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Forest Invasives in Iowa: Current Problems and Future Issues

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Iowa's forest resources of primarily deciduous trees covers over 0.8 million hectares (2 million acres) of upland and floodplain sites too steep or too wet for traditional row crop agriculture. These limited natural forests along with urban trees and shelterbelts plantings of trees are critical for environmental and economic enhancement in the state. Although not yet established in the state, exotic insects, such as gypsy moth, Asian longhorned beetle, and pine shoot beetle, threaten native tree vitality. Established exotic diseases such as oak wilt and Dutch elm disease continue to plague the survival of Iowa's oak and elm resources, respectively. Perhaps the greatest threat to Iowa's forests is from exotic plants such as garlic mustard that replace native woody natural regeneration. Due to tight fiscal and staffing limitations, a cooperative effort through the Iowa Forest Insect and Disease Management Council works to focus monitoring, management, and research on exotic forest pests in the state.

INDEX DESCRIPTORS: insect disease, forest insects, forest invasives, introduced species, gypsy moth, Asian longhorned beetle, pine shoot beetle, oak wilt and Dutch elm disease, garlic mustard, *Lymantria dispar, Anoplophora glabripennis, Tomicus piniperda, Ceratocystis fagacearum, Certicystis ulmi, Allaria petiolata.*

Our own backyards are a mini-summary of invasive species problems. For instance, my Siberian husky, Yukon, dug up my Kentucky bluegrass (*Poa annua*) lawn near my neighbor's fence while chasing their 2 m Boa snake. While chasing the snake, Yukon's fur rubbed into the Canada thistle (*Cirsium arvense*) growing along my neighbor's fence, getting thistle burs imbedded in his deep coat of fur. Later as Yukon's massive fur was shed, I watched a European starling (*Sturnus vulgaris*) scoop up the fur and make a nest into the mulberry (*Morus alba*) growing on my other neighbor's yard. This demonstrates that little events can add up to major problems in the future. This paper focuses on forest invasives, current problems with forest invasives, and how forest invasives could affect our forests in the future.

THE FORESTS OF IOWA

Iowa possesses over 2.7 million ha of tree cover in 4 classes (Jungst et al. 1998). The first is the "upland" forests dominated by oak/hickory (*Quercus/Carya* spp.) and sugar maple/basswood (*Acer saccharum/Tilia americana*) trees. The second is the "bottomland or riparian" forests dominated by elm/green ash/silver maple/cottonwood/willow (*Ulmus americana/Fraxinus pennsylvanica/Acer saccharinum/Populus deltoides/Salix nigra*) trees. The third class of forests is "urban" forests, those that grow in our cities and communities dominated by green ash, silver maple and hard maples such as black maple (*Acer nigrum*), Norway maple (*Acer platanoides*) and sugar maple. These urban forests are also home to some of the best remaining old growth bur oak (*Quercus macrocarpa*), red oak (*Quercus rubra*), and white oak (*Quercus alba*) trees in the state. The final class of forest is the "shelterbelt/windbreak" created in rural Iowa to buffer the strong winter winds. Our shelterbelts/windbreaks are dominated by non-native conifers, such as Scotch pine (*Pinus sylvestris*), Colorado blue spruce (*Picea pungens*), and arborvitae (*Thuja occidentalis*) (Van Der Linden and Farrar 1984).

Iowa's forests are dominated by private ownership. Private citizens own 92% of our forests, and most of these are farmers, who own over 60% of our forests (approximately 120 ha/farmer). These owners have a history of forest use and timber harvesting; however, the fastest growing ownership is "absentee" landowners, people who own the land but do not live on it. These absentee landowners have different goals than farmers and are less interested in generating income from their trees through timber harvesting. Eighty-five percent (85%) of our urban trees also exist on private lands, such as peoples' front and back yards.

Iowa's forests have a long history of use, from livestock grazing to timber harvesting. In all 4 Iowa forest classes, it is safe to say one tree in four is in poor condition due to: (1) past high grade or selective logging that takes the best trees and leaves the worst based upon tree size (i.e., diameter limit cutting) (2) old age as many of Iowa's oaks are 150–200 years of age, (3) site impacts due to soil compaction, development and just plain tough sites that impact root growth and sustainability, and (4) storm impacts. For the latter category, storm impacts, a variety of weather extremes have been seen during the last two decades that included: droughts, floods, ice storms, and severe winds. These extreme weather conditions caused significant damage to hundreds of thousands of hectares of Iowa's forest and increased secondary insect and disease problems (Iowa DNR 1996).

Gradually over time, due to selective and high grade logging practices on private lands, Iowa's forests are changing in species composition towards more shade tolerant species (those capable of reproducing in shade). The 1990 Forest Inventory showed that Iowa's oak resources were declining in hectares and being replaced by shade tolerant sugar maple, basswood and ironwood (*Ostrya virginiana*). In addition, our urban areas are being populated by fast growing cultivars of maple and ash, as consumers plant trees that produce quick shade (Brand and Walkowiak 1990).

The future issues of Iowa's forests reflect the reality of the condition of our current forests. Our forests have been abused over time. Iowa's forests often only exist in this agricultural state because they occupy areas that are too steep or too wet to grow crops. Iowa's forest

ownership is changing from people who make a living off of the land to people that recreate on the land. Within this setting, we will discuss exotic insects, diseases and plants that are significant threats to the existence and health of Iowa's forests.

EXOTIC INSECTS

The major exotic insects that threaten the future health of Iowa's limited forest resources are the: (1) gypsy moth (*Lymantria dispar*), (2) Asian longhorned beetle (*Anoplophora glabripennis*), and (3) pine shoot beetle (*Tomicus piniperda*).

The gypsy moth was introduced into the United States at Medford, Massachusetts in 1869 by a researcher trying to develop disease resistant silkworms. They escaped and have spread westward and southwestward. Currently, the insect infests parts of the Northeast, East Coast and upper Midwest of the United States. An United States Department of Agriculture (USDA) quarantine is in place, currently in northwest Indiana to the eastern lakeshore counties of Wisconsin, to help prevent the movement of gypsy moth. In the quarantine area, pesticides, mass trapping, and bio-controls like *Bacillus thurgingiensis* are used to slow the spread of the gypsy moths. We estimate that such measures have delayed the natural arrival of gypsy moths into Iowa by at least 10 years, and, if accidental introductions can be minimized, found, and/or treated, we may be able to keep the insect from establishing itself in the state.

The gypsy moth overwinters as eggs in egg masses that are silver dollar sized and salmon in color, and the eggs hatch in mid-May. The larvae, fuzzy with rows of blue and red spots when mature, can defoliate host trees, preferably oaks, Iowa's state tree. This defoliation puts the trees under great stress during the growing season and can lead to significant tree mortality, especially on thin or compacted soils. The female gypsy moths are whitish with thread-like antennae, but they cannot fly. However, the male moths can fly, and they find a mate with their feathery antennae that picks up female moth pheromone (McManus et al. 1989).

The Iowa Department of Agriculture and Land Stewardship (IDALS) and the USDA Animal and Plant Health Inspection Service (APHIS) has conducted a yearly statewide survey and trapping program in Iowa since the early 1970s in cooperation with the Forests and Prairies Division of the Iowa Department of Natural Resources (IDNR) and other partners. This surveying and trapping program acts as a constant vigilance regarding the introduction of the gypsy moth into Iowa from infested nursery stock arriving from other states. Egg masses are often found in dense foliage trees of spruce, and, therefore, can easily be transported when trees are shipped from infested areas into the state. New homeowners and visitors to Iowa can also introduce gypsy moths because gypsy moths place their egg masses on the undersides of picnic tables, boats, outdoor furniture, campers, and vehicles. Therefore, anyone traveling from infested areas to the east of Iowa could bring new insects into the state.

Recent catches of gypsy moths are much less than the high of 371 in 1998. In 1999, 135 male moths were caught, and in 2000, a total of 46 moths were caught across the state. Currently, the western front line for control of the gypsy moth is in south-central Wisconsin, however, transport of unauthorized infested nursery stock from eastern states pose a continual threat to the spread beyond the current range (Iowa DNR 2000).

The Asian longhorned beetle is a native of China, Korea, and Japan. The Chinese planted a principle host of the beetle, poplars, during their "green" revolution, and that caused an explosion of beetle numbers. As the Chinese use dead and dying poplar trees for wood in solid packing materials for goods, some of these beetles were inadvertently shipped to the United States. As a result, Asian longhorned beetle populations were established in several port areas, including New York City and Chicago.

The Asian longhorned beetle larvae overwinters in the sap/heartwood of host trees, preferring maple species. The mature larvae are 5 cm in length and pupate just under the bark of host trees by late summer. The adult beetles emerge from 0.5 cm holes. The adults (approximately 4 cm in length) are coal-black in color, with white spots and long antennae. After mating, adult beetles lay their eggs in niches cut in the bark. The beetle attacks and feed on "healthy" trees, with the larval mining first into the cambium and later into the sap/heartwood, girdling and weakening the tree.

Damage to trees from Asian longhorned beetle feeding girdles and kills branches and later kills the tree itself. Five quarantine areas have been established in the Chicago metro area to prevent the spread of Asian longhorned beetles. In these areas, eradication efforts to control the beetle has meant the removal of many trees from Chicago neighborhoods, many of which had lost trees during the Dutch elm disease problems of the 1960s. Five areas are also under quarantine in the New York metro area. Eradication has meant a large number of trees being removed from city neighborhoods at great expense to stop the spread of this pest. In some neighborhoods, this has meant removal of the only trees and, as a result, has led to great emotional distress (USDA APHIS 2000).

The pine shoot beetle was introduced into the United States, again in solid wood packing materials, this time from shipments of goods from Europe. Said to be the second most important pest of lumber production areas of Europe, this beetle has caused a federal quarantine to avoid further entry into our nation's softwood lumber areas. However, it has already caused considerable damage to the Christmas tree industry in the Midwestern states of Ohio and Indiana.

Currently, the pine shoot beetle has spread to a large number of counties throughout the Great Lakes region. It overwinters in niches cut into the bark at the base of healthy pine trees, and it emerges in the spring to establish galleries in dead and dying trees. These galleries are vertical passages underneath the bark of pine trees, such as Scotch and Red Pines (*Pinus resinosa*) that were commonly planted in plantations in the Great Lakes region as well as here in Iowa. The adults emerge from the wood in late summer. Before overwintering as mature adults, the beetle feeds in new shoots of host pine trees, causing yellowing of the foliage and eventual death of the shoots. While the pine shoot beetle has not yet been found in Iowa, traps are used to monitor potential arrival into the state. If they were to become established, they would threaten Iowa's extensive Christmas tree industry as well as thousands of ornamental pines used in our communities (McCullough 1994).

EXOTIC DISEASES AND PLANTS

Iowa's trees and forests also face continued threats from existing exotic diseases such as oak wilt (*Ceratocystis fagacearum*) and Dutch elm disease (*Certicystis ulmi*) along with many exotic plants like garlic mustard (*Allaria petiolata*).

Oak wilt impacts between 2,000–3,000 ha of Iowa's oak forests each year, and infection areas are scattered and spotty in nature, often making control difficult and impractical. All oaks, especially red oaks are impacted, often with quick tree mortality within 2 to 3 weeks of infection. Oak wilt spreads underground via root grafts between like oak species, and it spreads overland by nitidulid beetles species (*Colopterus* spp.) that feed on oak wilt fungus fruiting pads or structures. The control options for oak wilt has involved timber harvesting of infected trees, stopping or killing the root grafts between infected and healthy trees, the use of systematic injections with expensive fungicides in early phases of infection, and doing nothing

Table 1. Additional Non-native Species that Threaten Iowa Forests

Multiflora rose	*Rosa multiforia*
Reed Canary Grass	*Phalaris arundinacea*
Common Buckthorn	*Rhamnus cathartica*
Honeysuckle	*Lonicera* spp.
Japanese Barberry	*Berberis thungergii*
White Mulberry	*Morus alba*
Siberian Elm	*Ulmus parviflora*
Tree of Heaven	*Ailanthus altissima*

with the hope that the oak wilt will eventually die off (Iowa State University 1987).

Dutch elm disease first impacted Iowa in the 1960s when our communities had most streets lined with American elm trees (*Ulmus americana*). In a matter of a few years, hundreds of thousands of the beloved city elms were killed, forever changing the face of Iowa's urban forests. The principal overland spreader or the disease, the European bark beetle (*Scolytus multistriatus*), was another introduced species to the U. S., and this introduced species also brought the fungus associated with Dutch elm disease (Tiffany 2001).

Since the 1990s, Dutch elm disease has continued to impact 1,200–1,500 ha annually, however, new populations of American elm have sprouted back in native areas along rivers and streams. These trees have become infected, and, because of lack of immediate sanitation, removal of infected trees, Dutch elm disease has become a major problem in Iowa again. The future spread of the disease is based upon the resprouting and natural regeneration characteristics of American elm along with lack of sanitation when the disease appears. This will probably result in a 30 to 40 yr cycle of outbreak of Dutch elm disease as treatment to prevent the disease beyond sanitation will only occur on high valued trees (USDA Forest Service 1998).

Garlic mustard is an invasive, non-native plant common in many Iowa forests. Garlic mustard can become established after a forest site is disturbed, and this shade-tolerant plant can quickly dominate a forest floor. After establishment, it readily spreads into high quality forests due to its light seeds that are easily attached to animal fur and human clothing. In addition, normal flowing water can carry seeds great distances. Control is difficult requiring the use of mechanical hand pulling or cutting prior to flowering in small populations of garlic mustard. In more established areas, chemical control through Glyphosate (Roundup®) in late fall into the early spring seems most practical, but very time consuming (Blair 2001).

In addition to garlic mustard, there are numerous other exotic and invasive plants that are impacting the natural regeneration of native tree species and threatened the natural ecosystems of Iowa's forest (Table 1). All of these pose problems to the long-term health and vitality of our native forests.

From this brief overview you can see that all of Iowa's trees and forests are vulnerable to impacts from exotic insects, diseases and plants, and that private ownership and its changing demographics will make management efforts to control these problems more complicated. Constant vigilance through monitoring and eradication appears to be the best recipe for exotic species nor yer established. For already established exotic forest pest problems, expanded awareness, technical assistance, on-the-ground action, and education are the keys for control.

IOWA FOREST INSECT AND DISEASE MANAGMENT COUNCIL

With over 2.7 million ha of tree cover in Iowa, our forests have value economically to the state by employing 7,000+ Iowans in the wood products industry as well as thousands more involved in outdoor recreation. Our forests also have important values environmentally for water quality, air quality, wildlife habitat, and soil erosion control. While new forest health issues involve our stare every day, we lack both a full-time staff dedicated to forest health protection as well as the resources to expand existing programs that protect forest health.

In consultation with Iowa State University staff members, Drs. Elwood "Woody" Hart and Harold "Sande" McNab, our IDNR offices decided to establish a volunteer advisory group to assist our efforts in awareness, education, and technical assistance relating to forest health issues because we shared common issues and interests in forest health with several other organizations. In addition, we saw a lack of networking among the various natural resource organizations that work in forest health activities.

We established a "Forest Health Task Force" by calling people who had an interest in forest health to a meeting in an informal setting. During the initial meetings of 20–30 organizations, we showed the benefits of mutual cooperation through cooperative projects and funding source sharing. In addition, this task force assisted in prioritizing forest health issues and projects by providing valuable input. Finally, we demonstrared that working together in this task force would allow us to look for opportunities to expand action on the ground.

As part of the Iowa Forest Health Task Force, we joined forces with another standing advisory group called the Gypsy Moth Advisory Board. This board had been established to maintain support from the USDA, to communicate goals and objectives, to gain input, and to get consensus on a gypsy moth program for the state. The goals and objectives and even some of the members of these two groups were the same, so it seemed practical to join the two groups together.

Since the Forest Health Task Force was established in the early 1990s, it has continued to grow in interests and membership, basically through word of mouth. We decided that the term "task force" which represents a short-term group was inappropriate, and the group decided to change the name to the Iowa Forest and Insect Disease Management Council. To date, no by-laws or organization officers have been established. While the group has been informal, it has been effective in prioritizing and establishing cooperative efforts to monitor, manage, and research forest exotics in Iowa.

To keep the group viable, we are constantly challenged to expand the scope of work to new areas, for example invasive plants. We actively recruit new members for involvement and for fresh ideas when necessary. These new people are from all different organizations with differing levels of expertise. If people are interested and willing to spend time in meetings discussing forest health issues, they are welcome. We do regular communications through direct mailings and e-mails to members. Finally, both of our state offices offer assistance in fund raising and program implementation on priority projects.

The Council has discussed the concept of establishing a more "formal" organization, one that is recognized by the Governor's office as a working organization of professional members. While a more "formal" group would give members recognition and some clout with their supervisors in attending meetings, the group remains a "working" organization rather than one with political appointees, and this concept is considered critical to keep the group effective. In addition, because insects, diseases, animals, plants, and even storms impact

forest resources, the group is still expanding its areas of interests while inviting additional people to participate. In the end, the group hopes to increase awareness among elected officials through unified communications.

The Iowa Forest Insect and Disease Management Council will be expanding its work concerning exotic and invasive species. The increased size of the council may require the creation of sub-groups or standing committees to allow work to be accomplished, but we hope to maintain annual to bi-annual meetings to keep the network functioning and growing to combat the exotic threats to Iowa's forest resources.

CONCLUSIONS

Iowa faces several serious exotic insect, diseases and plants that threaten to impact the 2.7 million ha of forests. These limited forests are critical for environmental and economic enhancement in the state. Cooperative efforts are being employed by state and federal agencies, universities, professional organizations, and volunteers to monitor, manage and research these exotic pests. As these threats to Iowa's forests continue, it is our hope that additional Iowa professionals will join the Iowa Forest Insect and Disease Management Council.

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