Ohio Invasive Plant Assessment Protocol

Purpose and Background

Invasive, non-native plants represent a significant environmental and economic problem to natural areas throughout Ohio. These invaders from other regions, free of local constraints, often outcompete existing native plants and interfere with fundamental ecosystem services. This assessment protocol was developed as *an objective, science-based process of identifying invasive, non-native plants that threaten the health and diversity of natural ecosystems in Ohio*. Such information is necessary for the removal, containment, or interception of those plants that have escaped or have the potential to escape from places where they have been introduced (intentionally or unintentionally) and subsequently invade natural areas.

This assessment protocol was developed by the Ohio Invasive Plant Council (OIPC), which in 2008 instituted a working group, composed of representatives across Ohio from academia, land management, the nursery industry, governmental agencies, and the interested public, to use scientific data to revise the list of invasive plants for the state of Ohio. The original list was created in 2000, spearheaded by the Ohio Division of Natural Areas and Preserves and based largely on input from land managers and others working in natural areas. Given the need to update the list over time and a desire to develop a rigorous and defendable process of identifying Ohio's invasive plants, the OIPC made this endeavor a major priority. An updated list founded on a science-based process is particularly important to land managers, the nursery community, researchers, and others in the Midwest evaluating invasive plants.
In 2009, the working group first began developing an assessment protocol, based on careful review of the scientific literature, existing protocols from other states and organizations, and input from OIPC members with expertise in relevant areas, especially invasive species research, land management, and the nursery industry. Recognizing that some invasive plants have past and current horticultural importance, the OIPC working group has worked with the Ohio Nursery and Landscape Association (ONLA) to ensure that the protocol addresses nursery introductions, especially cultivars (cultivated varieties). This protocol is intended to provide fundamental and realistic determinations of invasiveness, aside from considerations of economic merit or the effectiveness of potential control measures. OIPC does not undertake to regulate the existence, production or introduction of specific non-native plants, leaving those activities instead to appropriate state agencies. OIPC will use this assessment tool to update the list of invasive plants in Ohio and make the updated list available through our website (http://www.oipc.info). Furthermore, OIPC will periodically update the list, recognizing fully that the invasive status of plants may be fluid, as new information becomes available and new introductions are made either intentionally or unintentionally. The assessment protocol itself should be periodically reevaluated and revised, as new information regarding invasiveness becomes available in the scientific literature.

Directions

The assessment protocol is divided into two steps. The first step efficiently identifies plants already recognized as problematic (i.e. noxious) on federal or state levels, or those which are already spreading and forming dense stands throughout the state. All other plants, including those for which key information is inconclusive or unknown are analyzed in the second, more

detailed step of the assessment protocol. This second step focuses on traits that have been recognized in the scientific literature as being associated with invasiveness, a predictive approach that has been recommended by the National Academy of Sciences (2002). The protocol specifically uses the inclusive term "plant" or "plants" because invasives are not necessarily a species, but may consist of a cultivar, subspecies, or other taxonomic entity, which will be assessed on an individual basis. The subsequent assessment will be reported only for that cultivar (i.e. not automatically for the species itself). This protocol has been designed to be used by any individual with an interest in invasive species, but for the purposes of updating the list of invasive plants in Ohio, an OIPC assessment team consisting of representatives from land management, academia, and the nursery industry will use this protocol to periodically examine plants brought to their attention. This protocol has been designed to focus only on non-native, terrestrial plants; for aquatic invasives, please refer to the Aquatic Weed Risk Assessment Tool (AqWRA) for the Great Lakes region, which provides more relevant questions for aquatic species.

To conduct the assessment of a given plant, the four questions in Step I must first be answered; if the answer to any of these questions is either "No" or "Unknown", the person doing the assessment proceeds to Step II. This second section consists of 18 conditions grouped by Invasion Status, Biological Characters, and Ecological Impacts. Using the provided worksheet, the user selects the most accurate single response for each condition, and then sums up the points associated with each response. Many questions also include an option of "information is unknown" (with a value of "U"); if this response is selected four or more times for Step II, the plant is automatically categorized as "Insufficient Data". Otherwise, the final total point value is then used to determine whether a plant is either "Invasive", "Pending Further Review" or "Not Invasive". A worksheet for Step II is included towards the end of this document.

In both steps of the assessment protocol, documentation must be provided to support each answer. Evidence from the peer-reviewed, scientific literature that specifically addresses each point is ideal and should be pursued whenever possible. We recognize however that in the cases of recently invading plants, such documentation may be rare or nonexistent. Until such documentation is available for these cases, multiple authorities must be consulted for each condition with the contributions of all such individuals and their area(s) of expertise clearly noted in the assessment for that plant. If there is not enough evidence to determine if a plant is invasive at the current time, the plant species will be slated for examination in the next review cycle. In these cases, a request for the required missing information will also be posted on the OIPC website as a research priority to facilitate future assessments of the plant.

OIPC Plant List Working Group
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Step I: Initial Assessment

1) **Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?**

   ☐ Yes (place on invasive plant list, no further investigation needed - STOP HERE)

   ☐ No (continue on to question #2)

2) **In how many regions of Ohio has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas?** *Please refer to the ODW regional map of Ohio (split into five regions based on counties, see below). See glossary for further definition of "widespread dispersion and establishment in natural areas".*

   ☐ Two or more regions (place on invasive plant list, no further investigation needed - STOP HERE)

   ☐ One region (continue on to question #3)

   ☐ None (continue on to question #3)

   List documentation:

3) **Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?** *For example, this may include alteration of nutrient cycling, community composition, physical structuring, and changes in the fire regime.*

   ☐ Yes

   ☐ No

   ☐ Unknown

   List documentation:

4) **Is the plant listed as invasive in an adjoining state to Ohio or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?**[1] *Recognizing that there can be a number of invasive plant lists available from different municipalities, parks, and other organizations within a single state, this question refers only to a list of invasives for each state generated from scientifically based assessment protocols by invasive plant councils (or similar entities) or state agencies. A single list for each state must be approved by the OIPC and will be made available on the OIPC website.*

   ☐ Yes

   ☐ No

   ☐ Unknown

   List documentation:

[1] The single best predictor of invasiveness is whether a species is also invasive elsewhere (Reichard & Hamilton 1997, Kolar & Lodge 2001, NAS 2002).

If the answer to BOTH questions #3 and #4 is YES, the plant is placed on the invasive plant list and no further investigation needed (STOP HERE). If the answer to BOTH questions is NO, the plant is not considered to be invasive and no further investigation is warranted. Otherwise, continue on to Step II.

Step II: Invasion Status

1) Current Invasion in Ohio

a. plant is not found in natural areas	0
b. plant is found in natural areas but only because it persists from previous planting in that location (e.g. old home site)	0
c. plant is only expanding from sites of previous planting	1
d. plant occurs in natural areas away from sites of planting	3
e. information is unknown	U

2) State Distribution

This questions pertains to the ODW regional map of Ohio (split into five regions based on counties).

a. plant is not naturalized in any region of Ohio	0
b. plant is naturalized in only one region in Ohio	1
c. plant is naturalized in two regions in Ohio	2
d. plant is naturalized in three regions in Ohio	3
e. plant is naturalized in four regions in Ohio	4
f. plant is naturalized in five regions in Ohio	5
g. information is unknown	U

3) Regional/US Distribution[1]

a. plant is not considered to be a problem in any other state	0
b. plant is not considered to be a problem in any state but is a widespread problem in similar habitat outside the US	1
c. plant has been reported as a widespread problem in another non-neighboring state within the USDA Plant Hardiness Zones 5-6	1
d. plant has been reported to be a widespread problem in 1-2 adjoining states	3
e. plant has been reported to be a widespread problem in 3 or more adjoining states	5
f. information is unknown	U

Step II: Biological Characters

4) Vegetative Reproduction

a. no vegetative reproduction	0
b. reproduces readily within the original site	1
c. has runners or spreading rhizomes that root easily[2]	3
d. fragments easily and fragments can be easily dispersed	4
e. true for both c. and d. above	5
f. information is unknown	U

[2] Vegetative spread is one of the best predictors of invasive (Reichard & Hamilton 1997 for woody plants, Kolar & Lodge 2001, Cadotte et al. 2006).

5) Sexual Reproduction

a. no sexual reproduction	0
b. infrequent sexual reproduction	1
c. frequent sexual reproduction, but high variation among years in seed production	3
d. frequent sexual reproduction (one or more events per year)	5
e. information is unknown	U

6) Number of Viable Seeds or Propagules per Plant

a. few (0-10)	1
b. moderate (11-1,000)	3
c. prolific (>1,000)	5
d. information is unknown	U

7) Flowering Period[3]

a. one month or less per year	0
b. between one to two months	1
c. between two to five months	2
d. longer than five months	3
e. information is unknown	U

8) Dispersal Ability

a. seeds/propagules lack characteristics promoting long-distance dispersal (e.g. fruits attractive to birds or mammals, or with adaptations to wind dispersal)	0
b. seeds/propagules have characteristics promoting long-distance dispersal, but no evidence of seeds traveling > 1km	3
c. seeds/propagules have characteristics promoting long-distance dispersal, and evidence of seeds traveling > 1km	5
d. information is unknown	U

9) Generation Time[4]

a. long juvenile period (5 or more years for trees and shrubs, 3 or more years for other growth forms)	0
b. short juvenile period (<5 years for trees and shrubs, <3 years for other forms)	3
c. information is unknown	U

[3] Supported by Cadotte et al. 2006.
[4] Generation time is associated with invasiveness (Reichard & Hamilton 1997, Kolar & Lodge 2001).

10) Establishment

a. unable to invade natural areas	0
b. can only colonize certain habitat stages (e.g. early successional habitats)	1
c. colonizes and establishes in edge habitats	3
d. colonizes and establishes in intact and healthy natural areas	6
f. information is unknown	U

Step II: Ecological Impacts

11) Impact on Ecosystem Processes

a. no documented effects on ecosystem-level processes	0
b. moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)	3
c. causes long-term, substantial alterations in the ecosystem (e.g., changing fire regime of an area, changing hydrology of wetlands)	6

12) Impact on Rare Organisms

a. no known negative impact on Ohio State-listed or federal-listed plants or animals	0
b. negatively impacts listed species, such as through displacement or interbreeding	3

13) Impact on Native Animals

a. no known negative impact on animals	0
b. documented direct or indirect negative effects on animal taxa	3

14) Impact on Native Plants

a. no known negative effects on native plants	0
b. negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa)	3
c. impacts native plants to such an extent that community structure is greatly altered	6

15) Hybridization

a. no known instances of hybridization with other plant species	0
b. can hybridize with native Ohio plants or commercially-available species, but seeds are inviable	1
c. can hybridize with native Ohio plants or commercially-available species, producing viable seed	3

16) Population Density

a. occurs only as small, sporadic populations or individuals	1
b. typically forms small, monospecific patches	3
c. is a dominant plant in area where population occurs (absolute cover 15-50%)	4
d. forms an extensive, monospecific stand (absolute cover >50%)	5
e. information is unknown	U

17) Role in Succession in Natural Areas

a. is an early successional species that temporarily invades a disturbed site but does not persist as the site matures	0
b. readily invades disturbed sites and persists, but does not interfere with succession	1
c. readily invades disturbed sites, persists and interferes with succession of native plants	4
d. successional information is unknown	U

18) Number of Habitats Invaded[5]

The question below pertains to the following habitat types in Ohio (grouped within broader categories):

Forestlands: Floodplain forest, hemlock-hardwood forest, mixed mesophytic forest, beech-maple forest, oak-maple forest, oak-hickory forest.

Grasslands: Alvar*, beach-dune community*, bur oak savanna*, slough-grass-bluejoint prairie*, sand barren*, big bluestem prairie, little bluestem prairie (xeric limestone prairie*+), post oak opening*+

Wetlands: Bog*, fen*, twigrush-wiregrass wet prairie*, marsh, buttonbush swamp, mixed shrub swamp, hemlock-hardwood swamp*, maple-ash-oak swamp, white pine-red maple swamp*

* Considered a rare plant community in Ohio by ODW's Biodiversity Database Program.

+ = xeric limestone prairies or cedar glades and post oak openings are unique to the Interior Low Plateau Region of Adams, Highland and Pike counties, and are not included in Schneider and Cochrane (1997).

a. not found in any natural habitats in Ohio	0
b. only found in 1 broad category	1
c. found in 2 broad categories or 2 rare habitat types	3
d. found in 3 broad categories or 3 rare habitat types	4
e. found in 4 or more rare habitat types	5
f. information is unknown	U

[5] Plant communities are from Schneider and Cochrane (1997).

For Step II, use the included worksheet to record point values, or record "U" if information is unknown. If there are at least four instances of "U", the plant is rated as "Insufficient Data". Otherwise, add the points to obtain the total (out of 76 possible points). Use the following table to determine the status of each plant being assessed:

Total Points	**Assessment in Ohio**
4 or more U	Insufficient Data
0-34	Not Known To Be Invasive
35-44	Pending Further Review
45-80	Invasive

After each assessment period, the following information will be made publically available on the OIPC website, following the established Policy & Procedures: (1) a list of plants that were evaluated; (2) a list of those plants that were assessed as "Invasive"; (3) the numerical score for each plant that was assessed, along with individual scores to each question. The latter information will allow interested parties to understand what scientific data are lacking for a particular plant (thus promoting future research), as well as where a plant might fall within the continuum, especially those that are not deemed Invasive or Not Invasive. All species should be periodically reassessed, especially those with Insufficient Data or Pending Further Review, as the invasive status of plants can be a fluid process, reflecting both the availability of new information and biological processes that may occur over time (e.g. release from a lag phase).

Literature Cited

Cadotte, M.W., Murrray B.R., and Lovett-Doust J. (2006) Evolutionary and ecological influences of plant invader siccess in the flora of Ontario. *Ecoscience* 13: 388-395.

Kolar, C.S. and D.M. Lodge (2001) Progress in invasion biology: predicting invaders. TRENDS in Ecology & Evolution 16(4): 199-204.

[NAS] National Research Council: Committee on the Scientific Basis for Predicting the Invasive Potential of Nonindigenous Plants and Plant Pests in the United States. 2002. *Predicting Invasions of Nonindigenous Plants and Plant Pests*. Washington (DC): National Academy of Sciences.

Reichard, S.H. and C.W. Hamilton (1997) Predicting invasions of woody plants introduced into North America. Conservation Biology 11(1): 193-203.

Schneider, G. and K. Cochrane. 1997. Plant Community Survey of the Lake Erie Drainage. ODNR, Division of Natural Areas and Preserves, Columbus, Ohio.

Glossary

Community structure – All species which are present in an area as well as their relative abundances, including their distribution and arrangement within a community.

Cultivation – the act of propagating and growing a species or cultivated variety (cultivar) for horticultural or ornamental use.

Edge habitat – An area where a forest or other natural area borders a field or other human-modified habitat.

Establishment – Colonization of an area by a population; growth of plants of a particular species in a new place.

Invasive species – An introduced species which reproduces and expands into natural or relatively natural areas, negatively impacting existing species. For the purposes of this protocol, we are only addressing plants that are not native to the region (in this case, the Midwestern U.S.).

Mono-specific - Consisting of a single species.

Natural areas - Natural, minimally managed or disturbed sites, not including agricultural fields, roadsides and human modified areas such as parking lots and landscaped areas. Natural areas can consist of high-quality ecosystems that are managed for biodiversity and to retain native species and natural processes to the extent possible, such as certain parks, nature preserves, state forests, wildlife areas, and metroparks.

Naturalized – A non-native species that successfully reproduces, but does not necessarily invade natural areas.

Non-native - Plant species not documented in Ohio prior to substantial European settlement (~ 1750 or 1800); these species have been introduced from other regions or countries. Note that only a small proportion of non-native species are invasive (i.e. "non-native" is not synonymous with "invasive").

Noxious – A plant of foreign origin that has been designated by the state or federal government as one that can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation, or the fish or wildlife resources of the United States or the public health (as defined in the1974 Federal Noxious Weed Act).

Propagule – The structure or stage of an organism that is capable of dispersal; in the case of most plants, the seed or fruit.

Population – A group of individuals of a single species in a given place.

Rhizome – Horizontal underground stem from which new plants can grow.

Sexual Reproduction – In plants, the production of seeds.

Stand – A unit or grouping of similar vegetation; an area that has vegetation distinct from nearby areas (e.g. a stand of trees, grass or shrubs).

Succession – Directional change in vegetation in an area over time, such as an open field eventually converting to woods.

Vegetative reproduction – Production of new plants without sexual reproduction, such as new plants growing from runners or rhizomes, or from fragments of a plant.

Widespread dispersion and establishment in natural areas – The plant species occurs in a patch or stand of at least one-quarter acre and within this area has a relative cover of at least 25% (visual or quantitative estimate). Relative cover is calculated for a particular layer (stratum) of vegetation, and refers to the area covered by one species divided by the total area covered by living plants. In the case of non-native plants that form a dense, continuous mat of rhizomes or stolons, the percent of the soil surface or upper level occupied by that root mat can be estimated as soil, rather than canopy.

STEP II WORKSHEET

Plant: _____ Person: _____

Date: _____

CONDITION	SCORE	DOCUMENTATION
Step II: Invasion Status		
1) Current Invasion in Ohio		
2) State Distribution		
3) Regional/US Distribution		
Step II: Biological Characters		
4) Vegetative Reproduction		
5) Sexual Reproduction		
6) Number of Viable Seeds/Propagules Per Plant		
7) Flowering Period		
8) Dispersal Ability		
9) Generation Time		
10) Establishment		
Step II: Ecological Impacts		
11) Impact on Ecosystem Processes		
12) Impact on Rare Organisms		
13) Impact on Native Animals		
14) Impact on Native Plants		
15) Hybridization		
16) Population Density		
17) Role in Succession in Natural Areas		
18) Number of Habitats Invaded		
TOTAL SCORE		