NRCS	**Michigan Technical Note** **USDA-Natural Resources Conservation Service**

Biology #17
Invasive Species: Environmental Evaluation of Plants for Conservation
Date: September, 2009

Introduction

The NRCS policy and requirements regarding invasive species are found in GM 190 Part 414 – Invasive Species. The basis for agency policy is Executive Order 13112, signed February 3, 1999, which directs Federal agencies 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."

Conservation planners need to address the challenges that invasive species pose. They must consider the factors that enable a plant species to become 'invasive' as they evaluate alternatives among plant materials for conservation purposes. NRCS policy encourages the use of native species for a given location and conservation practice. However, noninvasive, non-native species may be used to meet both the agronomic and conservation objectives of the decision maker when native species will not support the conservation needs, so long as the plant will not adversely affect the environment or natural surroundings.

'Invasive Species' and Other Terms

Executive Order 13112 defines an **invasive species** as, "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health". The Executive Summary further refines the definition of 'invasive species' to only include those species that are "… non-native to the ecosystem under consideration". Michigan's Invasive Plant Species List is given in Section II of the Field Office Technical Guide.

An organism can be considered as **non-native** (**alien, exotic, foreign, introduced, or non-indigenous**) if it occurs artificially in locations beyond its known historical natural range. This could involve movement across large distances such as across continents, or just movement to another ecosystem or region, such as from one state in the United States to another. The transfer is done through human activities, either accidentally or intentionally.

Species **native** to a region are generally recognized as having occurred without direct or indirect human actions, such as prior to European settlement. Many introduced species have become **naturalized** over time, but they are still considered non-native.

A **weed** is loosely defined as a 'plant out of place'; many invasive plant species were introduced intentionally as landscape or crop plants and later escaped cultivation and became invasive.

Finally, the term **noxious** is a legal description used specifically for plant species that have been determined to be major pests of agricultural systems and that are subject by law to certain restrictions. The Michigan list of Prohibited and Restricted Weeds is in Section II of the Field Office Technical Guide.

Biological Characteristics Affecting 'Invasiveness'

For a plant species to become invasive, certain plant characteristics and environmental conditions must be in place. There are several characteristics that are common among many invasive plant species. These include: rapid growth, early maturity, copious seed production, effective seed production, high seed germination rate, long-lived seed, vegetative reproduction (such as by rhizomes), and early leaf out and late leaf fall, and a lack of natural biological control. Not all of these characteristics are required for a species to become invasive. However, good conservation plants may need these properties in order to persist and provide long-term conservation benefits.

In order for a non-native plant to become invasive, it must first have the ability to survive in a particular area. Plants must be adapted to a particular range of growing conditions including moisture levels, tolerance to heat or cold, winter hardiness, and growing season length. In particular, a non-native plant must be able to germinate and to survive to maturity or become established by vegetative means.

If able to survive a particular environment, the non-native plant must also be capable of forming a population that is self-sustaining that does not require reintroduction to maintain a viable population. The reproductive ability of a plant is determined by its reproductive mode and frequency, the time the plant takes to reach reproductive ability, seed production and seed survival, and the potential for vegetative regeneration.

Finally, the ability to disperse and spread from the site of establishment is a significant characteristic of an invasive plant. For example, some plants have the ability to disperse seed over a large area in a short amount of time via wind, or by transport on or in birds or animals. Plants may have a vegetative growth habit that allows rapid spread via rhizomes or underground roots. It should be noted that there are several examples of plant species that behaved in a relatively benign manner for decades only to later become invasive after certain population thresholds were achieved.

A good source of information about these plant characteristics for particular plant species is the PLANTS database (http://plants.usda.gov), found on the NRCS website.

Impact on Habitats, Ecosystems and Land Use

An important component of the term 'invasive species' is whether the organism **causes or is likely to cause economic or environmental harm or harm to human health**. There are many plant and animal species that have been introduced by humans for use in agriculture, horticulture or aquaculture. For the purposes of this technical note, invasive species do not include non-native

species that are under human control or domestication, or where humans depend on the non-native species for survival, for economic security or for maintaining a desirable quality of life.

A plant that has the ability to invade and become established in undisturbed natural areas is a primary concern. Most non-native plant species will establish easily in areas where disturbance has already occurred, such as a tilled field or roadside, and may only persist in these habitats. Natural disturbances such as tree fall, wildfires or flooding may also be avenues for invasive species to establish.

Some invasive species possess the ability to outcompete native plants and adversely affect natural areas. The growth habit of a non-native plant may allow the plant to crowd out more desirable plant species, negatively impacting the ecosystem that they enter. Some plants exude chemicals from their roots or plant tissue which inhibit seed germination or seedling growth of neighboring plants. This ability is called **allelopathy**. The plant may also have the potential to hybridize with related native species and produce offspring that are more competitive than either parent. This is termed hybrid vigor.

Some of the known negative impacts on ecosystem processes include: a reduction in biodiversity; loss of habitat for desired insects, birds, and other wildlife including threatened or endangered species; lost food sources for wildlife; and disruption of plant-animal associations such as pollination, seed dispersal and host-plant relationships.

Invasive plant species can have an adverse impact on land use. For example, non-native wetland plants such as *Phragmites* or purple loosestrife (*Lythrum salicaria*) can adversely affect wetland wildlife habitat by outcompeting native plant species and reducing plant diversity. Excessive aquatic weed growth from a non-native species such as *Hydrilla* can reduce recreational opportunities in lakes and streams. Spotted knapweed (*Centaurea maculosa*) that has invaded pastures reduces the nutritive value of forage.

Ease of Management

As long as a non-native species remains **under human control** it would not be considered invasive. Escaped or feral populations of formerly domesticated plants and animals would be considered invasive species. Conversely, just because a species causes economic or environmental harm does not mean it is an invasive species – for example, Canada goldenrod (*Solidago canadensis*) can grow aggressively in grassland habitats, but is a native species that is a valuable food source for pollinator insects, so it would not be considered an invasive species.

The methods available to landowners to manage invasive species are an important consideration, along with the feasibility, cost, relative ease of control, and potential for impacts on non-target areas of the control measures. One of the roles of NRCS is to work with state agencies and non-government organizations in their public education programs. If an invasive plant can be detected early, before it has had a chance to become widely established, control measures can be more effective and economical. Oftentimes a coordinated effort involving multiple public and private entities is needed to prevent, contain and perform outreach and monitoring of invasive species. An important role of NRCS is to help private landowners recognize, inventory and control invasive species on their land to prevent them from spreading.

Conservation Need and Plant Use

Ultimately, the value or need for a plant species is based on the human considerations (+H) of conservation planning. A non-native plant may be valuable for erosion control or as a forage or crop, even if it has growth or reproductive characteristics which may make the plant potentially invasive. For conservation planning, the relative value of a plant species is measured by the effectiveness of the plant to meet conservation objectives, and the availability (or non-availability) of other plant species to meet the same goals and objectives. The conservation planner must weigh the potential benefits of a conservation plant species against the likelihood of that species to escape and cause harm elsewhere.

Since the beginning of European settlement, hundreds of non-native plants were brought to North America for food, ornamental, medicinal or other uses. Many of these non-native plant species have become naturalized over time. These naturalized plants, however much a part of our current landscapes and ecosystems, may not provide the same level of ecosystem benefits as the native plant species which they replaced. For example, if a conservation objective is wildlife habitat, it is usually best to use native species as part of the planned vegetative practice, such as incorporating native plants and forbs within a fencerow or windbreak.

Environmental Evaluation Tool

To minimize the risk of releasing a potentially invasive species, the NRCS Plant Materials Program has modified an evaluation tool that they use as part of their plant release program. Conservation planners are not required to use the tool, but it illustrates the factors that can be assessed to predict if a plant used for conservation has the potential of causing offsite environmental or economic damage. Information used to fill out the form was taken from the PLANTS database. The environmental evaluation includes criteria relating to the biological characteristics of a plant, the potential impact on species interactions and ecosystems, the ease of managing the plant, and conservation need. Although this evaluation procedure takes into account many of the factors that are indicators of potential invasiveness, it cannot eliminate all risks associated with the release of a non-native species.

The following example illustrates an assessment of amur honeysuckle (*Lonicera maackii)* (Attachment 1), which is on the Invasive Plant Species List. The environmental evaluation shows that Amur honeysuckle has a moderate potential for adverse impacts on offsite natural systems, and though it is moderately difficult to control it is rated low for conservation need and is therefore not recommended for use in conservation plantings.

The plant species in the following tables have been evaluated with an Environmental Evaluation worksheet adapted from the NRCS National Plant Materials Manual. The Environmental Evaluation worksheet assesses the ability of the species to adversely affect habitats, ecosystems, and agricultural areas (Impact on Habitat); the degree of management which might be needed to control the species if it becomes a problem, or eradicate the species if it is no longer desirable (Ease of Management); the importance of the species to meet a conservation need (Conservation Need); and the biological properties which indicate the natural ability of the species to propagate and maintain itself under natural conditions (Natural Propagation Potential). It is possible for a plant to rate low on Impact on Habitats, and thus be recommended, and still have a high rating on Natural Propagation Potential indicating that the plant has the ability to propagate and maintain itself naturally. Good conservation plants usually need to persist to be able to solve the conservation problem or need for which they were intended.

(Attachment 1. Amur honeysuckle example)

Plant Environmental Evaluation Worksheet

A. Introduction

This worksheet is used as a ranking tool for documentation of a plant for use in conservation, including any recommendations associated with the plant. Criteria relating to the plant are: natural propagation potential, the potential impact of species interactions on the ecosystem, the ease of managing the plant, and the conservation need. As with any such ranking system, it is necessary to use sound judgment and experience when completing the worksheet and interpreting the results. Criteria that are applicable for developed or agricultural areas may not be applicable for natural or wild lands.

B. Understanding this Worksheet

The primary purpose for this worksheet is to determine if a plant has the potential to adversely affect the environment or natural surroundings. It is possible for a plant to rate low on Part 1 (Impact on Habitats), and thus be recommended, and still have a high rating on Part 4 (Natural Propagation Potential) indicating that the plant has the ability to propagate and maintain itself naturally. Good conservation plants usually need to persist to be able to solve the conservation problem or need for which they were intended. This is even more important for plants used in critical areas, i.e. severely eroding sites.

C. Instructions

1. Rate the plant based on the following criteria by highlighting your assessment. If the criterion does not apply to the species then do not rate for that criterion. If you do not have enough information on the species to complete at least Parts 1, 2 and 4 in Section A, then additional data must be accumulated through literature searches, cooperators, or studies to be able to complete these sections. Lack of data does not allow choice of a response. Positive responses under Section A shall only be used when there is data in support of no impact. Additional notes which may be used to clarify or interpret the ranking should be included in the margins of this worksheet.

2. All rating criteria must be completed for a plant material, even if it is found in Section A, Part 1 that the plant has a low impact on the environment. Evaluation of all criteria will provide documentation that a thorough evaluation was completed for the plant. This documentation may be needed in the future if questions are raised about the potential invasiveness or control of the plant.

Environmental Evaluation of Conservation Plants

Name of person scoring: Rose Lake Staff **Date of scoring:** March 2008

Scientific Name: *Lonicera Maackii* (Rupr.) Herder **Common Name:** Amur honeysuckle

Release Name (if applicable):

Is the plant native to the US? **Yes** **No**

Is the plant native to the area of intended use? **Yes** **No**

Authority used to determine native status: **USDA, NRCS. 2008. PLANTS Database**

What is the intended area of use for this plant?

What is the intended use for this plant?

Areas in which the species is known to be invasive or has a high probability of being invasive:

Summary of Criteria from Section A	**Score**
Part 1. Impact on Habitats, Ecosystems, and Land Use	**21**
Part 2. Ease of Management	**22**
Part 3. Conservation Need and Plant Use	**3**
Part 4. Natural Propagation Potential	**56**

Final Determination for Conservation Plant Recommendation Based on the Environmental Evaluation:

OK to Recommend

OK to Recommend but qualify use and intended area of use*

X **Do Not Recommend**

I certify that this Environmental Evaluation was conducted with the most accurate and current information possible.

Signature of Person Scoring Date

Section A. Scoring of Criteria for Impact, Management, Need and Natural propagation potential

Circle the appropriate number for each of the following criteria. Add up the scores for each part and record at the end of each part. Comments which clarify answers or provide supporting information may be included in the right margin of the worksheet or attached on a separate sheet of paper.

Part 1: Impact on Habitats, Ecosystems, and Land Use

This section assesses the ability of the species to adversely affect habitats, ecosystems, and agricultural areas.

1) Ability to invade natural systems where the species does not naturally occur

a)	Data show species not known to spread into natural areas on its own	0
b)	Establishes only in areas where major disturbance has occurred in the last 20 years (e.g., natural disasters, highway corridors)	3
c)	Establishes in mid- to late-succession natural areas where minor disturbances occur (e.g., tree falls, stream bank erosion), but no major disturbance in last 20-75 years	6
d)	Often establishes in intact or otherwise healthy natural areas with no major disturbance for at least 75 years	10

2) Negative impacts on ecosystem processes (e.g., altering fire occurrence, rapid growth may alter hydrology)

a)	No perceivable negative impacts	0
b)	Minor negative impacts to ecosystem processes	2
c)	Known significant negative impacts to ecosystems processes	6
d)	Major, potentially irreversible, alteration or disruption of ecosystem processes	10

3) Impacts on the composition of plant communities where the species does not naturally occur

a)	No negative impact; causes no perceivable changes in native populations	0
b)	Noticeable changes in community composition that have negative or unknown impacts on 1) biodiversity of natural systems, or on 2) desirable agricultural/developed systems	5
c)	Causes major negative alterations in community composition	10

4) Allelopathy

a)	No known allelopathic effects on other plants	0
b)	Demonstrates allelopathic effects on seed germination or seedling growth of other plants	3
c)	Demonstrates allelopathic effects to mature stages of other plants	5

5)	**Impact on habitat for wildlife (vertebrate or invertebrate) or domestic animals (aquatic and terrestrial), including threatened and endangered species (coordinate with USFWS and state Heritage Programs as appropriate)**	
a)	No negative impact on habitat, or this criteria not applicable based on intended use for the plant (explain intended use, why not applicable, and how to assure plant won't be used in an inappropriate, sensitive context)	0
b)	Minor negative impact on habitat or species interactions (e.g., decreased palatability; lower wildlife value; decreased value for undesirable animal species, shifts in herbivore frequency, shifts in disease frequency)	2
c)	Significant negative impact on habitat or species interactions (e.g., foliage toxic to animals; significantly lower value for wildlife; excludes desirable animal species from a domesticated area or any native species from wildland area; increases exotic, invasive or pest species in any area)	5
6)	**Impact on other land use**	
a)	No negative impacts on other land uses	0
b)	Minor impacts (plant could invade adjacent areas and decrease its value)	3
c)	Significant impacts (plant may alter the system or adjacent lands significantly enough to prevent certain uses, or negatively affects biodiversity on same or adjacent wildlands.)	5
	Total Possible Points	**45**
	Total Points for Part 1	**21**

<u>Part 2. Ease of Management</u>

This part evaluates the degree of management which might be needed to control the species if it becomes a problem, or eradicate the species if it is no longer desirable.

1)	**Level of effort required for control**	
a)	Effective control can be achieved with mechanical treatment	0
b)	Can be controlled with one chemical treatment	2
c)	One or two chemical or mechanical treatments required or biological control is available or practical	5
d)	Repeated chemical or mechanical control measures required	10
2)	**Effectiveness of community management to potentially control the plant**	
a)	No management is needed, the plant is short-lived and will significantly decrease or disappear within 5 years under normal conditions without human intervention	0
b)	Routine management of a community or restoration/preservation practices (e.g., reasonably practical and financially feasible control methods including some forms of prescribed burning, flooding, controlled disturbance, pasture renovation) effectively controls the species	2
c)	Cultural techniques beyond routine management can be used to control the plant	4
d)	Cultural techniques beyond routine management can be used but are unlikely to occur in a timely manner due to expense or difficult logistics	8
e)	The previous options are not effective for managing or controlling the Species	10
3)	**Side effects of chemical or mechanical control measures**	
a)	Control measures used on species will have little or no effect on other plants or wildlife	0

b) Control measures used on species will cause moderate effects on other plants or wildlife	3
c) Control measures used on species will cause major effects on other plants or wildlife	5

<u>**If spreads by seed, or both seed and vegetative means, go to #4</u>
<u>**If spreads by vegetative means only, go to #5</u>

4) Seed banks

a) Seeds viable in the soil for 1 year or less	0
b) Seeds remain viable in the soil for 2-3 years	3
c) Seeds remain viable in the soil for 4-5 years	5
d) Seeds remain viable in the soil for more than 5 years	8

5) Vegetative regeneration under natural conditions

a) Regeneration from resprouting of cut stumps	1
b) Regeneration from pieces of the root left in the soil	4
c) Regeneration from root or stem parts left in the soil	6

6) Resprouts after cutting above-ground parts

a) Does not resprout <u>or</u> resprouts but the species is sterile and does not produce seed	0
b) Resprouts and produces seed in future years	5
c) Resprouts and produces seed in same year	8
Total Possible Points	**47**
Total Points for Part 2	**22**

<u>Part 3. Conservation Need and Plant Use</u>

This part evaluates the importance of the species to meet a conservation need. Describe the conservation need.

1) Potential Use(s) of the Plant

a) Used for low-priority issues or single use	1
b) Has several uses within conservation	2
c) Has many uses within conservation as well as outside of conservation	4
d) Has high-priority use within conservation	5

2) Availability of Other Plants to Solve the Same Conservation Need

a) Many other plants available	1
b) Few other plants available	3
c) No other plants available	5

3) Consequences of <u>Not</u> Recommending This Plant

a) No impact to conservation practices	0
b) Minor impact on one or more conservation practice	1
c) Serious impact on one conservation practice	3

d) Serious impact on more than one conservation practices	5
Total Possible Points	**15**
Total Points for Part 3	**3**

Part 4. Natural Propagation Potential

This part evaluates the biological properties which indicate the natural ability of the species to propagate and maintain itself under natural conditions. Note: these criteria relate to the species under natural conditions, as opposed to the species under managed conditions used to increase the species, i.e. seed increase programs, or specific propagation methods which do not normally occur in nature.

1) Typical mode of reproduction under natural conditions

a) Plant does not increase by seed or vegetative means (skip to #11)	0
b) Reproduces almost entirely by vegetative means	1
c) Reproduces only by seeds	3
d) Reproduces vegetatively and by seed	5

2) Reproduction (by seed or vegetative) in geographic area of intended use

a) Reproduces only outside the geographic area of intended use	1
b) Reproduces within the geographic area of intended use	3
c) Reproduces in all areas of the United States where plant can be grown	5

3) Time required to reach reproductive maturity by seed or vegetative methods

a) Requires more than 10 years	1
b) Requires 5-10 years	2
c) Requires 2-5 years	3
d) Requires 1 year	5

** If reproduces only by seed, skip to #5

4) Vegetative reproduction (by rhizomes, suckering, or self-layering)

a) Vegetative reproduction rate maintains population (plant spreads but older parts die out)	1
b) Vegetative reproduction rate results in moderate increase in population size (plant spreads <3' per year)	3
c) Vegetative reproduction rate results in rapid increase in population size (plant spreads >3' per year)	5

** If reproduces only vegetatively, skip to #11

5) Ability to complete sexual reproductive cycle in area of intended use

a) Not observed to complete sexual reproductive cycle in the geographic area of intended use, but completes sexual reproduction in distant areas of the United States	1
b) Not observed to complete sexual reproductive cycle in the geographic area of intended use, but completes sexual reproduction in adjoining geographic areas	3

c)	Observed to complete the sexual reproductive cycle in the geographic area of intended use	5
6)	**Frequency of sexual reproduction for mature plant**	
a)	Almost never reproduces sexually	0
b)	Once every five or more years	1
c)	Every other year	3
d)	One or more times a year	5
7)	**Number of viable seeds per mature plant each reproductive cycle**	
a)	None (does not produce viable seed)	0
b)	Few (1-10)	1
c)	Few/Moderate (11-100)	3
d)	Moderate seeded (>100 - 999)	5
e)	Many-seeded (>1,000)	8
8)	**Dispersal ability**	
a)	Limited dispersal (<20') and few plants produced (<100)	1
b)	Limited dispersal (<20') and many plants produced (>100)	3
c)	Greater dispersal (>20') and few plants produced (<100)	7
d)	Greater dispersal (>20') and many plants produced (>100)	10
9)	**Germination requirements**	
a)	Requires open soil and disturbance to germinate	1
b)	Can germinate in vegetated areas but in a narrow range or in special conditions	5
c)	Can germinate in existing vegetation in a wide range of conditions	10
10)	**Interspecific Hybridization**	
a)	Has not been observed to hybridize outside the species	0
b)	Hybridizes with other species in the same genus	3
c)	Hybridizes with other genera	5
11)	**Competitive ability (of established plants)**	
a)	Poor competitor for limiting factors	0
b)	Moderately competitive for limiting factors	5
c)	Highly competitive for limiting factors	10
	Total Possible Points	**73**
	Total Points for Part 4	**56**

References

Many of the criteria used in this rating system were adapted from the following sources:

Hiebert, Ron D. and James Stubbendieck. 1993. Handbook for Ranking Exotic Plants for Management and Control. US Department of the Interior, National Park Service, Denver, CO.

Randall, John M., Nancy Benton, Larry E. Morse, and Gwendolyn A. Thornhurst. 1999. Criteria for Ranking Alien Wildland Weeds. The Nature Conservancy, Arlington, VA.

Section B. Scoring and Interpretation

Based on the scores from above, circle the points range you scored to determine the appropriate interpretation.

Part	Points Scored	Interpretation
Part 1. Impacts on Habitats, Ecosystems, and Land Use	0-15	**Low** chance plant is going to affect the environment
	16-25	**Mod**erate chance plant is going to affect the environment
	26-45	**High** chance plant is going to affect the environment
Part 2. Ease of Management	0-20	**Easy** to control
	21-30	**Mod**erate to control
	31-47	**Diff**icult to control
Part 3. Conservation Need and Plant Use		
	0-5	**Low** need
	6-9	**Mod**erate need
	10-15	**High** need
Part 4. Natural Propagation Potential	0-25	**Low** chance plant is going to propagate and increase itself
	26-40	**Mod**erate chance plant is going to propagate and increase itself
	41-73	**High** chance plant is going to propagate and increase itself