments of broom corn from Europe in the early 1900s. It reached Indiana in the 1920s and the rest of the Corn Belt by the 1950s. Losses due to feeding by first and second-generation larvae, and occasionally third generation larvae, could approach one billion dollars but for the deliberate pest management interventions practiced today. These practices include the use of resistant or tolerant hybrids, and more recently the use of hybrids genetically modified to produce toxins lethal to the larvae although they pose little risk to most other organisms.



Dead ash trees killed by Emerald Ash Borer (photo credit unknown)

The first major exotic invasive plant disease to hit American forests was Chestnut Blight, first reported in New York in 1904. By the 1930s, this disease had removed the American chestnut tree as a viable component of the eastern hardwood forests, including Indiana's forests. The next major exotic invasive plant disease was Dutch Elm Disease (DED), first reported in Indiana in 1934. This disease eliminated the American elm and red elm from the forests and tree-lined streets of Indiana by the 1960s.

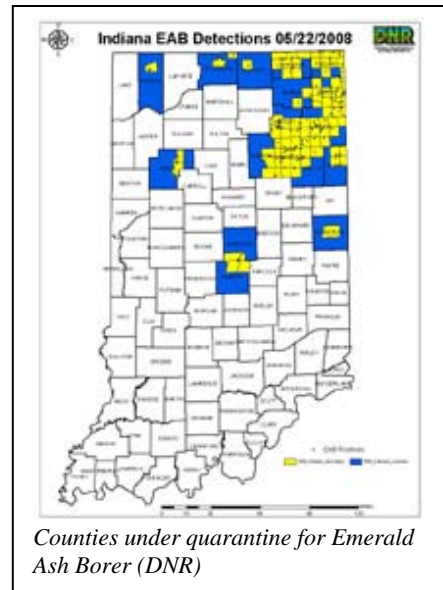
More recent agricultural pest arrivals include the Alfalfa Weevil. Alfalfa was introduced into the Midwest from Central Asia in the 1850s. A century later the Alfalfa Weevil, which also originated in Central Asia, found its way to the US. It became a major pest until a complex of natural enemies was introduced and distributed throughout the alfalfa growing regions of the US. Less than 3% of the fields reach economic injury levels since the natural enemies became established. The benefit/cost ratio of this project has been estimated at more than 91:1.

The introduction of several new invasive species has placed honey bees at risk. Varroa mites and tracheal mites have been present in Indiana since 1988. Varroa mites are a particular problem with beekeepers because they have become vectors for honey bee viruses. The small hive beetle is a tropical or subtropical beetle from Africa that was first found in hives in Indiana in 2003 attacking unprotected honey supers. The

Africanized honey bee (AHB), sometimes called “killer bees”, have steadily migrated northward since its accidental release from a breeding program in Brazil in 1957. It is still unknown if AHB can establish as far north as Indiana, but the possibility increases significantly if climate change results in milder winters in Indiana. If it does establish, it will greatly affect how Indiana beekeepers manage their hives, since AHB exhibit more aggressive defensive behavior and are less adapted to commercial pollination and honey production than domestic honey bees. New viruses and diseases of honey bees such as Israeli Acute Paralysis virus and *Nosema ceranae*, which may be associated with well-publicized Colony Collapse Disorder in the western U.S., could arrive in Indiana at any time.

Gypsy Moths (GM) first achieved a foothold in northeast Indiana in the 1980s. Today, GM is present in 8 counties across the northern border. A threat to 80% of Indiana’s forests, active management has been conducted for 25 years. The DNR partners with the USDA Forest Service in the “Slow The Spread” (STS) program, a science-based strategy designed to significantly slow the advance of GM by several years or decades. Expending an average of \$670,350 of state and federal funds annually since 2000, this program has prevented defoliation and spread of GM into new areas thus lessening the negative impact to Indiana’s oak forest resources that could result from an uncontrolled gypsy moth epidemic. The oak forest resources of Indiana are estimated to be worth hundreds of millions of dollars.

Emerald Ash Borer (EAB) is the most recent exotic pest to impact Indiana’s forests. First discovered infesting ash trees in southern Michigan in 2002, it has since been spread in six other states including Indiana (in 2004) and the Canadian Province of Ontario. EAB is believed to have come from Asia in solid wood packing material used in cargo shipments. The larvae feed beneath the bark of ash and disrupt the circulation of water and nutrients through the tree. More than 25 million ash trees have been killed in Michigan alone since its introduction. The estimated 147 million ash trees found in Indiana forests and the large number of ash in the state’s urban environments are severely threatened by EAB. Upwards of \$200 million dollars was spent in the affected regions to eradicate EAB in the early years following detections.



Other invasive exotic species of imminent concern are Sudden Oak Death, Asian Soybean Rust, Hemlock Woolly Adelgid, Sirex Woodwasp and several species of bark beetles. In addition to these invasive exotic insect and disease problems, over 50 insects and 8 diseases are on “Indiana’s Most Unwanted Plant Pest List” which was developed by the Cooperative Agriculture Pest Survey Committee (<http://extension.entm.purdue.edu/CAPS/>).

**Why do invasive insects and plant diseases do so well?** The exotic invasive insects and diseases do well because they frequently encounter concentrated populations of preferred hosts to support their lifecycles, weather conditions that favor the development of large populations, and a lack of natural enemies (parasites, predators and pathogens). Many exotic invasive species arrive unaccompanied by the natural enemies found in their area of origin. Without these three elements, exotic invasive insects and diseases can develop strong populations that seriously impact Indiana’s natural and agricultural resources.

**How do invasive insects and plant diseases get here?** Invasive exotic insects and diseases usually are transported into the U.S. unintentionally through trade from shipping infested commodities or packing material. Some insect invaders may hitchhike in on commercial transportation traveling between international destinations. Some of the prospective invaders that survive these international trips are

intercepted at ports of entry. However, because of the sheer volume of international trade which continues to increase every year, and the relatively small percentage of shipments inspected (less than 2-5%), the likelihood of successful invasions is on the increase. Examples of invasive species introduced this way include Chestnut Blight, Dutch Elm Disease, Asian Longhorn Beetle and Emerald Ash Borer.

Another way invasive pests come in is through deliberate introductions. For example, Gypsy Moth was brought to Massachusetts from Europe after the Civil War in a misguided attempt to breed them with silk moths to advance the production of silk for the clothing industry. Unfortunately, caterpillars escaped and thrived in the oak trees of Massachusetts. Having no natural enemies and an abundant food source, their population grew to epidemic levels in 20 years and began to spread to the rest of the country.

Many invasive insects and pathogens that affect forests are inadvertently transported throughout the state in nursery stock, unprocessed lumber, and firewood. Although nursery and lumber industries are regulated in Indiana, firewood remains a major stumbling block in management of insects and diseases.

***How do invasive insects and plant diseases endanger Indiana's resources and citizens?***

**Forestry** – Tree species such as chestnut and ash have been a very important part of Indiana's forests, and have been of great value as timber species. The estimated potential loss to Indiana's forest industry because of EAB is significant. In fact, EAB could eventually cause the extinction of ash trees on the North American continent. Even if an insect or plant disease does not eliminate its host species, it can create economic and environmental impacts such as reduced volume growth in timber trees from insect feeding or girdling of branches, stems, or roots by diseases. This damage has subsequent impacts to the timber industry from reduced volume available for conversion to timber products or reduction in the quality of the timber product. Damage resulting from invasive insect and plant diseases also causes an increase in business costs for the timber industry to move logs in interstate and international commerce as they cope with regulatory requirements placed to prevent spread and development of damaging outbreaks.

**Agriculture** – Invasive insects and plant diseases greatly impact agriculture in Indiana. One recent invasive insect, the Asian soybean aphid, has significantly decreased soybean productivity in the U.S. In 2003 an estimated 300 million bushels were lost to the aphid. With today's soybean prices hovering at \$15/bushel, this could result in losses totaling about \$4.5 billion. Another threat to soybeans is Asian Soybean Rust. Broad establishment of this fungus is expected to cause annual losses averaging between \$240 million and \$2 billion to farmers. This rust was found in Indiana for the first time in 2006.

**Green Industry** – Insects and plant diseases threaten the green industry (businesses involved in live plant trade, including growing, selling, planting or maintaining) by destroying stock, increasing costs associated with treatment for insects and diseases, and creating costs to maintain compliance with quarantines. When EAB arrived in Indiana, all ash nursery stock essentially became worthless, causing losses of hundreds of thousands of dollars to growers in Indiana. The pathogen that causes Sudden Oak Death, a disease that is killing thousands of acres of oaks in California and Oregon, is carried on several popular ornamental plants. The organism was found on plant material imported for sale in Porter County in 2006; fortunately, it appears that the pathogen was unable to establish in that incident. If it would establish, the disease could virtually shut down nurseries, garden centers and re-wholesale facilities due to the number of host plants that can harbor this pathogen.

**Beekeeping** – Beekeeping is estimated to be a \$10 million industry in Indiana but invasive pests have greatly impacted the survival and productivity of hives around the state. Impacts to honeybees also cause ripple effects throughout agriculture and natural resources, as decreases in bee-driven pollination (required for about a third of our food production) reduce fruit set both in agricultural crops and in native plants. This problem also lessens the amount of available food for wildlife.

**Biodiversity** – The loss of a tree species from a forest because of an insect pest has many cascading impacts. Some of the gaps left by the EAB-killed ash trees in southeastern Michigan are being filled not by native hardwoods, but by glossy buckthorn, an invasive shrub. As invasive shrubs take over, populations of forest birds that nest in the tree canopy will decline. There are many native butterfly and moth species that are entirely dependent on ash, so its destruction will also mean the loss of all those native species.

**Urban Trees** - In the urban forest, economic impacts from invasive insects and plant diseases is intensified as homeowners and communities lose the benefits that trees provide to property values and other areas. When an exotic insect or plant disease kills trees in urban settings, individual residents and city governments must incur the additional expenses of removing and replacing the trees. These groups are also exposed to liability from hazardous situations created by dead and dying trees. Ash is a vital component of the urban forest in many parts of the country. Assuming that EAB is capable of spreading through all urban areas of the lower 48 states and destroying all urban ash trees, the United States could suffer a national undiscounted loss of \$20 to \$60 billion (Federal Register, October 14, 2003 (Volume 68, Number 198)).

**Public Health** – The presence of certain exotic insects at epidemic levels creates public health issues. For example, when gypsy moth is at outbreak levels, the frass that results from the caterpillars' voracious feeding and the presence of huge numbers of crawling caterpillars creates alarm and disgust amongst people living in the situation, leading to unrest and demands for governmental intervention. For some susceptible individuals, urticating hairs from gypsy moth larvae may cause alarming allergic reactions that require medical attention. Two mosquito species from Asia that carry West Nile Virus, a disease which has caused considerable human mortality and morbidity throughout the United States, are now in Indiana.

### ***Existing efforts***

**Prevention** – The DNR – Division of Entomology and Plant Pathology (DEPP) has authority under IC 14-24 to prevent and manage exotic species. Under IC 14-24-2, the Director of the DEPP has authority to 'locate, check and eradicate a pest or pathogen' and can take appropriate emergency action that includes orders to treat and to prevent movement of a pest or pathogen. This authority is implemented under IAC 312-18 which provides the guidance to locate, check, eradicate, treat and prevent movement of pests or pathogens that are newly introduced or not widely established in Indiana.

Other agencies and organizations share jurisdiction and provide assistance on insect and plant disease projects. USDA APHIS and USDA Forest Service are two federal agencies that work closely with DEPP to prevent new infestations.

The Exotic Insects Education Coordinator position, housed in the Department of Entomology at Purdue University and funded by DEPP and supported in part by USDA APHIS PPQ, provides outreach and education materials on invasive insects and plant diseases that threaten Indiana.

**Early Detection and Rapid Response** – There are several programs in place to search for insects and plant diseases in commodities of economic importance, vulnerable habitats and ecosystems, and at risk pathways. Under these programs, the use of surveys is the primary tool to address detection. The prevention effort noted above is also part of this detection effort. For rapid response, surveying plays a crucial role to aid in the response decisions.

The DNR, USDA APHIS, and USDA Forest Service are the primary agencies that conduct surveys and rapid response efforts targeting invasive insects and plant diseases. The DNR takes the lead in performing this work but receives important operational, technical, and funding assistance from USDA APHIS and USDA Forest Service.

These efforts are further supported by the Cooperative Agricultural Pest Survey (CAPS). CAPS was established in 1982 as a combined federal and state effort to collect and manage data on plant pests, weeds, and biological control agents. Funded by USDA APHIS and cooperatively administered by the DNR and Purdue University, CAPS utilizes the knowledge of these agencies to direct survey work for invasive insects and plant diseases that threaten Indiana's resources. The goals of CAPS are to provide early detection of exotic plant pests and weeds, supply timely and accurate plant pest and weed distribution data to support export of US agricultural products, and to maintain a pest information database to support cooperative management of Plant Pest Quarantine program pests and biological control programs while continuously enhancing the CAPS communication network.

Another cooperative effort in place is the Forest Health Program which is housed in the DNR – Division of Forestry and funded by the USDA Forest Service. The Forest Health Program conducts surveys for forest health problems which include invasive insects and plant diseases. The Forest Health Program works cooperatively with the above mentioned agencies to conduct surveys and management efforts against exotic invasive species such as Gypsy Moth and Emerald Ash Borer.

Other cooperators in early detection include Purdue's Cooperative Extension Service, Purdue's Plant Pest Diagnostic Lab, and the Indiana Crop Improvement Association. The Cooperative Extension Service shares information on pests and pathogens and in doing so enhances the survey for the pest or pathogen. The Plant Pest Diagnostic Lab provides the examination, identification and official determination of a pest or pathogen. The Indiana Crop Improvement Association works under an agreement with the DNR – Division of Entomology and Plant Pathology to survey crop fields for pests and pathogens providing data to support the sale and movement of various grains in domestic and international trade.

Control and Management – To control and manage new invasive insects and plant diseases, the first goal and response is to eradicate the species; this effort is usually funded totally by federal agencies such as USDA APHIS. However, for well established species eradication is usually not feasible and instead, a variety of control methods are employed to minimize the impact of the invader.

In agriculture, many invasive insects are controlled with pesticides such as those used for the control of cereal leaf beetles or those found in the newly developed transgenic host plants which reduce populations of European corn borer. In other cases, invasive insects are the subject of classical biological control programs such as those employed for the eastern alfalfa weevil or the soybean aphid. The effort to develop control technologies and management strategies depends on the perceived economic value of the commodity, habitat or ecosystem at risk. For most insects and plant diseases, farmers bear the increased cost of chemical control of new invasives to address the potential for decreased productivity.

The Gypsy Moth Slow the Spread Program (STS) in Indiana has been very successful in managing this exotic insect that threatens 80% of Indiana's forest and tree resource. Its goal is to reduce the spread rate to 6 miles per year. From 2000 when STS began, the program has effectively utilized federal and state funding sources to reduce the spread rate to 3.6 miles per year in Indiana. Over this period, \$5,362,785 has been expended on STS, which represents \$3,713,475 of federal and \$1,649,310 of state funds, or for every dollar expended, \$0.31 is state funds and \$0.69 is federal funds.

Control efforts must be species- and area- specific and must be flexible as situations change over time, as they have for EAB. First detected in Michigan in 2002 and in Indiana in 2004, the initial management goal of state and federal EAB programs was eradication. However, further surveys, research, economic analysis and evaluation indicated that eradication was not only too costly but unachievable on a national basis. Indiana was the first to realize that the costs of eradication were too great and the ability to achieve



eradication from a biological and technological basis was not feasible. Currently, Indiana cooperates with other infested states to conduct management work—survey, information and education, quarantine management, and research - to develop better methods to address EAB.

## E. Terrestrial Invasive Vertebrates

**The problem** Birds were some of the first invasive vertebrates introduced in the United States. Rock pigeon (early 1600s), English or house sparrow (1850s), European starlings (1890s), and the house finch (1940s) are now well established throughout the states.

There are also a number of relatively new introductions of invasive vertebrates in Indiana. Feral hogs have been present in the state for a number of years and in a few locations a sizeable population has been established. Feral hogs were almost certainly illegally introduced by individuals wishing to be provided with another hunting opportunity, and are now documented in at least 14 counties. Mute swans have been present in the state for decades, commonly as domestic pets. The population of wild mute swans is increasing not just in Indiana but in other northern states. Indiana herpetologists are concerned about two species that have recently invaded. The river cooter, a turtle native to the southeastern US, has been observed increasing in abundance in Indiana recently. The European wall lizard has an established population at the Falls of the Ohio State Park near Clarksville.

There are several other invasive vertebrates that have the potential to arrive in Indiana. Monk parakeets, which are popular in trade, have established in climates similar to ours. Eurasian collared doves are rapidly expanding throughout the eastern United States. Many states in the Midwest have records for this species and sightings are increasing. There are a couple of confirmed records of collared doves in Indiana but it is not known whether this species is reproducing in our state. Nutria, a large rodent native to South America, was brought to the southern US for the fur farming industry. Nutria are now established in the wild and are approaching southern Indiana. The three-toed box turtle, a popular species in the pet trade, poses a threat if it gets into the wild as it will hybridize with our already decreasing population of native box turtle.

**Why do terrestrial invasive vertebrates do so well?** Introduced species may not have the predators of their native range to keep their populations in check. Some species, like feral hogs, have a very high reproductive capacity so once they are introduced their population can increase rapidly. Feral sows can produce two litters a year with four to ten piglets in each; within just a few years, hog numbers can explode in an area. Nationwide it is estimated that the feral hog population has increased 125% between 1988 and 2004.

**How do terrestrial invasive vertebrates get here?** Invasive vertebrates are getting into Indiana primarily through legal and illegal trades. Feral hogs are presumed to have been brought into the state illegally to provide an additional hunting opportunity. Non-native birds that have a high potential of establishing in our state are currently in trade including mute swans. In addition, turtles and reptiles are popular in pet trades and unfortunately often get released into the wild when the owner no longer wishes to care for the animals.

### **How do terrestrial invasive vertebrates endanger Indiana's resources and citizens?**

Competition with native vertebrates – Exotic species will compete with native wildlife for food and space. Mute swans are very territorial especially during nesting and will drive native waterfowl from the area. Feral hogs cause significant damage to forest habitats, reducing forage for native wildlife, including white-tailed deer. Nutria consume large amounts of wetland vegetation that could impact the numbers of other



*Feral hogs carry disease, cause damage to crops and forests, and are starting to establish in Indiana (Courtesy of The Samuel Roberts Noble Foundation, Ardmore, Oklahoma)*

vertebrates, like waterfowl, that use the same habitat. Non-native reptiles and amphibians can compete with native species, some of which are already in decline.

Potential carriers of diseases – Introduced wildlife could be a carrier of a disease that could harm our native wildlife. Feral hogs carry at least 30 important viral and bacterial diseases that can be passed to domestic hogs, other animals, and humans. Bait salamanders have been shown to be a carrier of chytrid fungus, a fungus responsible for deformities observed in frogs and toads.

Agricultural damage – Feral hogs can cause substantial damage to agricultural crops; Texas, the state with the largest feral hog population, reports the annual damage to agriculture at \$51.8 million. Nationwide, the estimate of feral hog damage is \$800 million per year.

Natural areas damage – Species like feral hogs cause tremendous damage to forests and other natural areas by rooting through the soil and wallowing. These kinds of damage also allow invasive plant species to move into and dominate disturbed areas.

Human conflicts with wildlife – Mute swans will become very aggressive toward humans while nesting and rearing young. People have been seriously hurt and even killed when attacked by swans. Feral hogs when rearing young can also be aggressive toward humans

### ***Existing efforts***

Prevention – An animal import permit must be obtained before a person can import a mammal, bird, reptile, amphibian, mollusk or crustacean for release or for sale for release in Indiana. (312 IAC 9-10-20). Permits are also necessary to possess dangerous animals (312 IAC 9-11-15). There are a large variety of non-domesticated vertebrate animals available in the pet trade, and shared jurisdiction between USDA APHIS, US Food and Drug Administration, and state agencies results in significant challenges to establishing clear laws and guidance on these species. For instance, after the monkey pox scare of 2003 (see the following section on animal diseases), import of all African rodents was banned at the federal level. However, there is no restriction or process in place to screen rodents from other continents, which may carry diseases just as detrimental. **A screening process would be beneficial to determine which of these species have a high risk of carrying diseases, or establishing as invasive species in Indiana.**

Early Detection and Rapid Response – There is limited early detection or rapid response initiated in Indiana for invasive vertebrates. Most invasive vertebrate discoveries are the result of public reports. While there are wildlife surveys that take place, few of the surveys are designed specifically to detect new invasive species. Waterfowl counts do include counts of mute swans, but they are not designed specifically for detection of swans. Non-game biologists conduct surveys and at times discover invasive species, but in most cases those surveys are not designed as an early detection tool.

In 2006 and 2007 the Division of Fish and Wildlife actively surveyed waterfowl in an effort to detect high pathogen forms of avian influenza. Since 2006, the Division of Fish and Wildlife, the Board of Animal Health, and USDA APHIS have collaborated in a request for the public to report sightings of feral hogs to better establish their range in Indiana.

Control and management – There are a few control and management options available to deal with invasive vertebrates, and eradicating them once established is very difficult. Hunting and trapping can be effective tools for some of the larger organisms such as feral hogs, mute swans, and nutria. With aggressive action taken soon after detecting an invasive vertebrate, it is possible to eradicate species like feral hogs. Several years ago the State of Illinois aggressively pursued feral hogs that had established in their state and killed all known populations. A 2006 USDA APHIS study contracted by the Midwest Association of Fish and

Wildlife Agencies recommended an aggressive effort, conducted by both state and federal agencies, to attempt to halt the spread of feral swine populations in the Midwest and, where possible, reduce or eliminate existing populations. In Indiana, feral hogs may be hunted at any time of year, but this is not well known or publicized (312 IAC 9-3-18.5b)

There is an administrative rule that allows English sparrows, starlings, and pigeons to be taken at any time (312 IAC 9-4-15). Reproductive intervention (e.g. addling eggs) can be used to reduce successful nesting for mute swans and they can be hunted through permit. While scaring birds away does not decrease the population of the invasive species, it mitigates against the negative effects of the birds.

## F. Animal Diseases

**The problem** Invasive animal diseases impact both livestock and wild animals in Indiana. Since contagious bovine pleuropneumonia was first found in the US in the 1800s, foreign animal diseases have been a source of economic hardship to the citizens of Indiana, and regulatory efforts have been established to decrease the impacts of disease to the animal livestock production industry. In an effort to keep our food supply safe, give the public wholesome food at a reasonable price, and maintain livestock production as an important part of our economic life, the United States Department of Agriculture (USDA) and state animal health agencies have developed programs to control, manage and eradicate severe infectious diseases that threaten the food supply and livestock industry in this country. Species brought from these countries may bring diseases that are novel or re-introduce something that was eradicated—any of which could devastate our animal populations. For example, foot-and-mouth disease, which was eradicated in 1929, would mean huge economic and personal losses for the livestock industry if reintroduced. Feral hogs, an invasive animal species in Indiana, can carry at least 30 important viral and bacterial diseases, including foot-and-mouth disease. In addition to disease organisms, feral hogs carry at least 37 parasites that affect people, pets, livestock, or wildlife.



*Cow with acute foot-and-mouth disease showing excessive salivation (Gray Book)*

There are a number of invasive animal diseases that are of concern to wildlife in Indiana. Chronic Wasting Disease (CWD) was found in Wisconsin's and northern Illinois' white-tailed deer populations in 2002. If this disease reaches Indiana's white-tailed deer population, it could devastate that population and severely impact the annual hunting season and the work of DNR related to that licensed sporting activity. CWD is classified in the group of Transmissible Spongiform Encephalopathies (TSE) caused by a prion. Scrapie in sheep, Bovine Spongiform Encephalopathy (BSE) in cattle and Crutchfield-Jakobs disease (CJD) in humans are also included in this grouping. BSE-infected products consumed by humans in the United Kingdom and Europe resulted in development of a new disease for this classification called new variant CJD. The unknowns with this classification of neurologic diseases are critical to keeping these infections out of wild and domestic livestock populations.

The first cases of monkey pox in the western hemisphere occurred in the US in 2003, and Indiana was right in the middle of the outbreak. In April 2003, Gambian Rats and other exotic rodents were imported from Ghana to Texas. After arriving in Texas, some of the rodents were purchased by an Illinois exotic pet dealer, where they came in close contact with prairie dogs. Infected prairie dogs were sold as pets, which then infected thirty-seven humans in a six-state region. Indiana had six victims, some seriously affected (see text box). At the time of this infection the Center for Disease Control knew little about the disease. Indiana officials were quick to react and 41 quarantines were eventually issued after measures were taken to locate and euthanize infected animals.

### Dangerous Pets

*In May 2003, a Fort Wayne family visited an Indiana pet show and bought two prairie dogs as pets. Within days, one of the prairie dogs looked ill, and it eventually died. At the same time, the six-year old girl and her parents also started feeling ill and developed skin lesions. A trip to the doctor revealed they had all been infected with monkey pox by the prairie dog. The six-year old developed severe encephalitis and was hospitalized for two weeks, eventually recovering.*



*Monkey pox lesions on child's hand (Marshfield Clinic, Wisconsin)*

West Nile Virus (WNV) was unknown in the western hemisphere prior to 2001 and is now established in Indiana, causing not only harm to bird species but to humans and horses as well. There were 30 cases of WNV in humans in Indiana in 2007 and dozens of equine cases despite vaccination. The arrival of WNV across the US between 2001 and 2005 has resulted in over 1,000 human cases and many thousands of equine cases, of which about one-third of the horses were euthanized or died. While vaccine has been developed for the horse, no human vaccine has been developed. Continuing vector (mosquito) control and public education are necessary to decrease vectors and limit human exposure to this potentially debilitating and fatal disease.

Salamanders commonly used live for fish bait may not become invasive in Indiana, but they have been shown to be a carrier of a chytrid fungus (*Batrachochytrium dendrobatidis*) that causes deformities in frogs and toads.

**Why do invasive animal diseases do so well? In part, these unwelcome species do well because of lack of communication among all the organizations that deal with them on different levels.** For example, Chronic Wasting Disease is an animal disease that impacts white-tailed deer, which are under the jurisdiction of the Division of Fish and Wildlife. However, deer and other cervids in game farms are under the jurisdiction of Board of Animal Health. This shared jurisdiction requires very clear communication and coordination between these agencies; currently, such communication is hampered by the absence of a coordinating body that would provide a central forum for discussion.

From a biological perspective, these disease organisms can establish easily because resident species have not been exposed to foreign animal diseases or organisms, which means that they have not developed resistance. New diseases generally have no vaccine or treatment readily available, so losses would be devastating to both native and non-native animal species. This frequently results in widespread infection and/or death. Depopulation and euthanasia of large numbers of animals is often the only effective means of control or eradication. If the problem becomes endemic, ongoing losses and, most importantly, loss of trade and sale would devastate the economy of this state and potentially the country.

**How do invasive animal diseases get here?** Animals usually come by unregulated or accidental shipment and escape or release by owner. Because many countries still live with these diseases and do not control their movement, we have to monitor our borders for these invasive agents. Diseases are brought in by shipment of infected animals into the country which have not been cleared for arrival in US or have arrived via illegal shipment. They are also incidentally introduced by travelers abroad who bring in food products that may be carrying disease agents that enter the animal food supply or pass the infectious agent in some way to the animal population. Some of these diseases can also be of a zoonotic nature and can pass to humans from animals, like West Nile Virus and monkey pox. Tuberculosis has been largely eliminated from our livestock, protecting the human population from this once serious disease condition. Now it has reappeared in neighboring states' wildlife and threatens our livestock which could potentially mean greater risk to humans.

**How do invasive animal diseases endanger Indiana citizens and resources?**

Animal agriculture – Introduction of invasive animal species or foreign animal diseases could be devastating to the livestock industry and our food supply. Animal agriculture is a \$3 billion dollar industry in this state from “farm to fork”. It provides jobs, economic prosperity and food to citizens of our state and many other states and countries. Introduction of infectious animals or diseases could paralyze our animal agriculture industry, which could drastically affect our farm industry, trade, and safe food supply. Virtually shutting down this industry could have a dramatic effect on more than 2/3 of the population, not just farmers, but also support industries, which employ Indiana residents.

Human health – There can be significant risk to human health with zoonotic disease that moves between animals and humans. WNV and monkey pox are two examples of invasive animal diseases that can impact human health.

Wildlife – Some foreign animal diseases can spread to wildlife and greatly impact them. Foot-and-mouth disease can affect all hoofed wildlife, including white-tailed deer. WNV drastically affected the corvid (e.g. blue jays and crows) populations for a number of years after the introduction of the virus, as these birds were the most susceptible to infection. Monkey pox, if it was not quickly contained, could have spread to native squirrels and devastated their populations.

***Existing Efforts:***

Prevention – The World Animal Health Organization/Office of International Epizootics maintains a list of reportable diseases and status of countries with respect to these diseases of concern in the animal health world. The list sets standards for diagnosis of these diseases as well as establishing disease-free status for trade purposes. The Indiana Board of Animal Health staff is trained at Plum Island New York as Foreign Animal Disease Diagnosticians to identify any foreign, emerging or new disease.

Certificates of Veterinary Inspection are required along with specific testing in different species to assure movement of animals does not bring a disease outbreak with it (345 IAC 1-3-4). Even with these control measures in place, it is still possible for invasive animals and animal disease to travel into and out of this country, because there are so many points of entry and many of these species can be transported by humans incidentally or purposely to disrupt food safety and public health. Ongoing research continues into disease, control, vaccination, and treatment through the USDA Agriculture Research Service. There is also continuing help to other countries to eradicate or control potentially devastating disease, thereby limiting the risk of reintroduction of these diseases to the United States. While there is control of importation of exotic species, our borders are not sealed to these potential threats to our animal and public health as evidenced by the recent monkey pox virus outbreak in 2003. While African rodents have been banned from importation, other exotic animals are still imported from other foreign countries and are potential disease threats for our native species and livestock. **Having good communication between the agencies with jurisdiction on import of wild animals is crucial to protect human and animal health.**

To prevent the introduction of CWD all deer and elk imported to game breeder-livestock facilities in Indiana must come from suppliers whose stock are certified to be free of CWD and Bovine Tuberculosis (345 IAC 1-3-29-32). At this time, Indiana has had no positive tests for CWD or Bovine Tuberculosis.

Early Detection and Rapid Response – One targeted early detection effort taking place in Indiana is the survey of hunter killed deer to determine if CWD is present in our herd. CWD samples have been collected annually since 2002, and fortunately, no positive detections have been found. An added benefit of the CWD sampling is that Bovine Tuberculosis is also tested for when the samples are processed. A captive cervid surveillance program monitors all deer and other cervid animals farmed behind fences for CWD, tuberculosis, brucellosis, and other infectious diseases that could threaten agricultural livestock programs. This is maintained through the Board of Animal Health veterinary staff and the practicing veterinarian who serve these clients.

Brucellosis testing continues in cattle and milk product to prevent re-introduction of this devastating disease that has been largely eliminated from our domestic livestock. Wild hoofed animals and feral hogs serve as a potential source for reintroduction of this disease, which could devastate our livestock industry. Tuberculosis is one of many diseases that is screened for on meat inspection and used to keep our food supply safe for human consumption.

Control and Management – There are several invasive animal diseases that are monitored and controlled in order to minimize impacts to the livestock industries and human health. These include tuberculosis in all species, especially cattle, cervids, swine and other livestock; brucellosis in all species; pseudorabies in swine; equine infectious anemia in horses; rabies in all species; and numerous poultry diseases. Tuberculosis involves testing of animals from infected states and slaughtering suspects and reported symptomatic animals so that they do not enter the food supply. Brucellosis could devastate reproduction in cattle and all species impacting meat and milk production. Feral hogs threaten to reintroduce pseudorabies virus to domestic swine, a virus which was eradicated in our country in 2001. Equine infectious anemia has been limited to a few cases a year by testing and eliminated positive carriers in the state. Rabies vaccination of companion animals has shielded the public from rare human rabies cases, but the threat of raccoon rabies means that continued vigilance is necessary to guard against this deadly disease. The Board of Animal Health works with the poultry industry to guard against disease agents that now only affect the birds but could become human health threats, such as avian influenza.

The Board of Animal Health is involved in many programs of testing, vaccination, monitoring and control that are critical to maintaining Indiana's place in the global agricultural economy. These programs are critical not only to Indiana's animals, agricultural community and the commodities they represent, but to potential human health threats such as rabies, tuberculosis, brucellosis and avian influenza. Continuing these disease control efforts and maintaining Indiana's status in the global trading economy is vital for the animal industries in this state. Close communication with other agencies to control exotic species introduction into Indiana will definitely enhance and expand the Board of Animal Health's present efforts.



### **Chapter III. RECOMMENDATIONS**

To decrease the impact of invasive species in Indiana, the Invasive Species Task Force has several recommendations that would improve the state's ability to prevent new invasions, detect new invasions quickly and respond to them, and increase effective control and management.

#### **COORDINATION**

##### **1. Improve coordination and communication between agencies and affected stakeholders through creation of an Invasive Species Council.**

While many agencies and organizations are working on invasive species issues in Indiana, there is currently a need for better communication between them. The regulating agencies and affected stakeholders have few opportunities to discuss these issues, which has led to a lack of effective invasive species coordination, inventory and data management, prevention activities, early detection efforts, and control and management activities. When communication does take place, it is almost always in reaction to a newly arrived invasive species, rather than a proactive discussion of how to prevent new invasive species.

Further, the science and economics of the impacts and management of invasive species is more than one person or one agency can expertly know or expertly implement as policy. The subject matter demands the expertise of a representative council to address the science and the policy issues in a way that results in an outcome that is fair and practical. A council with differing expert knowledge, and differing authorities over affected persons in this state, and differing policy arenas, will provide the best and most logical attempt to address these issues.

It is recommended that an Invasive Species Council be formed through statute to fill this role. The Invasive Species Council's (ISC's) purpose would be to increase communication between authorities and affected parties; to assist in developing consistent and cohesive policies for state agencies as well as accountability for their invasive species actions; coordinating data collection/management to support prevention and early detection-rapid response; to coordinate outreach and education activities; and to get appropriate resources to invasive species managers. The ISC is further discussed in Appendix E and would be charged with accomplishing the recommendations that follow which are noted with [ISC].

#### **INFORMATION AND COMMUNICATION**

##### **2. Develop and share information resources to target management in a cost-effective manner [ISC – Duty 2].**

Everyone agrees that prevention and early detection are the most cost-effective ways to address invasive species, but these strategies depend on knowing where invasive species are in Indiana and where they aren't. Currently, there is no agency charged with gathering and maintaining data on invasive species in Indiana. The ISC will address this deficiency and establish a lead agency for each taxon (plants, insects and plant diseases, aquatics, animal diseases) to develop and maintain a unified data management system for Indiana. This information is crucial for agencies and land managers to determine which new invasive species threaten which parts of Indiana, whether eradication of new infestations is feasible, and what are appropriate control strategies.

##### **3. Coordinate with other Midwest state governments as well as regional and federal agencies and other relevant organizations on common invasive species issues to increase consistency and effectiveness of programs [ISC – Duty 3].**

Invasive species don't stop at Indiana borders, and neither should the communications about invasive species. There are existing efforts to coordinate beyond our borders through participation in the Mississippi Basin Panel on Aquatic Nuisance Species, the Great Lakes Aquatic Nuisance Species Panel, the Midwest Exotics Forest Pest Workshop, the Central Plant Board, and the Midwest Invasive Plant Network. There is also shared jurisdiction and coordination with federal agencies on many invasive species issues. The Invasive Species Council will reach out broadly to other Midwest states, regional groups, and federal agencies to find and import the best examples of prevention, early detection, and control of invasive species.

**4. Work with agencies and organizations to coordinate a comprehensive education and outreach effort to share new information and best practices, including convening or supporting invasive species meetings [ISC – Duty 4]**

There are many entities in Indiana that have produced educational products on invasive species, but the products have not been disseminated well to the target audiences, and the lack of coordination between entities has resulted in the independent production of multiple similar products. The Invasive Species Council will coordinate what educational materials are needed, with what message for which audience, and what entity should produce them. The educational effort should focus on ways to prevent invasive species and early detection material, but identification and control should be addressed as well.

Research on invasive species impacts and control methods has increased dramatically as the threat posed by invasive species has become clear. To get those research results into the hands of landowners and land managers, the ISC would convene or support at least one invasive species conference per biennium in Indiana. These conferences would be organized with the help of partners such as the Indiana Academy of Science, the Midwest Invasive Plant Network, Indiana Native Plant and Wildflower Society, the Midwest Association of Fish and Wildlife Agencies, and the Center for Aquatic Conservation at the University of Notre Dame.

**POLICY AND PRACTICE**

**5. Improve the consistency and efficiency of state agencies' invasive species policies and procedures. [ISC – Duty 5]**

Given the many state agencies and their varied missions in Indiana, it is not surprising that there are inconsistencies in policies and practices on invasive species between them. In some cases, one state agency is actively working to eradicate or control an invasive species that other agencies have deliberately introduced. To assure wise use of state funds, the Invasive Species Council will provide a regular forum for reviewing current state agency policies and practices to identify ways to improve consistency and address any deficiencies.

**6. Allocate appropriate resources to invasive species efforts to improve prevention, early detection, and control and management in Indiana in a cost-effective manner.**

**A. Executive Director of the Invasive Species Council position:** In order to coordinate the many duties of the Invasive Species Council, an Executive Director is needed. The Executive Director will coordinate all aspects of the ISC's duties and actions, including setting meetings, assuring Council members fulfill their roles and complete their assignments, reporting to the legislature on steps taken and priorities for funding. Since this individual will be expected to work with all state agencies responsible for invasive species, the Executive Director position should be based outside of these

agencies in a neutral location. **It is recommended that an Executive Director position be created and housed at Purdue University.**

**B. Emergency Invasive Response fund:** When a new invader like *Hydrilla* appears in the state, moving quickly to address it is crucial. Response time is limited by having no emergency funds to pay for eradication efforts. Such funds can be used to provide match for federally available dollars otherwise unavailable to the state. **It is recommended that \$2 million funding be established in a DNR capital account within the OMB for funding emergency rapid response by the DNR for new invasive species that threaten key resources in Indiana.**

**C. Terrestrial Invasive Species Coordinator position:** The position of Aquatic Invasive Species Coordinator within the Division of Fish and Wildlife has allowed Indiana to make tremendous progress on the issue of aquatic species in the last three years (see page 17), from taking on new invaders to developing a risk assessment system to keep invasive aquatic plants out of trade. This success should serve as a model for a complementary position, that of the Terrestrial Invasive Species Coordinator. **It is recommended that a position of Terrestrial Invasive Species Coordinator be created within the DNR.**

**D. Invasive plant management grant funds:** There are funds for regulated invasive species in place in each regulatory agency, though these funds are limited. There are also small amounts of money available to control invasive species on state land. However, this is not much use if there are no resources available to control invasive species on the private lands surrounding state lands. **It is recommended that \$1 million be appropriated per annum to serve as a source for grant money to manage invasive plants. This money would be administered by a state agency and be allocated on a 1:1 match basis to cooperative groups of landowners working on invasive plant management around the state.**

## LEGISLATION

### **7. Amend statutory language to allow more effective implementation of invasive species regulations**

Existing statute in Indiana allows the regulatory agencies – Department of Natural Resources, Board of Animal Health, and Office of Indiana State Chemist – to address invasive species in the state. A few changes and additions to statute will simplify implementation of the statutes.

**A. Clarify spatial scale of DNR – Division of Entomology and Plant Pathology quarantine authority.** Quarantine authority for DEPP within IC 14-24-4.2 (declaration of infested areas) should be amended to allow quarantines to be established based on the appropriate spatial scale – township, county, watershed, or other spatial measure – rather than only by township.

**B. Clarify DNR – Division of Entomology and Plant Pathology authority for pests and pathogens to include those that impact the environment.** The current wording of IC 14-8-2-203 limits DEPP authority to pest and pathogens that impact only “nursery stock, agricultural crops, other vegetation, or bees”. This list should be amended to also include the environment, in order to address impacts to lakes or other resources that are impacted by pests and pathogens. This is consistent with IC 14-24-2-5 that gives DEPP authority for emergency actions when pests or pathogens may cause environmental hazards.

**C. Establish civil penalty authority for the DNR.** When invasive species regulations are violated, the DNR does not have authority to apply penalty fees. Civil penalty authority for the DNR would

allow a penalty schedule to be established for potential violations, increasing the effectiveness of these regulations.

**Appendix A. Establishment of Indiana Invasive Species Task Force.**

**Indiana Invasive Species Task Force**

**NATURAL RESOURCES STUDY COMMITTEE (IC 2-5-5-1)**

**THE COMMITTEE IS CHARGED WITH STUDYING THE FOLLOWING TOPICS:**

**A. Impact of invasive species in Indiana (HCR 86 and SCR 75)**

*That the Legislative Council is urged to direct the Natural Resource Study Committee (Committee) to study the impacts of invasive species in Indiana.*

*That the Committee, if so directed, shall establish a task force to study the economic and environmental impacts of invasive species in Indiana and provide findings and recommendations on strategies for prevention, early detection, control and management of invasive species to minimize these impacts.*

*That the task force, if established, shall be composed of the following members:*

*(1) the State Entomologist or his designee;*

Phil Marshall, Acting State Entomologist  
Department of Natural Resources – Division of Entomology and Plant Pathology  
402 W. Washington St., Rm W290  
Indianapolis, IN 46204-2748  
317-232-4120  
pmarshall@dnr.in.gov

*(2) the State Chemist or his designee;*

Dr. Robert D. Waltz, Indiana State Chemist and Seed Commissioner  
Purdue University  
175 S. University St.  
West Lafayette, IN 47907-2063  
765-494-1492  
rwaltz@purdue.edu

*(3) the Director of the Animal Board of Health or his designee;*

Dr. Sandra Norman  
Indiana State Board of Animal Health  
805 Beachway Drive, Ste. 50  
Indianapolis, IN 46224-7785  
317-227-0323  
snorman@boah.in.gov

*(4) the director of the Purdue Center for Crop Biosecurity and Invasive Species or his designee; (this center is now inactive; chair of Invasive Plant Species Assessment Working Group and State Aquatic Invasive Species Coordinator substituted instead)*

Ellen Jacquart, Chair of Invasive Plant Species Assessment Working Group  
The Nature Conservancy

1505 N. Delaware #200  
Indianapolis, IN  
317-951-8818  
[ejacquart@tnc.org](mailto:ejacquart@tnc.org)

Doug Keller, Aquatic Invasive Species Coordinator  
Department of Natural Resources –  
Division of Fish and Wildlife  
402 W. Washington St., Rm W273  
Indianapolis, IN 46204-2748  
317-234-3883  
[dkeller@dnr.in.gov](mailto:dkeller@dnr.in.gov)

*(5) a representative of the nursery and landscape industry;*

Indiana Nursery and Landscape Association  
President Rick Haggard (or his designee)  
CM Hobbs Nursery  
1201 S. 1050 E  
Indianapolis, IN 46231  
(317) 837-8301  
[rhaggard@cmhobbs.com](mailto:rhaggard@cmhobbs.com)

*(6) a representative of a conservation group;*

John Miller, President  
Oak Heritage Conservancy  
P.O. Box 622  
Aurora, IN 47001  
513-404-8268  
[quercusalba@embarqmail.com](mailto:quercusalba@embarqmail.com)

*(7) a representative of a city park; and*

Keith Ruble, Superintendent  
Vigo County Parks Department  
Vigo County Annex Building  
155 Oak Street  
Terre Haute, IN 47807  
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*That the task force shall issue reports and recommendations to the Natural Resource Study Committee when it first meets in 2008. The Natural Resource Study Committee shall then issue a final report with recommendations back to the Legislative Council by November 1, 2008.*

**Appendix B. Organizations represented by or consulted by the Indiana Invasive Species Task Force**

Board of Animal Health  
Indiana Chapter of the Society of American Foresters  
Indiana Chapter of The Nature Conservancy  
Indiana Conservation Alliance  
Indiana Department of Natural Resources  
    Division of Entomology and Plant Pathology  
    Division of Forestry  
    Division of Nature Preserves  
    Division of State Parks  
    Division of Fish and Wildlife  
Indiana Hardwood Lumbermen's Association  
Indiana Lake Management Workgroup  
Indiana Native Plant and Wildflower Society  
Indiana Nursery and Landscape Association  
Indiana Wildlife Federation  
Invasive Plant Species Assessment Working Group  
Natural Resource Conservation Service  
Oak Heritage Conservancy  
Purdue University  
    Cooperative Extension Service  
    Department of Entomology  
    Department of Botany and Plant Pathology  
Southern Indiana Cooperative Weed Management Area  
University of Notre Dame – Center for Aquatic Conservation  
Vigo County Parks and Recreation Department



**Appendix C. Invasive Species Task Force newsletters.**

The three newsletters on the following pages were created to summarize and disseminate the work of the Invasive Species Task Force between December 2007 and April 2008.

DECEMBER 2007

# NEWSLETTER OF THE INVASIVE SPECIES TASK FORCE

Created by the Natural Resources Study Committee, October 2007



## What is the Invasive Species Task Force?

During the 2007 legislative session, Representative Clyde Kersey introduced House Bill 1087 to study the eradication and containment of bush honeysuckle and to make recommendations to the Natural Resources Study Committee. He filed this bill because his local parks were struggling to eradicate Amur bush honeysuckle (pictured above), which threatens much of the Vigo County Parks' landholdings.

The Nature Conservancy met with Representative Kersey to discuss his bill and to suggest that possibly he expand that to include the breadth of invasive species. While Amur bush honeysuckle may be one of the worst plant invaders, there are many other species of great concern to landowners, including aquatic invasive species (like hydrilla), invasive insects and plant diseases (like emerald ash borer), invasive vertebrate animals (like feral hogs), and invasive animal diseases (like Chronic Wasting Disease in deer), each with its own costs.

In addition to the existing invasive species in Indiana, there is also the important issue of preventing further invasions and detecting new invasions quickly and responding. As an example, we are all familiar with kudzu pictured to the left. While there are currently relatively few sites of this nasty vine in the state, it has the



potential to cover many acres if left unchecked. Not only can it strangle out native vegetation, kudzu also serves as an alternate host for a new invasive plant disease moving into Indiana – Asian soybean rust. The economic implications to farmers are clear, and the state has responded by working to eradicate kudzu from Indiana. Representative Kersey agreed to the expansion recognizing that bush honeysuckle would be in good company as invasive species are addressed.

### \$\$\$ \$\$\$\$ *Economic Impacts* \$\$\$ \$\$\$\$

#### *Did you know?*

- Invading alien species in the United States cause major environmental damages and losses adding up to almost \$120 billion per year (Pimental *et al.*, 2005)
- The establishment of one exotic fungus in the U.S. – Asian soybean rust – is expected to cause annual losses averaging between \$240 million and \$2.0 billion to farmers. This rust was found in Indiana for the first time in 2006.
- It is estimated that if the emerald ash borer (EAB), an insect that has already killed millions of ash trees in the Midwest, is not contained or eradicated it will cost state and local governments \$7 billion over the next 25 years to remove and replace dying ash trees. EAB invaded Indiana in 2004; there are now 16 infested counties in northern and central Indiana.

Senator Landske was then contacted about being a Senate Sponsor, to which she agreed. Her district has not only been impacted by terrestrial plant invaders, but by invasive aquatic plants. Since Representative Kersey's bill was not heard in committee, both Representative Kersey and Senator Landske introduced concurrent resolutions. As a result, the Legislative Study Committee assigned this topic to the Natural Resources Study Committee.

## The Natural Resources Study Committee's Assignment.

The Study Committee determined a Task Force would be valuable and that as the resolutions suggested, a group of technical experts would be the best to provide them with information. The Task Force was appointed and asked to study the economic and environmental impacts of invasive species in Indiana and provide findings and recommendations on strategies for prevention, early detection, control and management of invasive species to minimize these impacts. The Task force is made up of individuals representing a diversity of interests, including aquatic and terrestrial, animals and insects, and pathogens (a list is attached.)

## First Meeting of the Task Force – November 15.

At the first meeting, the task force members discussed what some of their expectations were or possible outcomes they would like to see from the work of the Task Force. Several hoped to see better oversight relative to invasive species and were open to a council and/or agreements addressed in statute or in rule.

Members also felt there exists a need for the ability to assess and respond to invasive species issues in a science-based, thoughtful way aimed at minimizing the economic and ecological impact of invasive species in Indiana.

Possible invasive species management models were discussed, including the "Gypsy Moth Slow the Spread" program, which is a multi-agency, multi-state group, formed into a Foundation that has efficiently used federal and state resources to slow the spread of gypsy moth. Also suggested was the work of the New York Invasive Species Task Force.

Others wanted to be involved to keep their groups and clients informed. Assisting landowners, possibly with a cost share program, was suggested and concern for the impacts to humans from possible exotic animals and animal diseases.

## The program of work.

A time line for the groups work was developed, which includes the presentations on the various taxa to inform and update the entire group on the status of invasive species and control/eradication efforts. The taxa include: invasive insects and plant diseases; terrestrial invasive plants, aquatic invasive species, and invasive terrestrial vertebrates, and animal diseases. Two taxa were presented at the first meeting: Invasive insects and plant diseases (pathogens) and terrestrial invasive plants.

Stakeholders were identified with whom the Task Force should be contacting and communicating throughout the process.

It was also decided that following most meetings, the entire group would visit the site of an invasive issue to get a better handle on some of the issues within each taxa.

Here is a picture of the Task Force at Fort Harrison State Park. Pictured is Keith Ruble discussing his work in Vigo County, where he is assisting Extension Forester Ron Rathfon in research on Asian bush honeysuckle control.

### *Did you know?*

- Asian bush honeysuckle is an invasive shrub found in every Indiana county
- When this shrub invades forests, it can decrease tree growth by more than 50%! For woodlot owners in Indiana, this is a significant decrease in the revenue they can expect from managing their forest.
- It can also almost stop tree regeneration, eliminating the next generation of forest



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*For more information on the work of the Task  
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## FEBRUARY 2008 NEWSLETTER OF THE INVASIVE SPECIES TASK FORCE

Created by the Natural Resources Study Committee, October 2007

Since our last newsletter, three more groups of invasive species were presented to the Task Force by Dr. Sandra Norman, of the State Veterinarian's Office, and Doug Keller, of the Indiana Department of Natural Resources, Division of Fish and Wildlife. They shared headline-worthy accounts of invasive fish that can literally knock people out of boats and a weed that can destroy a lake for fishing and boating (photo right.) We also heard an account of an animal disease infecting pet prairie dogs (photo below left) that was stopped before it could spread, possibly threatening human health and native animals such as squirrels. To read more detail on the first two meetings, go to [www.invasivespecies.in.gov](http://www.invasivespecies.in.gov).



Permission to use Photo by Brian Nelson



We have now heard from experts on: terrestrial invasive plants, invasive insects and plant diseases, aquatic plants and animals, vertebrate invasive animals, and animal diseases. Experts have shared information about the species of concern to them and their organizations, the status of

these species, methods of controlling and/or eradicating, state laws and regulations governing each taxon and any needs for changing statute or regulation.

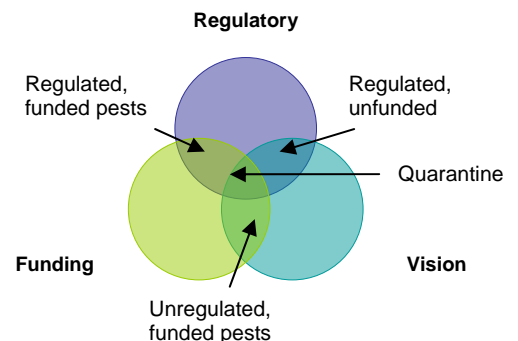
### Consideration of Subgroup Document

A subgroup of the Task Force met in December to discuss issues raised at the first task force meeting and develop 'straw man' suggestions for addressing those issues. The subgroup focused on the need for more coordination on invasive species, as well as the need for better data management. They also considered the lack of capacity to address invasive species, and the benefits of stronger, clearer, and more consistent policies on invasive species in state agencies. Most of the discussion was spent on the coordination issue, using the Venn diagram at right to guide them.

At the full Task Force meeting in January, the subgroup presented a model structure of an Invasive Species Council, its roles and duties. There was lively discussion about the formation of such Council and the associated

### Did You Know?

- Hydrilla was found for the first time in the Midwest in August 2006 in Lake Manitou (near Rochester, Indiana)
- This aquatic weed has destroyed hundreds of lakes for fishing, boating and swimming in the southern U.S.
- To keep this weed from destroying Lake Manitou and spreading to other lakes it will cost **\$2 million over five years** to eradicate it.



responsibilities. A new draft of the model structure incorporating these comments is being shared by Task Force members with their constituencies to get broader input on any necessary changes. At the March meeting, the Task Force will be compiling, debating and refining the model, based on input from various constituencies. A finished document will be prepared and shared with the selected legislators for their input and guidance.



Gambian rats sold as pets can carry monkeypox infections  
(Photo source unknown.)

### ***Dangerous Pets...***

- RATS! In April 2003, Gambian Rats (photo left) were imported from Ghana to Texas.
- After an outbreak of monkey pox, the infection was traced back to these rats.
- After arriving in Texas, some of the rats were purchased by an Illinois exotic pet dealer, where they came in close contact with prairie dogs.
- Infected prairie dogs were sold as pets, which then infected humans (see photo below) and other pets.
- At the time of this infection the CDC knew little about the disease.
- Indiana officials were quick to react and 41 quarantines were eventually issued after measures were taken to locate and euthanize infected animals.
- Prairie dogs seemed to be both the victim of the monkeypox and the vector for human infection.
- Such exotic animals are frequently sold at "swap meets" in Indiana.



Close-up of monkeypox lesions on the arm and leg of a female child. (Photo source unknown)

### **Six easy ways you can help stop the spread of invasive species:**

- Verify that the plants you are buying for your yard or garden are not invasive. Replace [invasive plants](#) in your garden with non-invasive alternatives. Ask your local nursery staff for help in identifying invasive plants!
- When boating, clean your boat thoroughly before transporting it to a different body of water.
- Clean your boots before you hike in a new area to get rid of hitchhiking weed seeds and pathogens.
- Don't "pack a pest" when traveling. Fruits and vegetables, plants, insects and animals can carry pests or become invasive themselves. Be sure to clean your bags and boots and throw out any food when you travel from place to place.
- Don't release aquarium fish and plants, live bait or other exotic animals into the wild. If you plan to own an exotic pet, do your research and plan ahead to make sure you can commit to looking after it.
- Volunteer at your local park, refuge or other wildlife area to help remove invasive species. Help educate others about the threat.

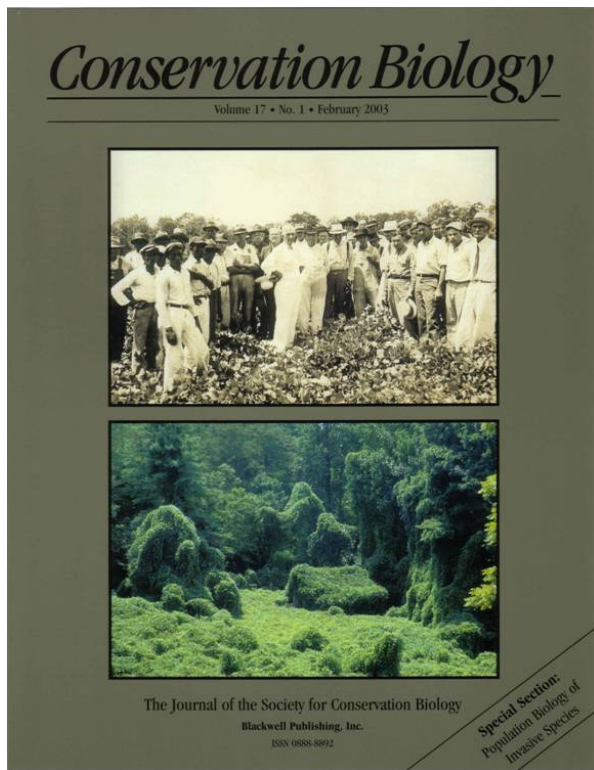
APRIL 2008

# NEWSLETTER OF THE INVASIVE SPECIES TASK FORCE

Created by the Natural Resources Study Committee, October 2007

## Final Presentation

In March, the Task Force heard from Dr. David Lodge, Director of Aquatic Conservation at the University of Notre Dame. Dr. Lodge provided information to put a federal context on the work of the members of the Invasive Species Task Force. He began his presentation with a slide of the February 2003 cover of the journal, *Conservation Biology* (pictured to the left.)



As it turns out, this is a picture of a group of Alabama farmers in the early 1900s, including his grandfather, who were proudly photographed for their efforts to improve soil and reduce erosion in the cotton fields they farmed. Kudzu, a legume, was planted for its nitrogen building characteristics and to control soil erosion. Unfortunately, the plant has been moving north ever since and is a dangerous invasive plant that has been banned in Indiana.

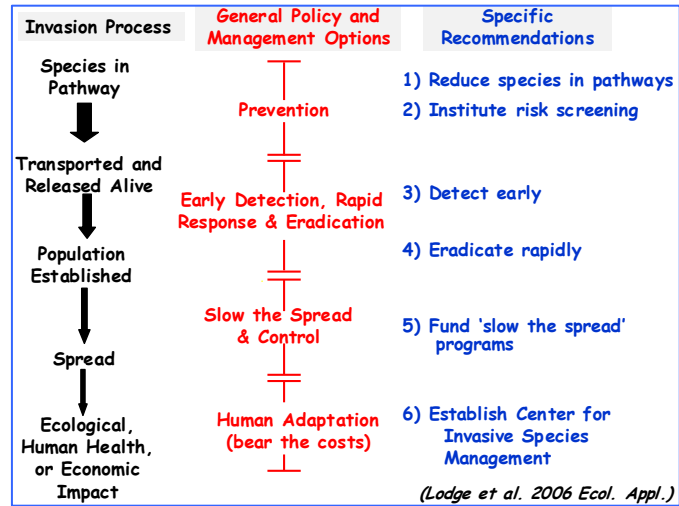
When it comes to a species like kudzu, you must look at the net effect—it may provide some benefits, but is the harm it causes greater than the benefits? He emphasized that we have learned much about invasive species since his great grandfather died, yet his kudzu legacy lives on and the family still spends a lot of time managing kudzu on this farm. Once an invasive species is here, it is often very difficult and very expensive to eradicate.

What is an invasive species? According to the National Invasive Species Council, it is a non-native species that causes or has the potential to cause environmental or economic harm, or harm to human health. Other common terms for 'non-native species' include exotics, aliens, or nonindigenous

species. The National Invasive Species Council was created through Executive Order 13112 in 1999, and they released the first National Invasive Species Management Plan in 2001.

The chart at the top of the next page clearly shows the invasion process, policy and management options and specific recommendations. Dr. Lodge focused his presentation on the first two recommendations because they are important in prevention: reducing species in pathways and instituting a risk screening process. With its connection to the Great Lakes, Indiana is in a major pathway for introductions. The Great Lakes themselves have over 190 invasive species. Much of these have come through shipping, such as zebra mussels. As these species arrive, we tend to fixate on the damage they cause--ecological, human health, or economic impact—rather than how to stop the *next* invader.

Today we have more pathways of invasion than ever before. It's not just plants, but animals, pathogens and aquatic species that are invading. All of the pathways can be put into two categories – they are either transportation related or from commerce in living organisms. Transportation includes all the modes: air, land and water. It includes all the packing materials and containers, as well as the mail and internet sales. It includes all the travelers and all their accoutrements. Commerce breaks down into three major types, plants in trade, non-food animals (pet, aquarium, research, hunting, breeding, etc.), and food, i.e. organisms for consumption. Pathways of invasive species are difficult to control because there are so many ports of entry in the U.S.



To prevent the import of invasive species, the federal government has adopted statutes over time such as the Lacey Act of 1900, the Public Health Service Act of 1946 and the Plant Protection Act of 2000, as well as the Animal Protection Act of 2002. All of these statutes have flaws, and could be significantly improved. A tremendous step forward would be to institute a risk screening process at the federal level to evaluate the invasiveness of species *before* they are allowed into the U.S. Recent scientific advances allow 80-90% accuracy in risk assessment.

Australia has used a pre-import screening tool for over 10 years. According to a recent publication (Keller et al. 2006), this screening process has paid for itself by keeping dangerous species out, leading to significant reductions in control costs. Ultimately, such screening tools allow you to achieve both environmental and economic goals.

(For more detail on this presentation or any of the other meetings, go to [www.invasivespecies.in.gov](http://www.invasivespecies.in.gov).)

### Consideration of Draft Findings and Recommendations Document

The Task Force members had been sent an advance copy of a new draft "Findings and Recommendations" document. Discussion began with the definitions and authorities and what are needed. After lengthy discussion, task force members agreed to work on definitions and a better summary paragraph of "The Problem."

The members were particularly challenged to consider whether the report provides clear priorities and whether or not there are changes or clarifications that need to be made to statute and rule.

Up until this meeting there had not been any discussion of funding for management. If funding were recommended, what would this do and how would it bring partners that leverage public dollars?

The next meeting was set for April 22 and the Task Force members were asked to think about additional recommendations or refining those we have addressed so far, as well as to review the current Findings and Recommendations document.



## Appendix D. Executive Order 13112

### Executive Order 13112 of February 3, 1999

#### Invasive Species

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 *et seq.*), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa *et seq.*), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 *et seq.*), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

#### Section 1. Definitions.

- (a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.
- (b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.
- (c) "Ecosystem" means the complex of a community of organisms and its environment.
- (d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.
- (e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.
- (f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.
- (g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.
- (h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.
- (i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.
- (j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

#### Sec. 2. Federal Agency Duties.

- (a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,
  - (1) identify such actions;
  - (2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and
  - (3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.
- (b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

**Sec. 3. *Invasive Species Council.*** (a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

**Sec. 4. *Duties of the Invasive Species Council.*** The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

**Sec. 5. *Invasive Species Management Plan.*** (a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs

and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to

the Office of Management and Budget on whether the order should be revised.

**Sec. 6. *Judicial Review and Administration.*** (a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

## Appendix E. Invasive Species Council proposal.

### Purpose

Decrease the impact of invasive species in Indiana by:

- Increasing communication between state agencies, scientific authorities, resource authorities, and affected parties;
- Assisting in developing consistent and cohesive policies for state agencies;
- Increasing accountability for state agency invasive species actions;
- Coordinating data collection/management to support prevention and early detection-rapid response efforts;
- Coordinating invasive species outreach and education activities; and
- Getting appropriate resources to invasive species managers

### Justification:

While many agencies and organizations are working on invasive species issues in Indiana, there is no organized communication or coordination between them. Regulating agencies and stakeholders have few opportunities to discuss the issue, which has led to a lack of coordination of invasive species inventory, data management, prevention activities, early detection efforts, and control and management activities. To address this deficiency, it is recommended that an Invasive Species Council (Council) be formed. The Council will have a communication and coordination focus and serve as an advocate for invasive species management in Indiana. The Council will also assure that regulators regularly interact with stakeholders to ensure rules and policies are reasonable, feasible, and informed by the best scientific information.

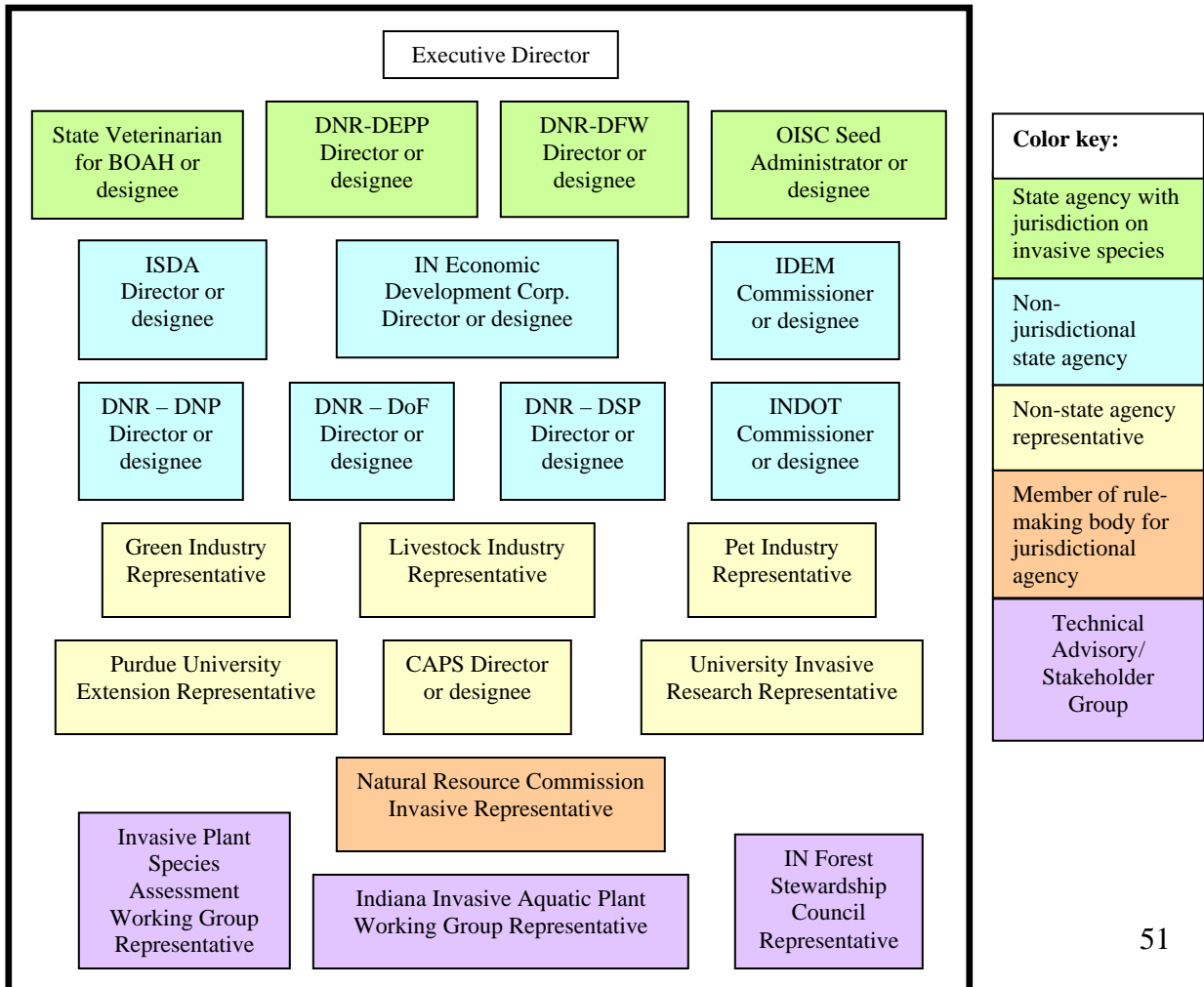
### Establishment and Structure:

- The Invasive Species Council (Council) would be created by statute.
- The Council holds no regulatory jurisdiction over invasive species; jurisdiction will continue to be held by DNR – Division of Entomology and Plant Pathology (DEPP), DNR – Division of Fish and Wildlife (DFW), Office of Indiana State Chemist (OISC), and Board of Animal Health (BOAH).
- The Council is led by an Executive Director; this position would preferably reside at Purdue University rather than in a state agency.
- A chair role for the Council rotates annually between the regulatory agencies.
- The Council shall add or eliminate council positions by majority vote as appropriate, considering whether a member or potential member represents a group either impacted significantly by invasive species or which spends significant time or resources on addressing invasive species, and is not already represented on the Council.
- The Council meets a minimum of once per year.
- The Council does not have authority to address appeals and grievances.
- Non-agency Council members will be appointed by the Governor and their terms will be three years, with terms staggered to ensure continuity.
- All Council members are voting members.

**Duties:**

1. The Council recommends priorities for invasive species projects, funding, and promulgation of rules and laws dealing with invasive species to the appropriate agencies and committees.
2. The Council addresses invasive species inventory and data management, and establishes a lead agency for each taxon (plants, insects and plant diseases, aquatics, animal diseases) to develop and maintain a unified data management system for Indiana.
3. The Council will communicate with other Midwest states, federal agencies and regional organizations to increase consistency and effectiveness in prevention, early detection, and control of invasive species.
4. The Council will coordinate education and outreach on invasive species. The Council will also convene or support invasive species meetings at least once per biennium to transfer best practices and pertinent research findings.
5. The Council will assist state agencies in reviewing their current policies and procedures on invasive species to identify deficiencies and inconsistencies that need to be addressed.
6. The Council will assist state agencies in reviewing their Performance Measures for accountability on their invasive species actions.
7. Each state agency on the Council shall report annually to the Council its actions in regard to Council recommendations.

**Indiana Invasive Species Council**



## Appendix F. References

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