Strategic Recommendations

for Managing Invasive Plants in Massachusetts

Massachusetts Invasive Plant Advisory Group
Final Report • February 28, 2005

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Massachusetts Invasive Plant Advisory Group (MIPAG)
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Cover photo credits, *clockwise from upper left*

Bill Byrne - Common reed, *Phragmites australis*

Stacey Leicht - Norway maple, *Acer platanoides*
Paul Somers – Carolina fanwort, *Cabomba caroliniana*
Bill Byrne – Purple loosestrife, *Lythrum salicaria*

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Introduction

The Massachusetts Invasive Plant Advisory Group (MIPAG), representing numerous public and private interests working together since 1999 to develop an effective response to the problem of invasive plant species, is pleased to offer its strategic recommendations to prevent, control and, where possible, eradicate invasive plant species in the Commonwealth of Massachusetts. These recommendations complement efforts at both the regional and national levels to establish an early detection and rapid response system for invasive plants. They acknowledge that to meaningfully address the environmental, cultural and economic impacts of invasive plant species in Massachusetts will require the commitment and collaboration of diverse groups, working in partnership at appropriate scales, to confront this problem that affects us all. This document identifies the essential components of a strategic response to invasive plant species for Massachusetts and suggests a management framework to maximize the efforts of all concerned.

The problem of invasive plant species in Massachusetts

The MIPAG defines invasive plant species as "non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.[1]"

The problem of invasive plants has been widely articulated[2]. The introduced invasive plants of greatest concern, both nationwide and to the Commonwealth of Massachusetts, have various biological traits providing them with competitive advantages over native species. In addition, having been transported out of their native environment, invasive plant species are free from the evolved, biological controls that manage population expansions and maintain biological diversity. Without these constraints, invasives have monopolized natural communities, displacing a wide range of native species in our region. This monopolization can have

[1] This definition was incorporated into criteria developed by the MIPAG to objectively evaluate and categorize plant species suspected of being invasive or having the potential to become invasive in Massachusetts. Under this definition, all synonyms, sub-species, varieties, forms and cultivars of that species are included unless proven otherwise by a process of scientific evaluation. The minutes of a MIPAG meeting held 6/17/2003 record the substitution of the word "non-native" for the word "introduced" in a previous definition. The MIPAG has assessed a total of 84 species using this definition, the results of which appear in Appendix A of this report.

[2] Wilson, E.O. 2002. *The Future of Life*. Vintage, New York: 44-50, 52-53, 64-65, 70-75, 95

substantial economic consequences[3], can impact rare and endangered species[4], and can dramatically alter long-established balances of both species composition and habitat qualities[5].

The changes accompanying invasions are often subtle, sometimes even visually attractive, so that the ecological problem they pose is not always immediately obvious. Nevertheless the most opportune time to reduce the threats posed by invasive plants is before they become widely established, and optimally before new invasions occur. Many of these invaders have become so well established across our landscape that eradication of any given species may be highly impractical unless a new invasion is detected early.

But this does not mean that nothing is possible. On the contrary, we have clear choices about how our landscape will look and how the ecosystems of the Commonwealth will function in the future. There is increasing momentum at the local, regional and national levels to forge a meaningful response to the problem of invasive plants.

- The Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) issued guidelines in September 2003 for the coordination of invasive plant detection, assessment and response by state, federal and private interests[6].
- The leadership of many national horticultural interests recently drafted and is currently promoting voluntary codes of conduct for their organizations regarding invasive plant species[7].
- The Invasive Plant Atlas of New England (IPANE), housed at the University of Connecticut, has emerged as a regional resource for detecting and monitoring the spread of invasive plant species[8].

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[3] "Economic damages associated with nonindigenous species and their control (in the United States) amount to approximately $137 billion per year." (Pimentel, David, L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and Economic Costs of Nonindigenous Species in the United States. BioScience 50: 53-65.)

[4] Invasive species are recognized as second only to habitat destruction in causing biodiversity decline worldwide. (Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48: 607-615.)

[5] Fox, M. D. and B. J. Fox. 1986. The susceptibility of natural communities to invasion. Ecology of Biological Invasions. R. H. Groves and J. J. Burdon. Cambridge University Press, New York**:** 57-66.

[6] Federal Interagency Committee for the Management of Noxious and Exotic Weeds; "A National Early Detection and Rapid Response System for Invasive Plants in the United States; Conceptual Design", Washington, D.C. September 2003.

[7] Known as the Saint Louis Declaration, these voluntary codes of conduct to help guide the decisions of both public and private horticultural interests regarding invasive plant control were profiled in an article that appeared in *BioScience*, June 2002/Vol. 52. No.6. A statement of Findings and Overarching Principles of the Saint Louis Declaration is available at the Missouri Botanical Garden's website: http://www.mobot.org/invasives/. The voluntary codes of conduct developed under the Saint Louis Declaration for government, nursery professionals, landscape architects, the gardening public, and botanic gardens and arborita appear in Appendix B of this report.

[8] The website for the Invasive Plant Atlas of New England is http://invasives.eeb.uconn.edu/ipane/

Management of invasive plant species is achievable when guided by clear objectives and a well-informed strategic management plan. The MIPAG believes Massachusetts has much to gain from developing and implementing such a strategic management plan to address introduced invasive plant species. Such a plan has already been developed for aquatic invasive species by the interagency Massachusetts Aquatic Invasive Species Working Group and consequently the Commonwealth of Massachusetts has been eligible for limited federal funding for outreach and management efforts[9].

Summary Recommendations: Massachusetts should develop and implement a strategic management plan based on the recommendations of the MIPAG and integrated with the existing Massachusetts Aquatic Invasive Species Management Plan to address introduced invasive plant species.

Principles for managing invasive plant species

The first principle of invasive plant management should be to manage for specific outcomes. It is insufficient to target a well-established invasive species for control without a clear understanding of where and to what end it is vital to manage its spread. A meaningful strategy of invasives management must first define what natural or cultural values should have priority for protection from established or incipient invasion to ensure their conservation.

Conserving native biological diversity requires a process that identifies and locates priority habitats and species to protect, and then determines the desired levels of ecological function and invasive plant tolerance thresholds sufficient to maintain the viability of these conservation targets. The Massachusetts Natural Heritage and Endangered Species Program's biodiversity assessments[10] can provide the framework for more specific prioritization of ecological resources to be protected from the impacts of invasive plant species. Cultural and economic resources that could be compromised by introduced plant species should also be identified, buffered, and protected from new invasions as part of a strategic management plan.

It is possible to exert some control over invasive plant species, but collectively and individually they are a problem that requires long-term solutions. Managing invasive species demands a commitment to vigilance and some level of sustained action in perpetuity. However,

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[9] The Massachusetts Aquatic Invasive Species Management Plan identifies feasible, cost effective outreach and management measures. Such plans are required by the Federal Aquatic Nuisance Species Task Force in order to be eligible for Federal funding enabled by the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (as amended by the National Invasive Species Act of 1996), This plan can be viewed at the following website: http://www.state.ma.us/czm/invasivemanagementplan.htm)

[10] The Massachusetts Natural Heritage and Endangered Species Program's BioMap and Living Waters Assessments, which comprehensively delineate core and buffer areas for priority terrestrial and freshwater conservation targets, may be accessed at http://www.mass.gov/dfwele/dfw/nhesp/nhbiomap.htm (BioMap) and http://www.mass.gov/dfwele/dfw/nhesp/nhaqua.htm (Living Waters).

the cost of control decreases when invasive thresholds are lower. If we address invasive species at the initial stages of an invasion when populations are low, the cost of maintaining a low level of invasion will be less than the control effort required to reduce a heavily invaded area to a lower threshold of invasion.

Regardless of the extent of the area of concern, the most cost-effective method of control is early detection and rapid response. The greatest benefits are realized through preventing new invasions at every point of entry, and moving quickly to control recently discovered populations. Eradication of established invasives may be impractical except in localized areas, but committing to prevention of new invasions is possible, logical, efficient, and imperative. Even after a problem species has become established in the Commonwealth, its spread to new areas, and particularly to new priority areas, should be actively prevented.

Any strategic management plan for invasive plant species in Massachusetts must acknowledge that resources devoted to control of invasives will never be sufficient to fund and staff all desirable management approaches. Therefore, it is critical to find ways to identify priority species, populations, and control methods, and to target control efforts to areas of the greatest ecological significance so that available resources are allocated wisely. The scientific assessment model pioneered by the MIPAG offers a viable and efficient means of employing public and private resources to fulfill this important prerequisite of a strategic management plan. Other resources and partnerships should be identified and secured to strengthen invasive plant management efforts to best effect.

Furthermore, it is important to know not only which introduced plant species are invasive or have the potential to become so if introduced to Massachusetts, but where each species is likely to have its greatest impacts. Some species may be highly invasive in some habitats, such as along the Massachusetts coastline, but will not persist inland. Others may have invaded a portion of the Commonwealth and their potential to become widespread needs to be determined. A scientific plant assessment process to inform management priorities is a critical component of the strategic recommendations presented in this document.

Turning these principles into action in Massachusetts requires the development of a strategic management plan for invasive plant species. This plan should emphasize a scientifically objective assessment process; a system for early detection and rapid response; setting research, management, and education priorities; and broad public and private partnerships that include integration among statewide, regional and national invasive species management efforts. The MIPAG stands ready to offer the Commonwealth its assistance in the development of a strategic management plan for invasive plant species in Massachusetts. An overview of these components follows.

Summary Recommendations: A strategic management plan for managing invasive plants in Massachusetts should include a scientifically objective assessment process; a system for early detection and rapid response; criteria for setting research, management and education priorities; and develop broad public and private partnerships integrating efforts from the local to national scales.

Scientifically objective assessment process to inform management priorities

The MIPAG recommends that the Commonwealth adopt its scientific evaluation criteria and assessment process. These criteria were tested over four years of evaluation by the MIPAG and have proven effective at determining which introduced species should be considered Invasive, Likely Invasive, or Potentially Invasive in the Commonwealth of Massachusetts[11]. In our experience, it has been critically important that this assessment process be a transparent, collaborative effort by a team representing numerous public and private interests working as partners in invasive plant species prevention and control. The MIPAG includes multiple representatives from state and federal government agencies; nursery and landscaping industry leadership; land management organizations, conservation non-profits; and research and educational institutions (see Appendix A). This process has engendered a high level of trust among participants and their respective agencies and organizations on this important issue, and can serve as a model for public / private collaboration on invasive species assessment.

We recommend that the work of the MIPAG be formalized as part of a strategic management plan for invasive plant species in Massachusetts. We further recommend adoption of the assessment criteria and lists of species developed by the MIPAG, with the understanding that lists will evolve as new species arrive and new data is available. In that case, we would recommend that the Commonwealth adopt the collaborative, scientific process of the MIPAG for further assessment. Annotated lists of species assessed by scientifically objective criteria should be maintained, updated, and disseminated annually with annotations for each species and indicating which species should be considered Invasive, Likely Invasive, or Potentially Invasive in Massachusetts. These lists should inform early detection, rapid response, and control strategies, and help educate the citizens of the Commonwealth about the impacts of these species and the importance of prevention and control.

We recommend that those species determined by this assessment process to be Potentially Invasive but not yet established in minimally managed habitats in Massachusetts be the predominant focus of early detection and rapid response strategies. Other possible candidates for eradication may be found among those species determined to be Likely Invasive but with few confirmed occurrences in Massachusetts. For widespread Invasive plant species, site-based rather than species-based strategies for control will be needed.

The annotations to the invasive plant lists produced through this assessment should also indicate those species that are widespread and invasive, as well as those that impact certain habitats and native community types. Where appropriate, annotations should also denote which parts of the Commonwealth are most likely to be impacted by specific invasive plants. (See Appendix A for the annotated list resulting from MIPAG's first two phases of assessments.)

Summary Recommendations: The Commonwealth should adopt the MIPAG criteria for invasive plant assessment and recognize the list of plant species determined by this process to be

[11] Plants assessed as Invasive or Likely Invasive are present in minimally managed habitats within the Commonwealth of Massachusetts. Those assessed as Potentially Invasive are not yet known to occur in minimally managed habitats in Massachusetts. For a full definition of these categories, see Appendix A of this report.

Invasive, Likely Invasive or Potentially Invasive within Massachusetts. It should maintain an ongoing, transparent assessment process using the MIPAG criteria and with the participation of both public and private interest groups. This assessment should inform invasive species management strategies. Prevention strategies should predominantly focus on species assessed as Potentially Invasive and controlling the spread of Invasive species into priority conservation areas. Candidate species for eradication strategies should be selected from among those assessed as Likely Invasive.

A centralized means for inter-agency coordination on invasive species

"No new invasions" should be our motto. To that end, we recommend that Massachusetts establish and support a centralized means within state government for inter-agency coordination on invasive species management, in partnership with public and private sector interests. This mechanism should help produce a strategic management plan for invasive plant species in the Commonwealth based on MIPAG's recommendations. It should help coordinate invasive species management efforts within the Commonwealth and integrate efforts with regional and national partners. It should identify repositories for data on invasive species, and also enable appropriate and efficient reporting mechanisms for early detection and rapid response[12]. Such coordination should not be limited to the activities of state agencies, but take full advantage of the experience and capabilities of the private and non-profit sectors. A coordinated effort will position Massachusetts to maximize available outside funding.

Summary Recommendations: We recommend that Massachusetts establish and support a centralized means within state government for inter-agency coordination on invasive species management, in partnership with public and private sector interests. This mechanism should help produce a strategic management plan for invasive plant species in the Commonwealth based on MIPAG's recommendations. It should help coordinate invasive species management efforts within the Commonwealth and integrate efforts with regional and national partners.

Early detection and rapid response system

Early detection and rapid response will be a central component of a strategic management plan for invasive species in Massachusetts. Preventing just one new invasion in Massachusetts by an introduced invasive plant species can have tremendous ecological and economic value. Keeping a pristine area free of invasive species will help preserve its viability. Many land managers agree that prevention should optimally receive a large majority of the resources and effort expended on invasive plant management[13]. Prevention is always preferable to control and

[12] As the problem of invasive species is not limited to plants, ideally an invasive species early detection and rapid response system for Massachusetts should be concerned with all taxa of invasive organisms, including plants, animals, parasites and pathogens.

[13] Dr. Richard D. Ilnicki, Professor Emeritus and former head weed researcher at Rutgers University, recommends that 70% of overall weed management efforts should focus on prevention strategies (personal communication).

eradication. Early detection and removal is more effective and less expensive than management action once an invasive organism has become well established.

Having an effective early detection and rapid response system in place for invasive plant species, well integrated with regional and national efforts, will be an essential investment in the future of the Commonwealth. The Massachusetts Aquatic Invasive Species Management Plan (MAISMP) has a strong early detection and rapid response component. Regional and national partners such as the Invasive Plant Atlas of New England (IPANE); the New England Invasive Plant Group (NIPGro); and the Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW) will also be important collaborators in this effort.

Summary Recommendations: The Commonwealth should establish and support an effective early detection and rapid response system for invasive species that is well integrated with regional and national efforts.

Research priorities

Preventing new invasions by non-indigenous species and managing those already established in Massachusetts will depend, at least in part, on understanding the biology of the organisms to be managed as well as the ecosystems they are invading. Success may depend on knowing or finding an "Achilles heel" for each species identified as Invasive, Likely Invasive, or Potentially Invasive. Collaboration with regional and national partners and access to existing research data on specific invasive species, will greatly enhance the effectiveness of early detection, rapid response and control measures in Massachusetts. The management of invasive plant species will require better information, acquired through ongoing research on the growth and reproduction of individual species and their effects on native plant habitats and communities.

The first principle of research should be a review of what has already been learned about the research topic to benefit from existing knowledge and focus new inquiries appropriately. Important gaps in the knowledge base should be identified and research priorities and partnerships established. Some gaps in knowledge have already been documented by the MIPAG during its assessment process.

Attempts to eradicate a new invader should not await research on the problem. Monitoring should be done simultaneously with the control efforts so that the results of the treatments are understood. Adaptive management, informed by scientific monitoring of the impact of threat abatement strategies and regular feedback of information, should guide all control actions undertaken.

We recommend that the Commonwealth set invasive species research needs and priorities and seek partnerships with educational institutions and other entities to conduct necessary research. As part of this research agenda, state agencies responsible for land management could conduct or facilitate research on the land they manage. It would be very helpful for the

Commonwealth to assign to a responsible entity the task of creating a centralized database of invasive species research to inform assessment and management efforts. Such a database could document and share the results of research undertaken by Massachusetts-based educational institutions and conservation organizations, as well as state agencies, and provide links to regional or national databases of this type. Funding sources for needed research should be developed and promoted.

Summary Recommendations: The Commonwealth should assign to a responsible entity the task of assessing invasive species research needs and priorities for Massachusetts. It should integrate the work of public and private research partners, actively develop sources of funding for this research, and maintain a centralized database of this research in easily accessible form and linked to regional or national databases of this type. Funding sources for needed research should be developed and promoted.

Management priorities

After assessment, the main modes of invasive plant species management are prevention, control, eradication where possible, and habitat restoration where required. It cannot be overemphasized that the greatest gains can be made early in the invasion, at the point of entry or even the port of destination. The most important elements of effective invasive plant prevention are an early detection and rapid response system for new invasions, and education about best management and prevention practices directed at the primary vectors for spreading invasive plant material.

Prevention should be driven by two main objectives: preventing the introduction and establishment of plants identified as Potentially Invasive in Massachusetts, and preventing Invasive or Likely Invasive plants already present in the Commonwealth from invading high priority natural and cultural resource areas. Because human behavior is the primary cause of both intentional and unintentional invasive species spread and dispersal, a comprehensive prevention strategy should include a strong and well-publicized outreach and education component and the structures to encourage the adoption of preventive measures by both the public and private sectors.

Prevention and control strategies need to affect and benefit both public and private lands that support high priority resources for conservation. For species that expand exponentially and leap from one habitat to another in short time periods, complete control is in some cases the only acceptable outcome, despite its costs. For others, containment and reduction in cover and density to acceptable levels is a valid management goal. Total eradication of an invasive species that is well established on the landscape of Massachusetts is probably not possible. Local extirpation, however, may be achievable and even the most desirable and appropriate outcome in some cases. Again, it is critical to know what values (ecological, cultural, and economic) are at risk from invasive species before any management occurs. The most important consideration is always to determine the desired status or outcome for the resource that has been compromised by invasive plant species and manage for that outcome.

Successful restoration of a minimally managed habitat may occur naturally after removal of invasive plants, but in many cases, habitats have been so altered that restoration will not occur on its own and may be impractical to attempt. Even the most sensitive management activity constitutes a disturbance and may provide other opportunities for disturbance-loving invasives to become established at a site unless careful post-management monitoring or restoration activity takes place. There may also be other factors contributing to the problem caused by invasives (e.g. excessive deer browse) that will also need to be addressed before the management objectives can be met for a particular site.

The Commonwealth should prioritize invasive species management areas for natural areas and cultural resources whose conservation values are at risk from these species. Management priorities for natural areas should be determined from within the significant core and buffer natural resource areas delineated by the BioMap and Living Waters assessments. Prioritization criteria should take into account the ecological values at risk and assess potential impacts from existing and incipient invasions.

We recommend that the federal, state and private entities responsible for conserving the Commonwealth's natural areas and cultural resources prioritize which of their holdings require protection from invasive species impacts, and then inventory these properties for invasive species presence and distribution. These baseline assessments should inform the development and implementation of comprehensive invasive species management plans to control existing invasions and prevent the introduction and spread of new invasive species.

Summary Recommendations: A strategic management plan for invasive species in Massachusetts should set priorities for prevention, control, eradication and restoration efforts. Prevention should emphasize an early detection and rapid response system for new invasions and education about best management and prevention practices directed at the primary vectors for spreading invasive plant material. Except where eradication is feasible, control efforts should always manage toward a desired status or outcome for conservation resources compromised by invasive plant species, rather than the invasive species itself. Priority areas for management should be determined by identifying at all scales the natural and cultural resources at risk from invasive species and conducting baseline assessments of invasive species at those sites.

Education priorities

Invasive plant species are a problem with a human cause. While the vast majority of species introduced to North America since European settlement have not proven to be invasive, those that are have profoundly impacted the ecology of this continent. Global movement of plant material only increases the likelihood of new invasions, even if the introduction is inadvertent. Wood products can also be vectors for the spread of introduced pests and pathogens that can have profound impacts, notably on forest health and diversity. Ballast water from ocean-going vessels has proved the source of terribly invasive marine organisms.

It is important to identify past and potential vectors for introduction and spread of invasive species, but it serves little purpose to apportion blame for those invasions already impacting the Massachusetts landscape. Each of us bears responsibility for addressing this threat within our own spheres and constituencies. We recommend targeted outreach and education to raise awareness of the extent of the invasive plant problem and of the importance of each of our roles in preventing and controlling invasive species.

Effective invasive plant species control requires effective communication among landowners, the green industry, government agencies, and non-profit organizations. Carefully designed and targeted education is the foundation of effective communication. Agency extension educators play significant public outreach roles that can complement the education activities undertaken by non-profit organizations and green industry leadership. Current information about the invasive qualities and geographic distribution of species meeting these criteria should be provided in readily accessible form to the public and state agencies.

Nurseries and landscape professionals should play a critical role as part of a strategic management plan to educate consumers about the problem of invasive plants and offer non-invasive alternatives. While they serve the tastes and demands of the public, they also can influence the market and are in a position to educate and inform as well as provide non-invasive alternatives to problem species.

One of the most encouraging developments from working collaboratively with green industry leadership on invasive plants has been the development of voluntary codes of conduct drafted at the Missouri Botanical Garden in 2002. Known as the Saint Louis Declaration, these protocols include standards and best management practices for preventing the spread of invasive plant material through the nursery trade and address the activities of government agencies, nursery professionals, landscape architects, the gardening public, and botanic gardens and arboreta. We recommend adoption of the voluntary protocols established under the Saint Louis Declaration by all Massachusetts government agencies, and encourage their adoption by nursery professionals, landscape architects, the gardening public, and botanic gardens and arboreta. We further recommend the Commonwealth prohibit state agencies from purchasing or intentionally introducing species determined to be Invasive, Likely Invasive or Potentially Invasive through the scientifically objective assessment process of MIPAG. Commercial industries should adopt a carefully constructed phase-out of these species in the trade while accommodating the economics of current inventories and existing contracts.

<u>Summary Recommendations</u>: We recommend targeted outreach and education to raise awareness of the extent of the invasive plant problem and of the importance of each of our roles in preventing and controlling invasive species. Public education should focus on those vectors of spread most likely to introduce invasive plants into priority areas. The Commonwealth should endorse and adopt the voluntary protocols established under the Saint Louis Declaration for all state agencies, and promote their adoption by nursery professionals, landscape architects, the gardening public, and botanic gardens and arboreta in Massachusetts. The Commonwealth should prohibit state agencies from purchasing or intentionally introducing species determined

to be Invasive, Likely Invasive or Potentially Invasive through the scientifically objective assessment process and commercial industries should construct and adopt a phase-out plan for these species in the trade.

Public and private partnerships

Invasive plant species are a problem whose solution requires greater resources than any single entity can feasibly apply. Solutions will require collaborative action at the local, state, regional and national levels to manage this problem in Massachusetts. We recommend that the Commonwealth adopt a strategic management plan for invasive plant species that makes optimal use of public and private partnerships and all available resources. Such a plan should identify the optimal partnerships or entities to support each aspect of invasive plant assessment, prevention, control, and eradication and the strategies that will support these efforts. In this way, strategies can be nested, so that efforts are complimentary rather than duplicative and occur at the right levels to achieve best results with available resources.

A regional partner, the New England Invasive Plant Group currently provides networking capabilities among those working on the invasive plant issue and will be a valuable resource for finding potential partners on various projects. Similarly, the Massachusetts Aquatic Invasive Species Working Group has already been developing partnerships and working on strategies for addressing aquatic invasive plants.

A number of federal funding sources for invasive species control on private lands exist and should be engaged as an important component of a strategic management plan for Massachusetts[14]. There are excellent local and regional non-governmental and for-profit groups with the commitment and resources to contribute to a comprehensive invasive species management effort. Efforts such as the voluntary collaboration among the diverse membership of the MIPAG illustrate the value of these partnerships and have the potential to make a significant impact. We recommend that these public and private partnerships remain a hallmark of invasive plant species management in Massachusetts.

<u>Summary Recommendations</u>: *Public and private partnerships should be endorsed and strengthened as part of a strategic management plan for invasive plants in Massachusetts. The transparent, collaborative work of the MIPAG should be encouraged and supported as the means of assessing invasive species for the Commonwealth. Regional and national Partnerships and sources of funding for invasive plant management should be promoted and integrated into invasives management efforts in Massachusetts.*

[14] The Commonwealth has been awarded considerable funding for restoration work by on private lands from the USFWS's Landowner Incentive Program (LIP). Securing and utilizing further federal support of this kind should be a priority under a strategic management plan for invasive plant species in Massachusetts.

Conclusion

In summary, the MIPAG recommends that the Commonwealth of Massachusetts, in partnership with other public and private sector interests, adopt the following strategic recommendations for managing invasive plants in Massachusetts:

1) Massachusetts should develop and implement a strategic management plan based on the recommendations of the MIPAG and integrated with the existing Massachusetts Aquatic Invasive Species Management Plan to address introduced invasive plant species.

2) A strategic management plan for managing invasive plants in Massachusetts should include a scientifically objective assessment process; a system for early detection and rapid response; criteria for setting research, management and education priorities; and develop broad public and private partnerships integrating efforts from the local to national scales.

3) Massachusetts should adopt the MIPAG criteria for invasive plant assessment and recognize the list of plant species determined by this process to be Invasive, Likely Invasive or Potentially Invasive within the Commonwealth. It should maintain an ongoing, transparent assessment process using the MIPAG criteria and with the participation of both public and private interest groups. This assessment should inform invasive species management strategies. Prevention strategies should predominantly focus on species assessed as Potentially Invasive and controlling the spread of Invasive species into priority conservation areas. Candidate species for eradication strategies should be selected from among those assessed as Likely Invasive.

4) Massachusetts should establish and support a centralized means within state government for inter-agency coordination on invasive species management, in partnership with public and private sector interests. This mechanism should facilitate the production of a strategic management plan for invasive plant species in the Commonwealth based on MIPAG's recommendations. It should help coordinate invasive species management efforts within the Commonwealth and integrate efforts with regional and national partners.

5) Massachusetts should establish and support an effective early detection and rapid response system for invasive species that is well integrated with regional and national efforts.

6) Massachusetts should assign to a responsible entity the task of assessing invasive species research needs and priorities for Massachusetts. It should integrate the work of public and private research partners, actively develop sources of funding for this research, and maintain a centralized database of this research in easily accessible form and linked to regional or national databases of this type. Funding sources for needed research should be developed and promoted.

7) A strategic management plan for invasive species in Massachusetts should set priorities for prevention, control, eradication and restoration efforts. Prevention should emphasize an early detection and rapid response system for new invasions and education about best management and prevention practices directed at the primary vectors for spreading invasive plant material.

Except where eradication is feasible, control efforts should always manage toward a desired status or outcome for conservation resources compromised by invasive plant species, rather than the invasive species itself. Priority areas for management should be determined by identifying at all scales the natural and cultural resources at risk from invasive species and conducting baseline assessments of invasive species at those sites.

8) Massachusetts should adopt a policy of targeted outreach and education to raise awareness of the extent of the invasive plant problem and of the importance of each of our roles in preventing and controlling invasive species. Public education should focus on those vectors of spread most likely to introduce invasive plants into priority areas. The Commonwealth should endorse and adopt the voluntary protocols established under the Saint Louis Declaration for all government agencies, and promote their adoption by nursery professionals, landscape architects, the gardening public, and botanic gardens and arboreta in Massachusetts. Specifically, the Commonwealth should prohibit state agencies from purchasing or intentionally introducing species determined to be Invasive, Likely Invasive, or Potentially Invasive through the scientifically objective assessment process of the MIPAG. Commercial industries should adopt a carefully constructed phase-out of these species in the trade while accommodating the economics of current inventories and existing contracts. Education and outreach described herein should be sufficiently funded and implemented assertively in order to steadily reduce the consumer demand for these species.

9) Public and private partnerships should be endorsed and strengthened as part of a strategic management plan for invasive plants in Massachusetts. The transparent, collaborative work of the MIPAG should be encouraged and supported as the means of assessing invasive species for the Commonwealth. Regional and national Partnerships and sources of funding for invasive plant management should be promoted and integrated into invasives management efforts in Massachusetts.

Respectfully submitted;

Rena Sumner MIPAG Chair	Cynthia Boettner MIPAG Coordinator	Timothy Abbott Strategic Management Plan Committee Chair

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Websites

Invasive Plant Atlas of New England
http://invasives.eeb.uconn.edu/ipane/

Massachusetts Aquatic Invasive Species Management Plan
http://www.state.ma.us/czm/invasivemanagementplan.htm

Massachusetts Natural Heritage and Endangered Species Program
BioMap - http://www.mass.gov/dfwele/dfw/nhesp/nhbiomap.htm
Living Waters - http://www.mass.gov/dfwele/dfw/nhesp/nhaqua.htm

Massachusetts Nursery and Landscape Association; Invasive Plants
http://www.mnla.com (click on "invasive plants")

Missouri Botanical Garden; draft voluntary codes of conduct
http://www.centerforplantconservation.org/invasives/

National Agricultural Library, for the National Invasive Species Council
http://www.invasivespecies.gov/council/main.shtml

The Nature Conservancy, Wildland Invasive Species Team
http://tncweeds.ucdavis.edu/

New England Wild Flower Society
http://www.newfs.org

Appendix A

The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts (with annotated list)

Massachusetts Invasive Plant Advisory Group

Research funded by:
Massachusetts Nursery and Landscape Association
Horticultural Research Institute
Massachusetts Executive Office of Environmental Affairs
Massachusetts Department of Fish & Game,
Division of Fisheries and Wildlife
The Nature Conservancy

Research conducted by:
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Partnering Organizations
American Nursery and Landscape Association , Arnold Arboretum of Harvard University, Brewster Conservation Administration, NSTAR Electric, Ecological Landscaping Association, Massachusetts Audubon Society
MA Department of Agricultural Resources - Div. of Regulatory and Consumer Services, MA Department of Conservation and Recreation - Div. of Water Supply Protection, MA Division of Fisheries and Wildlife - Natural Heritage and Endangered Species Program, Massachusetts Natural Heritage & Endangered Species Advisory Committee, Massachusetts Nursery and Landscape Association, New England Nursery Association, New England Wildflower Society, Northeastern Weed Science Society, Silvio O. Conte National Fish and Wildlife Refuge, The Nature Conservancy, University of Massachusetts Extension Service

Coordination provided by:
Silvio O. Conte National Fish and Wildlife Refuge
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Update: April 1, 2005. ***For most recent update, visit www.mnla.com or www.newfs.org***

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Purpose and organizing principles of the Massachusetts Invasive Plant Advisory Group (MIPAG)

Formerly known as the Massachusetts Invasive Plant Group, the Massachusetts Invasive Plant Advisory Group (MIPAG) was formed in 1999 by the Ad Hoc Native Plant Advisory Committee to begin addressing the invasive plant issue in Massachusetts. The Executive Office of Environmental Affairs recognized it as part of the Massachusetts Council on Invasive Species. This Council was intended to serve as a coordinating mechanism for the various invasive species management activities undertaken by state agencies, federal agencies, and private organizations.

The Massachusetts Invasive Plant Advisory Group is a voluntary collaboration between public and private organizations concerned about the problem of invasive plants in Massachusetts. Eighteen entities are represented including state and federal governmental agencies in fish and wildlife, agriculture, and natural resources; the horticulture industry; academic science institutions; land management and nonprofit conservation organizations. Its members affirm their commitment to working within their individual organizations to substantially address the impact of species determined by scientific criteria to be Invasive, Likely Invasive, or Potentially Invasive in the Commonwealth of Massachusetts.

The first order of business of the MIPAG has been to determine which plant species are invasive in Massachusetts. With the assistance of Dr. Leslie Mehrhoff of the University of Connecticut, the group adopted a definition and set of biologically based criteria upon which to objectively evaluate plants suspected to be invasive in the state. The group contracted with Dr. Mehrhoff to gather existing data about these species and help the group assess which are currently invasive and which have the potential to become problematic in Massachusetts.

Findings from plant evaluations of 85 species (conducted in two phases) include an annotated list of Invasive, Likely Invasive, and Potentially Invasive species. The annotated list, as well as information about the evaluation process, definitions and criteria, and group member composition, are contained within this document and can also be found online at *www.mnla.com* and *www.newfs.org*. Also included on the annotated list are species that were considered but for which sufficient information or evidence is currently lacking for an adequate evaluation.

The MIPAG makes all its important decisions at its scheduled meetings by voting. In certain instances, representatives of the same member organization voluntarily share a vote and alternate their attendance. Quorum for any meeting must be 2/3 of the voting membership (currently 12), and any decision must pass by a 2/3 majority of members present. The only exception is when a vote is taken at a meeting to determine the status of a species under assessment by MIPAG criteria for invasiveness in Massachusetts. In this case, all voting members have the right to vote, with those absent from the meeting having not more than two additional weeks after the initial vote to submit their votes to the MIPAG recorder. Only one vote per organization is allowed. Agreed by quorum on 6/12/2002, "a 2/3 majority will be calculated only using affirmative and negative votes cast. Abstentions will not be included."

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Massachusetts Criteria for Evaluating Non-Native Plant Species for Invasiveness

(THESE CRITERIA HAVE NO OFFICIAL STATUS FOR MASSACHUSETTS)

The Massachusetts Invasive Plant Advisory Group (MIPAG) defines invasive plants as *"non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.* As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

The following criteria are being used to objectively evaluate and categorize plant species suspected of being, or with the potential to become, invasive in Massachusetts. They were developed by the George Safford Torrey Herbarium at the University of Connecticut and a subcommittee of the Massachusetts Invasive Plant Group representing science, nursery, and conservation professionals.

The criteria enable the separation of plants into the following categories:

- *Invasive Plants in Massachusetts*
- *Likely Invasive Plants in Massachusetts*
- *Potentially Invasive Plants in Massachusetts (species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth)*

For a species to be included on the list of species determined to be **Invasive, Likely Invasive or Potentially Invasive** in Massachusetts, it must be substantiated by scientific investigation (including herbarium specimens, peer-reviewed papers, published records and other data available for public review) to meet specific criteria**.** The process of reviewing individual plant species for their invasiveness in Massachusetts is ongoing and may result in a change in status pending new data and further review.

Tabular summary of criteria to be met

	Criteria that must be met
Base criteria	1-4
Invasive	1-9
Likely Invasive	1-5, at least one of 6-9, at least one of 10-12
Potentially Invasive	1-4, (not 5), 13-15

For a species to be designated as "INVASIVE", "LIKELY INVASIVE" or "POTENTIALLY INVASIVE" it must to meet certain base criteria (#1-4 below). The species must:

1. Be nonindigenous to Massachusetts.
2. Have the biologic potential for rapid and widespread dispersion and establishment in minimally managed habitats.
3. Have the biologic potential for dispersing over spatial gaps away from site of introduction.
4. Have the biologic potential for existing in high numbers away from intensively managed artificial habitats.

If a species does not meet all four of the previous criteria, stop here. The species cannot be listed at this time. If a species meets all four, go on to #5.

5. Be naturalized in Massachusetts (persists without cultivation in Massachusetts)

If a species meets Criteria 1-4 and Criterion 5, it may be considered "INVASIVE " or "LIKELY INVASIVE" in Massachusetts. Go to Criteria 6-9.

If it does <u>not</u> meet Criterion 5, it may be considered "POTENTIALLY INVASIVE" if it meets Criteria 13-15.

6. Be widespread in Massachusetts**,** or at least common in a region or habitat type(s) in the state.
7. Have many occurrences of numerous individuals in Massachusetts that have high numbers of individuals forming dense stands in minimally managed habitats
8. Be able to out-compete other species in the same natural plant community.
9. Have the potential for rapid growth, high seed or propagule production and dissemination, and establishment in natural plant communities.

If a species meet the initial five Criteria and Criteria 6-9 it may be considered a "INVASIVE" species in Massachusetts.

If a species meets the initial five Criteria, but does not meet all of Criteria 6-9 at this time, it may be considered a "LIKELY INVASIVE" species in Massachusetts if in addition it meets at least one of the following three Criteria (#10-12).

10. Have at least one occurrence in Massachusetts that has high numbers of individuals forming dense stands in minimally managed habitats
11. Have the potential, based on its biology and its colonization history in the northeast or elsewhere, to become invasive in Massachusetts.
12. Be acknowledged to be invasive in nearby states but its status in Massachusetts is unknown or unclear. This may result from lack of field experience with the species or from difficulty in species determination or taxonomy.

If the species meets the basic criteria for invasiveness (Criteria 1-4) but is not naturalized in Massachusetts (Criterion 5), the species may be considered "POTENTIALLY INVASIVE" in Massachusetts if it meets the following three criteria (#13-15):

13. The species, if it becomes naturalized in Massachusetts, based on its biology and biological potential, would pose an imminent threat to the biodiversity of Massachusetts **and**
14. Its naturalization in Massachusetts is anticipated, **and**
15. The species has a documented history of invasiveness in other areas of the Northeast.

DEFINITIONS TO ACCOMPANY
"CRITERIA FOR EVALUATING NON-NATIVE PLANT SPECIES FOR INVASIVENESS IN MASSACHUSETTS"

Biologic potential - The ability of a species to increase its number, either sexually and/or asexually.

Invasive plants – Non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. *As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.*

Indigenous species - otherwise A species that occurs natively in Massachusetts. Indigenous species often have a pre-colonial presence (pre 1500) or have arrived in the region more recently without the aid of human intervention. Synonymous with native species.

Intensively managed habitats - Intensively managed habitats are habitats or land systems where management efforts and investments of time, money and labor occur frequently. Examples include manicured lawns, landscaped grounds, gardens, roadsides or agricultural lands for crops or livestock.

Likely Invasive plants – non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "Invasive plant" designation.

Minimally managed habitats - Minimally managed habitats are habitats where management efforts and investments of time, money and labor are infrequent or non-existent. These habitats may have been intensively managed for anthropogenic reasons at one time in their history. In some instances, management may be more intense but management is done for conservation purposes and is primarily aimed at preserving elements of biological diversity such as imperiled species or critical natural communities. Minimally managed habitats are similar to "natural areas" but the distinction is made in order to remove bias, misconceptions or ambiguities that surround the term "natural area".

Non-indigenous species - A species that is not native or naturally occurring (based on its biology, phylogeny, distribution and current knowledge about the species) within Massachusetts. A species may be indigenous to North America but non-indigenous in Massachusetts. Synonymous with non-native species.

Naturalized species - A non-indigenous taxon that occurs without the aid and benefits of cultivation in Massachusetts. Further, it implies two biological points: it freely and regularly reproduces in the wild, sexually or asexually, and occurrences persist over time.

Natural plant community - A natural plant community is an association or assemblage of plant species that repeatedly occur together in reoccurring patterns in a specific type of habitat. This assemblage can be characterized by dominant species and biological properties. A natural plant community implies a minimally managed situation where all or most of the species that make up the assemblage are indigenous to the defined area.

Occurrence – Existing example of a species on the landscape.

Potentially invasive plants – Non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth.

Spatial gaps - This term is used in reference to the ability of a species to disperse away from existing occurrences. The concept of crossing spatial gaps is used to distinguish those species that can disperse over discontinuities and become established elsewhere from species that spread across a habitat only by continual, uninterrupted growth.

Invasive, Likely Invasive, and Potentially Invasive Plants in Massachusetts: Findings from the Assessment Process by the Massachusetts Invasive Plant Advisory Group

Plants voted as: INVASIVE

"Invasive plants" are non-native species that have spread into native or minimally managed plant systems in Massachusetts. These plants cause economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Acer platanoides L. **(Norway maple)**
A tree occurring in all regions of the state in upland and wetland habitats, and especially common in woodlands with colluvial soils. It grows in full sun to full shade. Escapes from cultivation; can form dense stands; out-competes native vegetation, including sugar maple; dispersed by water, wind and vehicles.

Acer pseudoplatanus L. **(Sycamore maple)**
A tree occurring mostly in southeastern counties of Massachusetts, primarily in woodlands and especially near the coast. It grows in full sun to partial shade. Escapes from cultivation inland as well as along the coast; salt-spray tolerant; dispersed by wind, water and vehicles.

Aegopodium podagraria L. **(Bishop's goutweed; bishop's weed; goutweed)**
A perennial herb occurring in all regions of the state in uplands and wetlands. Grows in full sun to full shade. Escapes from cultivation; spreads aggressively by roots; forms dense colonies in flood plains.

Ailanthus altissima (P. Miller) Swingle **(Tree of heaven)**
This tree occurs in all regions of the state in upland, wetland, & coastal habitats. Grows in full sun to full shade. Spreads aggressively from root suckers, especially in disturbed areas.

Alliaria petiolata (Bieb.) Cavara & Grande **(Garlic mustard)**
Synonym: *Alliaria officinalis* Andrz. Ex Bieb.
A biennial herb occuring in all regions of the state in uplands. Grows in full sun to full shade. Spreads aggressively by seed, especially in wooded areas.

Berberis thunbergii DC. **(Japanese barberry)**
A shrub occuring in all regions of the state in open and wooded uplands and wetlands. Grows in full sun to full shade. Escaping from cultivation; spread by birds; forms dense stands.

Cabomba caroliniana A.Gray **(Carolina fanwort; fanwort)**
A perennial herb occuring in all regions of the state in aquatic habitats. Common in the aquarium trade; chokes waterways.

Celastrus orbiculatus Thunb. **(Oriental bittersweet; Asian or Asiatic bittersweet)**
A perennial vine occuring in all regions of the state in uplands. Grows in full sun to partial shade. Escaping from cultivation; berries spread by birds and humans; overwhelms and kills vegetation.

Plants voted as: INVASIVE *(continued)*

Cynanchum louiseae Kartesz & Gandhi **(Black swallow-wort, Louise's swallow-wort)**
Synonyms: *Cynanchum nigrum* (L.) Pers. non Cav.; *Vincetoxicum nigrum* (L.) Moench
A perennial vine occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to partial shade. Forms dense stands, out-competing native species: deadly to Monarch butterflies.

Elaeagnus umbellata Thunb. **(Autumn olive)**
A shrub occurring in uplands in all regions of the state. Grows in full sun. Escaping from cultivation; berries spread by birds; aggressive in open areas; has the ability to change soil.

Euonymus alatus (Thunb.) Sieb. (**Winged euonymus; Burning bush)**
A shrub occurring in all regions of the state and capable of germinating prolifically in many different habitats. It grows in full sun to full shade. Escaping from cultivation and can form dense thickets and dominate the understory; seeds are dispersed by birds.

Euphorbia esula L. **(Leafy spurge; wolf's milk)**
A perennial herb occurring in all regions of the state in grasslands and coastal habitats. Grows in full sun. An aggressive herbaceous perennial and a notable problem in western USA.

Frangula alnus P. Mill. **(European buckthorn; glossy buckthorn)**
Synonyms: *Rhamnus frangula* L.; *R. frangula* var. *angustifolia* Loud.
Shrub or tree occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Produces fruit throughout the growing season; grows in multiple habitats; forms thickets.

Glaucium flavum Crantz **(Sea or horned poppy; yellow hornpoppy)**
A biennial and perennial herb occurring in southeastern MA in coastal habitats. Grows in full sun. Seeds float; spreads along rocky beaches; primarily Cape Cod and Islands.

Hesperis matronalis L. **(Dame's rocket)**
A biennial and perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Spreads by seed; can form dense stands, particularly in flood plains.

Iris pseudacorus L. **(Yellow iris)**
A perennial herb occurring in all regions of the state in wetland habitats, primarily in flood plains. Grows in full sun to partial shade. Out-competes native plant communities.

Lepidium latifolium L. **(Broad-leaved pepperweed; tall pepperweed)**
A perennial herb occurring in eastern and southeastern regions of the state in coastal habitats. Grows in full sun. Primarily coastal at upper edge of wetlands; also found in disturbed areas; salt tolerant.

Lonicera japonica Thunb. **(Japanese honeysuckle)**
A perennial vine occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Rapidly growing, dense stands climb and overwhelm native vegetation; produces many seeds that are bird dispersed; more common in southeastern Massachusetts.

Lonicera morrowii A.Gray **(Morrow's honeysuckle)**A shrub occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Part of a confusing hybrid complex of nonnative honeysuckles commonly planted and escaping from cultivation via bird dispersal.

Plants voted as: INVASIVE *(continued)*

Lonicera x bella Zabel [*morrowii* x *tatarica*] **(Bell's honeysuckle)**
This shrub occurs in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade. Part of a confusing hybrid complex of nonnative honeysuckles commonly planted and escaping from cultivation via bird dispersal.

Lysimachia nummularia L. **(Creeping jenny; moneywort)**
A perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Escaping from cultivation; problematic in flood plains, forests and wetlands; forms dense mats.

Lythrum salicaria L. **(Purple loosestrife)**
A perennial herb or subshrub occurring in all regions of the state in upland and wetland habitats. Grows in full sun to partial shade. Escaping from cultivation; overtakes wetlands; high seed production and longevity.

Myriophyllum heterophyllum Michx. **(Variable water-milfoil; Two-leaved water-milfoil)**
A perennial herb occurring in all regions of the state in aquatic habitats. Chokes waterways, spread by humans and possibly birds.

Myriophyllum spicatum L. **(Eurasian or European water-milfoil; spike water-milfoil)**
A perennial herb found in all regions of the state in aquatic habitats. Chokes waterways, spread by humans and possibly birds.

Phalaris arundinacea L. **(Reed canary-grass)**
This perennial grass occurs in all regions of the state in wetlands and open uplands. Grows in full sun to partial shade. Can form huge colonies and overwhelm wetlands; flourishes in disturbed areas; native and introduced strains; common in agricultural settings and in forage crops.

Phragmites australis (Cav.) Trin. ex Steud. subsp. **australis (Common reed)**
A perennial grass (USDA lists as subshrub, shrub) found in all regions of the state. Grows in upland and wetland habitats in full sun to full shade. Overwhelms wetlands forming huge, dense stands; flourishes in disturbed areas; native and introduced strains.

Polygonum cuspidatum Sieb. & Zucc. **(Japanese knotweed; Japanese or Mexican Bamboo)**
Synonym: *Fallopia japonica* (Houtt.) Dcne.; *Reynoutria japonica* Houtt.
A perennial herbaceous subshrub or shrub occurring in all regions of the state in upland, wetland, and coastal habitats. Grows in full sun to full shade, but hardier in full sun. Spreads vegetatively and by seed; forms dense thickets.

Potamogeton crispus L. **(Crisped pondweed; curly pondweed)**
A perennial herb occurring in all regions of the state in aquatic habitats. Forms dense mats in the spring and persists vegetatively.

Ranunculus ficaria L. **(Lesser celandine; fig buttercup)**
A perennial herb occurring on stream banks, and in lowland and uplands woods in all regions of the state. Grows in full sun to full shade. Propagates vegetatively and by seed; forms dense stands especially in riparian woodlands; an ephemeral that outcompetes native spring wildflowers.

Rhamnus cathartica L. **(Common buckthorn)**
A shrub or tree occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Produces fruit in fall; grows in multiple habitats; forms dense thickets.

Plants voted as: INVASIVE *(continued)*

Robinia pseudoacacia L. **(Black locust)**
A tree that occurs in all regions of the state in upland habitats. Grows in full sun to full shade. While the species is native to central portions of Eastern North America, it is not indigenous to Massachusetts. It has been planted throughout the state since the 1700's and is now widely naturalized. It behaves as an invasive species in areas with sandy soils.

Rosa multiflora Thunb. **(Multiflora rose)**
A perennial vine or shrub occurring in all regions of the state in upland, wetland and coastal habitats. Grows in full sun to full shade. Forms impenetrable thorny thickets that can overwhelm other vegetation; bird dispersed.

Trapa natans L. **(Water-chestnut)**
An annual herb occurring in the western, central, and eastern regions of the state in aquatic habitats. Forms dense floating mats on water.

Plants votes as: LIKELY INVASIVE

"Likely Invasive plants" are non-native species that are naturalized in Massachusetts but do not meet the full criteria that would trigger an "Invasive plant" designation. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Ampelopsis brevipedunculata (Maxim.) Trautv. **(Porcelain-berry; Amur peppervine)**
A woody vine found primarily in southeastern counties of Massachusetts but known from some western counties as well. Occurs in upland woodland edges and thickets and grows in full sun to partial shade. Escapes from cultivation and is bird dispersed.

Anthriscus sylvestris (L.) Hoffmann **(Wild chervil)**
Synonym: *Chaerophyllum sylvestre* L.
A biennial or short-lived perennial herb with a few reported sites in minimally managed habitats scattered across the state. It occurs in old fields, wetlands, roadsides and proliferates in floodplain soils. Grows in full sun to partial shade. It has a very long taproot and is reported to be spreading in Vermont and Connecticut.

Berberis vulgaris L**. (Common barberry; European barberry)**
A shrub occurring in all regions of the state, primarily in uplands. It grows in full sun to full shade. The potential of this plant to spread is high; once common but widely eradicated because it is an alternate host for wheat rust; it hybridizes with Japanese barberry.

Cardamine impatiens L. **(Bushy rock-cress; narrowleaf bittercress)**
A winter annual or biennial herb found in western Massachusetts occurring in rich woods, rocky ledges, roadsides, and stream banks. It grows in full sun to full shade. Disperses seeds easily and is spreading rapidly in other parts of New England.

Centaurea biebersteinii DC. **(Spotted knapweed)**
Synonym: *Centaurea maculosa* auct. non Lam.
A biennial or perennial herb occurring in all regions of the state in upland and coastal habitats. Grows in full sun. Aggressively grows in well-drained, disturbed soils; serious problem in western states where it out-competes native grassland species, literature reports are currently lacking for this in the northeast.

Plants voted as: LIKELY INVASIVE *(continued)*

Cynanchum rossicum (Kleopov) Borhidi **(European swallow-wort; pale swallow-wort)**
Synonym: *Vincetoxicum rossicum* (Kleopov) Barbarich
A perennial herb occurring in the western region of the state in upland habitats. Grows in full sun to partial shade. Forms dense stands; found primarily in the lower Connecticut River Valley.

Egeria densa Planchon **(Brazilian waterweed; Brazilian elodea)**
Synonyms: *Anacharis densa* (Planch.) Victorin; *Elodea densa* (Planch.) Caspary
A perennial herb occurring in the eastern and southeastern regions of the state in aquatic habitats. Common in the aquarium trade; chokes waterways; currently only found in a few MA ponds.

Epilobium hirsutum L. **(Hairy willow-herb; Codlins and cream)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun. Seeds dispersed by wind and water; evidence currently lacking that this species out- competes other vegetation in minimally managed habitats.

Euphorbia cyparissias L. **(Cypress spurge)**
A perennial herb occurring in all regions of the state in upland habitats. Grows in full sun. Persists in open areas; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

Festuca filiformis Pourret **(Hair fescue; fineleaf sheep fescue)**
A perennial grass occurring in all regions of the state, in grasslands and open woodlands. Grows in full sun to partial shade. Common in minimally managed grassland habitats; more data needed on its ability to outcompete native species.

Glyceria maxima (Hartman) Holmburg **(Tall mannagrass; reed mannagrass)**
A perennial grass currently known from one marsh in Essex County. Grows in full sun to partial shade. Spreads vegetatively and produces viable seeds; forms dense stands.

Heracleum mantegazzianum Sommier & Levier **(Giant hogweed)**
A perennial herb occurring in scattered sites across all regions of the state; thrives in multiple habitats. Grows in full sun to full shade. Escapes from cultivation; seeds can be dispersed by water; can cause severe skin reactions.

Humulus japonicus Sieb. & Zucc. **(Japanese hops)**
An annual herbaceous vine with current records in western MA, but historical records from all regions of the state. Grows in floodplain forests and riverbanks in full sun to partial shade. Escapes from cultivation; capable of prolific growth.

Hydrilla verticillata (L.f.) Royle **(Hydrilla; water-thyme; Florida elodea)**
A perennial aquatic herb occurring in the southeastern region of the state. Only found in one MA pond currently (2004); easily dispersed by birds and humans; chokes entire water bodies.

Ligustrum obtusifolium Sieb. & Zucc. **(Border privet)**
A shrub occurring in all regions of the state in woodlands and woodland edges. Grows in full sun to full shade. Widespread and shade tolerant, bird dispersed; more data needed on density and distribution; flowers are needed to identify species.

Lonicera tatarica L. **(Tatarian honeysuckle)**
A shrub found from Boston westward in thickets, woods, and edges of woods. Can grow in full sun to full shade. Commonly confused with other non-native honeysuckles; crosses with Morrow's honeysuckle *(L. morrowii)* to produce the invasive hybrid Belle's honeysuckle *(L.* x*bella)*.

Plants voted as: LIKELY INVASIVE *(continued)*

Microstegium vimineum (Trin.) A. Camus **(Japanese stilt grass; Nepalese browntop)**
An annual grass occurring in the western region of the state in upland and wetland habitats. Grows in full sun to full shade. Forms dense stands; currently localized in the lower Connecticut River Valley; spreads in flood plains.

Miscanthus sacchariflorus (Maxim.) Franch. **(Plume grass; Amur silvergrass)**
This perennial grass is currently known to occur in central MA in wetland margins and roadsides. Grows in full sun. Spreads by rhizomes and develops dense stands along roadsides and adjacent native habitats.

Myosotis scorpioides L. **(Forget-me-not)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun to full shade. Escaping from cultivation; prolific in open wooded streams, stream-banks and wet meadows; evidence about its persistence is needed.

Myriophyllum aquaticum (Vell.) Verdc. **(Parrot-feather; water-feather; Brazilian watermilfoil)**
Synonym: *Myriophyllum brasiliense* Camb.
A perennial herbaceous aquatic occurring in southeastern MA along a shallow pond edge.
Grows in full sun to partial shade. Reproduces from fragments; commonly used in the water garden trade.

Najas minor All. **(Brittle water-nymph; lesser naiad)**
An annual herb occurring in the western region of the state in aquatic habitats. Chokes waterways; spread by humans and possibly birds; currently found only in Berkshire County (2002).

Nymphoides peltata (Gmel.) Kuntze **(Yellow floating heart)**
This aquatic perennial occurs in ponds in central MA. Grows in full sun to partial shade. Can create a dense floating mat on ponds and can reproduce from fragments.

Phellodendron amurense Rupr. (sensu lato) **(Amur cork-tree)**
Synonyms: *Phellodendron japonicum* Maxim.; *Phellodendron amurense* var. japonicum (Maxim.) Ohwi; *Phellodendron sachalinense* (F. Schmidt) Sarg.; *Phellodendron amurense* var. sachalinense F. Schmidt; *Phellodendron lavallei* Dode; *Phellodendron amurense* var. lavallei (Dode) Sprague
This tree occurs in uplands of eastern to central MA. Grows in full sun to full shade. A bird dispersed species that has escaped cultivation.

Pueraria montana (Lour.) Merrill **(Kudzu; Japanese arrowroot)**
Synonym: *Pueraria montana* var. *lobata* (Willd.) Maesen & S. Almeida
A perennial herbaceous vine found in southeastern MA. Occurs at Arnold Arboretum; uplands. Grows in full sun to partial shade. Present in MA and subject to control; marginally hardy in MA but has the potential to invade minimally-managed areas based on its performance elsewhere.

Ranunculus repens L. **(Creeping buttercup)**
A perennial herb occurring in all regions of the state in wetlands. Grows in full sun to full shade. Common around springs and wetlands; evidence currently lacking that this species out- competes other vegetation in minimally managed habitats.

Rorippa amphibia (L.) Bess. **(Water yellowcress; great yellowcress)**
Synonyms: *Nasturtium amphibium* (L.) Ait. f.; *Sisymbrium amphibium* L.
A perennial herb occurring in central MA. Grows in wetlands in full sun to partial shade. Common and increasing in central MA river drainages; a major threat to riparian habitats forming dense stands at some locations.

Plants voted as: LIKELY INVASIVE *(continued)*

Rubus phoenicolasius Maxim**. (Wineberry; Japanese wineberry; wine raspberry)**
A shrub found in uplands of southern MA. Can grow in full sun to partial shade.
Animal and human dispersed; forms thickets.

Senecio jacobaea L. **(Tansy ragwort; stinking Willie)**
A biennial herb occurring in a few sites east of the Connecticut River; habitat is open uplands. Grows in sun or partial shade. This species is highly invasive in the Canadian Maritimes; may also spread from disturbed areas.

Tussilago farfara L. **(Coltsfoot)**
A perennial herb occurring in all regions of the state in upland and wetland habitats. Grows in full sun to full shade. Particularly problematic in lime seeps and disturbed sites; evidence currently lacking that this species out-competes other vegetation in minimally managed habitats.

Plants voted as: POTENTIALLY INVASIVE

"Potentially invasive plants" are non-native species not currently known to be naturalized in Massachusetts, but that can be expected to become invasive within minimally managed habitats within the Commonwealth. As defined here, "species" includes all synonyms, subspecies, varieties, forms, and cultivars of that species unless proven otherwise by a process of scientific evaluation.

Arthraxon hispidus (Thunb.) Makino (**Hairy joint grass; jointhead; small carpetgrass)**
An annual grass historically known from Franklin County but not currently known from the state. Habitats elsewhere include roadsides, shores, ditches, and low woods and fields. Grows in full to partial shade. Is problematic in Connecticut and southward.

Carex kobomugi Ohwi **(Japanese sedge; Asiatic sand sedge)**
A perennial sedge established mainly in sand dunes and growing in full sun. There is only one current New England location--in Rhode Island; it can spread rapidly in dune systems.

Lonicera maackii (Rupr.) Herder **(Amur honeysuckle)**
A shrub having specimens and reports from a number of MA counties, but verification of naturalization at these locations is needed. The likely habitats are woods and woodland edges. Can grow in full sun or shade. Escapes from cultivation, but documentation needed regarding naturalized populations in MA; recognized as invasive in the Midwest and portions of the southeastern USA.

Polygonum perfoliatum L. **(Mile-a-minute vine or weed; Asiatic tearthumb)**
Synonym: *Ampelygonum perfoliatum* (L.) Roberty & Vautier
This annual herbaceous vine is not currently known to exist in MA, but has been found in RI and CT. Habitats include streamside, fields, and road edges in full sun to partial shade. Highly aggressive; bird and human dispersed.

EVALUATED PLANTS NOT MEETING CRITERIA
(Do not list at this time)

The following plants were evaluated for invasiveness by the Massachusetts Invasive Plant Advisory Group. They did not meet the necessary criteria to list them as Invasive, Likely Invasive or Potentially Invasive at the time of evaluation.

Actinidia arguta (Sieb. & Zucc.) Planchon ex Miq. **(Hardy kiwi; tara vine)**
A woody vine that is dioecious (i.e., with male and female flowers on separate individuals). It grows in full sun to partial shade. Can form dense stands; evidence needed to evaluate its reproductive ability and potential to establish new populations away from cultivation.

Akebia quinata (Houtt.) Dcne. (**Five-leaved Akebia; chocolate vine)**
A woody vine that grows in full sun to full shade. Can form dense stands; evidence needed to evaluate its reproductive ability and potential for establishment away from cultivation.

Catalpa speciosa (Warder) Warder ex Engelm. (**Northern catalpa)**
A tree that grows in full sun to partial shade. Preliminary data suggest that this species could be invasive in floodplain forests; more data is needed on its ability to out compete native species.

Cytisus scoparius (L.) Link (**Scotch broom; English broom)**
A shrub that grows in full sun to partial shade. Current evidence does not show that it is spreading rapidly from cultivation and out competing native species in Massachusetts.

Elaeagnus angustifolia L. (**Russian olive)**
A small tree or shrub that grows in full sun to full shade. Not currently known from minimally managed habitats in Massachusetts; invasive elsewhere in the United States; commonly confused with autumn olive (*Elaeagnus umbellata*).

Festuca ovina L. (**Sheep fescue)**
A perennial grass that grows in full sun. More data needed on its ability to outcompete native species in minimally managed habitats.

Ligustrum ovalifolium Hassk. **(California privet)**
Shrub. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed in identification and invasiveness.

Ligustrum sinense Lour. **(Chinese privet)**
A shrub that can tolerate full sun or shade. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed on identification and invasiveness.

Ligustrum vulgare L. **(European privet)**
Shrub. Because of the difficulty in identifying privet species and the current lack of data, we have chosen not to rank most privets; further research is needed in identification and invasiveness.

Lonicera xylosteum L. **(Dwarf honeysuckle)**
Shrub. Reports of naturalized occurrences need verification in MA.

Miscanthus sinensis Anderss. **(Eulalia; Chinese silvergrass)**
A perennial grass that grows in full sun. More data needed for minimally managed habitats.

EVALUATED PLANTS NOT MEETING CRITERIA *(continued)*

Morus alba L. **(White mulberry)**
A tree that grows in full sun to partial shade. Reports of naturalized occurrences and invasiveness need verification in MA.

Polygonum sachalinense F. Schmidt ex Maxim. **(Giant knotweed)**
Synonyms: *Fallopia sachalinensis* (F. Schmidt ex Maxim.) Dcne.;
Reynoutria sachalinensis (F. Schmidt ex Maxim.) Nakai
A perennial herb that grows in full sun. Data needed on occurrences in minimally managed areas in MA; highly invasive in the maritime provinces of Canada.

Populus alba L. **(White poplar)**
A tree that grows in full sun. Data needed on occurrences in minimally managed areas.

Rorippa microphylla (Boenn. ex Reichenb.) Hyland ex A. & D. Löve **(Watercress; onerow yellowcress)**
Synonym: *Nasturtium microphyllum* Boenn. Ex Reichenb.
A perennial aquatic that grows in full sun to partial shade. There is difficulty in separating this species from *Rorippa nasturtium-aquaticum*; more data needed on its current status on the landscape and its impact on minimally managed habitats.

Rorippa nasturtium-aquaticum (L.) Hayek **(Watercress)**
Synonym: *Nasturtium officinale* Ait. f.
A perennial aquatic that grows in full sun to partial shade. There is difficulty in separating this species from *Rorippa microphylla*; more data needed on its current status on the landscape and its impact on minimally managed habitats.

Rosa rugosa Thunb. **(Japanese rose; rugosa rose)**
A shrub that grows in full sun. This is a widely planted urban & coastal plant; listing it as Invasive or Likely Invasive does not accurately reflect all the properties of this plant; there are no data at this time to suggest that this species is disruptive to native plant habitats in MA.

Sedum telephium L. ssp. telephium **(Live-forever; orpine; witch's moneybags)**
A perennial herb that can grow in full sun to shade. More data needed on taxonomy, nomenclature, and occurrences in minimally managed areas.

Verbascum thapsus L. **(Common mullein; flannel mullein; velvet plant)**
A biennial herb that grows in full sun. Although MIPAG does not feel this species meets the criteria for listing at this time, its occurrence in critical habitats (especially limestone cliff communities) is of concern; species has not been proven to have outcompeting qualities; more data needed on this species and the very similar *Verbascum phlomoides*, including taxonomy, persistence, and their impact on minimally managed habitats.

Species Reviewed (Phases I and II): Listed Alphabetically

Species	Common name	Category
Aegopodium podagraria	Bishop's goutweed; bishop's weed;	Invasive
	goutweed	
Acer platanoides	Norway maple	Invasive
Acer pseudoplatanus	Sycamore maple	Invasive
Actinidia arguta	Hardy kiwi; tara vine	Do not list at this time
Ailanthus altissima	Tree of heaven	Invasive
Akebia quinata	Five-leaved Akebia; chocolate vine	Do not list at this time
Alliaria petiolata	Garlic mustard	Invasive
Ampelopsis brevipedunculata	Porcelain-berry; Amur peppervine	Likely invasive
Ampelygonum perfoliatum – see Polygonum perfoliatum		
Anacharis densa – see Egeria densa		
Anthriscus sylvestris	Wild chervil	Likely invasive
Arthraxon hispidus	Hairy joint grass; jointhead; small carpet grass	Potentially Invasive
Berberis thunbergii	Japanese barberry	Invasive
Berberis vulgaris	Common barberry; European barberry	Likely Invasive
Cabomba caroliniana	Carolina fanwort; fanwort	Invasive
Cardamine impatiens	Bushy rock-cress; narrowleaf bittercress	Likely Invasive
Carex kobomugi	Japanese sedge; Asiatic sand sedge	Potentially Invasive
Catalpa speciosa	Northern catalpa	Do not list at this time
Celastrus orbiculatus	Oriental bittersweet; Asian or Asiatic bittersweet	Invasive
Centaurea biebersteinii	Spotted knapweed	Likely Invasive
Centaurea maculosa – see Centaurea biebersteinii		
Chaerophyllum sylvestre – see Anthriscus sylvestris		
Cynanchum louiseae	Black swallow-wort; Louise's swallow-wort	Invasive
Cynanchum nigrum – see Cynanchum louiseae		
Cynanchum rossicum	European swallow-wort; pale swallow-wort	Likely Invasive
Cytisus scoparius	Scotch broom; English broom	Do not list at this time
Egeria densa	Brazilian water weed, Brazilian elodea	Likely Invasive
Elaeagnus umbellata	Autumn olive	Invasive
Elaeagnus angustifolia	Russian olive	Do not list at this time
Elodea densa – see Egeria densa		
Epilobium hirsutum	Hairy willow herb; Codlins and cream	Likely Invasive
Euonymus alatus	Winged euonymus; burning bush	Invasive
Euphorbia cyparissias	Cypress spurge	Likely Invasive
Euphorbia esula	Leafy spurge; wolf's milk	Invasive
Fallopia japonica - see Polygonum cuspidatum		

Fallopia sachalinensis - see Polygonum sachalinense		
Festuca filiformis	Hair fescue; fineleaf sheep fescue	Likely Invasive
Festuca ovina	Sheep fescue	Do not list at this time
Frangula alnus	European buckthorn; glossy buckthorn	Invasive
Glaucium flavum	Sea or horned poppy; yellow hornpoppy	Invasive
Glyceria maxima	Tall mannagrass; reed mannagrass	Likely Invasive
Hesperis matronalis	Dame's rocket	Invasive
Heracleum mantegazzianum	Giant hogweed	Likely Invasive
Humulus japonicus	Japanese hops	Likely Invasive
Hydrilla verticillata	Waterthyme, Florida elodea	Likely Invasive
Iris pseudacorus	Yellow iris	Invasive
Lepidium latifolium	Broad-leaved pepperweed; tall pepperweed	Invasive
Ligustrum obtusifolium	Border privet	Likely Invasive
Ligustrum ovalifolium	California privet	Do not list at this time
Ligustrum sinense	Chinese privet	Do not list at this time
Ligustrum vulgare L.	European privet	Do not list at this time
Lonicera japonica	Japanese honeysuckle	Invasive
Lonicera maackii	Amur honeysuckle	Potentially Invasive.
Lonicera morrowii	Morrow's honeysuckle	Invasive
Lonicera tatarica	Tatarian honeysuckle	Likely invasive
Lonicera xylosteum	Dwarf honeysuckle	Do not list at this time
Lonicera x bella [morrowii x tatarica]	Bell's honeysuckle	Invasive
Lysimachia nummularia	Creeping jenny; moneywort	Invasive
Lythrum salicaria	Purple loosestrife	Invasive
Microstegium vimineum	Japanese stilt grass; Nepalese browntop	Likely Invasive
Miscanthus sacchariflorus	Plume grass; Amur silvergrass	Likely Invasive
Miscanthus sinensis	Eulalia; Chinese silvergrass	Do not list at this time
Morus alba	White mulberry	Do not list at this time
Myosotis scorpioides	Forget-me-not	Likely Invasive
Myriophyllum aquaticum	Parrot feather; water-feather; Brazilian water-milfoil	Likely Invasive
Myriophyllum brasiliense - see Myriophyllum aquaticum		
Myriophyllum heterophyllum	Variable water-milfoil; two-leaved water-milfoil	Invasive
Myriophyllum spicatum	Eurasian or European water-milfoil; spike water-milfoil	Invasive
Najas minor	Brittle water-nymph; lesser naiad	Likely Invasive
Nasturtium amphibium - see Rorripa amphibia		
Nasturtium microphyllum – see Rorippa microphylla		
Nasturtium officinale - see Rorippa nasturtium-aquaticum		
Nymphoides peltata	Yellow floating heart	Likely Invasive
Phalaris arundinacea	Reed canary-grass	Invasive
Phellodendron amurense	Amur cork-tree	Likely Invasive

Phellodendron amurense var. japonicum - see Phellodendron amurense		
Phellodendron amurense var. lavallei - *see Phellodendron amurense*		
Phellodendron amurense var. sachalinense - see Phellodendron amurense		
Phellodendron lavallei - see Phellodendron amurense		
Phellodendron sachalinense - see Phellodendron amurense		
Phragmites australis	Common reed	Invasive
Polygonum cuspidatum	Japanese knotweed; Japanese or Mexican bamboo	Invasive
Polygonum perfoliatum	Mile-a-minute vine or weed; Asiatic tearthumb	Potentially Invasive
Polygonum sachalinense	Giant knotweed	Do not list at this time
Populus alba	White poplar	Do not list at this time
Potamogeton crispus	Crisped pondweed; curly pondweed	Invasive
Pueraria montana	Kudzu; Japanese arrowroot	Likely Invasive
Pueraria montana var. lobata – see Pueraria montana		
Ranunculus ficaria	Lesser celandine; fig buttercup	Invasive
Ranunculus repens	Creeping buttercup	Likely Invasive
Reynoutria sachalinensis – see Polygonum sachalinense		
Reynoutria japonica – see Polygonum cuspidatum		
Rhamnus cathartica	Common buckthorn	Invasive
Rhamnus frangula – see Frangula alnus		
Robinia pseudoacacia	Black locust	Invasive
Rorippa amphibia	Water yellowcress; great yellowcress	Invasive
Rorippa microphylla	Watercress; onerow yellowcress	Do not list at this time
Rorippa nasturtium-aquaticum	Watercress	Do not list at this time
Rosa multiflora	Multiflora rose	Invasive
Rosa rugosa	Japanese rose; rugosa rose	Do not list at this time
Rubus phoenicolasius	Wineberry; Japanese wineberry; wine raspberry	Likely Invasive
Sedum telephium ssp. telephium	Live-forever; orpine; witch's moneybags	Do not list at this time
Senecio jacobaea	Tansy ragwort; stinking Willie	Likely Invasive
Sisymbrium amphibium - see Rorripa amphibia		
Trapa natans	Water-chestnut	Invasive
Tussilago farfara	Coltsfoot	Likely Invasive
Verbascum thapsus	Common mullein; flannel mullein;	Do not list at this time

velvet plant
Vincetoxicum nigrum – see Cynanchum nigrum
Vincetoxicum rossicum – Cynanchum rossicum

Species Reviewed (Phases I and II): Listed by Category

Species	Common name	Category
Acer platanoides	Norway maple	Invasive
Acer pseudoplatanus	Sycamore maple	Invasive
Aegopodium podagraria	Bishop's goutweed, bishop's weed; goutweed	Invasive
Ailanthus altissima	Tree of heaven	Invasive
Alliaria petiolata	Garlic mustard	Invasive
Berberis thunbergii	Japanese barberry	Invasive
Cabomba caroliniana	Carolina fanwort; fanwort	Invasive
Celastrus orbiculatus	Oriental bittersweet; Asian or Asiatic bittersweet	Invasive
Cynanchum louiseae	Black swallow-wort; Louise's swallow-wort	Invasive
Elaeagnus umbellata	Autumn olive	Invasive
Euonymus alatus	Winged euonymus, burning bush	Invasive
Euphorbia esula	Leafy spurge; wolf's milk	Invasive
Frangula alnus	European buckthorn, glossy buckthorn	Invasive
Glaucium flavum	Sea or horned poppy, yellow hornpoppy	Invasive
Hesperis matronalis	Dame's rocket	Invasive
Iris pseudacorus	Yellow iris	Invasive
Lepidium latifolium	Broad-leaved pepperweed, tall pepperweed	Invasive
Lonicera japonica	Japanese honeysuckle	Invasive
Lonicera morrowii	Morrow's honeysuckle	Invasive
Lonicera x bella [morrowii x tatarica]	Bell's honeysuckle	Invasive
Lysimachia nummularia	Creeping jenny, moneywort	Invasive
Lythrum salicaria	Purple loosestrife	Invasive
Myriophyllum heterophyllum	Variable water-milfoil; two-leaved water-milfoil	Invasive
Myriophyllum spicatum	Eurasian or European water-milfoil; spike water- milfoil	Invasive
Phalaris arundinacea	Reed canary-grass	Invasive
Phragmites australis	Common reed	Invasive
Polygonum cuspidatum	Japanese knotweed; Japanese or Mexican bamboo	Invasive
Potamogeton crispus	Crisped pondweed, curly pondweed	Invasive
Ranunculus ficaria	Lesser celandine; fig buttercup	Invasive
Rhamnus cathartica	Common buckthorn	Invasive
Robinia pseudoacacia	Black locust	Invasive
Rosa multiflora	Multiflora rose	Invasive
Trapa natans	Water-chestnut	Invasive
Ampelopsis brevipedunculata	Porcelain-berry; Amur peppervine	Likely invasive
Anthriscus sylvestris	Wild chervil	Likely invasive
Berberis vulgaris	Common barberry; European barberry	Likely Invasive
Cardamine impatiens	Bushy rock-cress; narrowleaf bittercress	Likely Invasive
Centaurea biebersteinii	Spotted knapweed	Likely Invasive
Cynanchum rossicum	European swallow-wort, pale swallow-wort	Likely Invasive
Egeria densa	Brazilian water weed; Brazilian elodea	Likely Invasive
Epilobium hirsutum	Hairy willow herb; Codlins and cream	Likely Invasive
Euphorbia cyparissias	Cypress spurge	Likely Invasive

Festuca filiformis	Hair fescue; fineleaf sheep fescue	Likely Invasive
Glyceria maxima	Tall mannagrass; reed mannagrass	Likely Invasive
Heracleum mantegazzianum	Giant hogweed	Likely Invasive
Humulus japonicus	Japanese hops	Likely Invasive
Hydrilla verticillata	Hydrilla; water-thyme; Florida elodea	Likely Invasive
Ligustrum obtusifolium	Border privet	Likely Invasive
Lonicera tatarica	Tatarian honeysuckle	Likely invasive
Microstegium vimineum	Japanese stilt grass, Nepalese browntop	Likely Invasive
Miscanthus sacchariflorus	Plume grass; Amur silvergrass	Likely Invasive
Myosotis scorpioides	Forget-me-not	Likely Invasive
Myriophyllum aquaticum	Parrot-feather; water-feather; Brazilian water-milfoil	Likely Invasive
Najas minor	Brittle water-nymph, lesser naiad	Likely Invasive
Nymphoides peltata	Yellow floating heart	Likely Invasive
Phellodendron amurense	Amur cork-tree	Likely Invasive
Pueraria montana	Kudzu; Japanese arrowroot	Likely Invasive
Ranunculus repens	Creeping buttercup	Likely Invasive
Rorippa amphibia	Water yellowcress; great yellowcress	Likely Invasive
Rubus phoenicolasius	Wineberry; Japanese wineberry; wine raspberry	Likely Invasive
Senecio jacobaea	Tansy ragwort; stinking Willie	Likely Invasive
Tussilago farfara	Coltsfoot	Likely Invasive
Arthraxon hispidus	Hairy joint grass; jointhead; small carpetgrass	Potentially Invasive
Carex kobomugi	Japanese sedge, Asiatic sand sedge	Potentially Invasive
Lonicera maackii	Amur honeysuckle	Potentially Invasive.
Polygonum perfoliatum	Mile-a-minute vine or weed; Asiatic tearthumb	Potentially Invasive
Actinidia arguta	Hardy kiwi; tara vine	Do not list at this time
Akebia quinata	Five-leaved Akebia; chocolate vine	Do not list at this time
Catalpa speciosa	Northern catalpa	Do not list at this time
Cytisus scoparius	Scotch broom; English broom	Do not list at this time
Elaeagnus angustifolia	Russian olive	Do not list at this time
Festuca ovina	Sheep fescue	Do not list at this time
Ligustrum ovalifolium	California privet	Do not list at this time
Ligustrum sinense	Chinese privet	Do not list at this time
Ligustrum vulgare L.	European privet	Do not list at this time
Lonicera xylosteum	Dwarf honeysuckle	Do not list at this time
Miscanthus sinensis	Eulalia; Chinese silvergrass	Do not list at this time
Morus alba	White mulberry	Do not list at this time
Polygonum sachalinense	Giant knotweed	Do not list at this time
Populus alba	White poplar	Do not list at this time
Rorippa microphylla	Watercress; onerow yellowcress	Do not list at this time
Rorippa nasturtium-aquaticum	Watercress	Do not list at this time
Rosa rugosa	Japanese rose; rugosa rose	Do not list at this time
Sedum telephium ssp. telephium	Live-forever; orpine; witch's moneybags	Do not list at this time
Verbascum thapsus	Common mullein; flannel mullein; velvet plant	Do not list at this time

Appendix B

Saint Louis Declaration

Draft voluntary codes of conduct for government, nursery professionals, landscape architects, the gardening public, and botanic gardens and arboreta: http://www.mobot.org/invasives/

Draft Voluntary Codes of Conduct for Government

1. Require risk assessment for government-led or financed plant introductions to ensure that no new harmful plant species are introduced, intentionally or unintentionally.

2. Do not distribute existing holdings of invasive plant species to areas where they can potentially do harm; eliminate these holdings or maintain new or existing holdings using appropriate safeguards.

3. Coordinate and facilitate collaboration in databases, early warning systems, monitoring, and other means of preventing invasive plant species problems.

4. Lead and fund (subject to budgetary considerations) the development of environmentally sound methods to control harmful invasive plant species, seek control of such species on public lands and promote their control on adjacent private lands.

5. Develop and promote the use of non-invasive plant species within all government units and to the public.

6. Facilitate, lead, coordinate and evaluate public outreach and education on harmful invasive plant species.

7. Encourage Federal employees and management to participate in ongoing training programs on invasive plant species.

8. Foster international cooperation to minimize the risk of the import and export of potentially invasive plant species.

9. Develop partnerships and incentive programs to lessen the impact of invasive plant species and provide non-invasive restoration materials.

10. Provide a forum for regular evaluation of the effectiveness of these voluntary codes of conduct towards preventing the invasive plant species problem.
11. Enforce invasive plant species legislation at all levels.

Draft Voluntary Codes of Conduct for Nursery Professionals

1. Ensure that invasive potential is assessed prior to introducing and marketing plant species new to North America. Invasive potential should be assessed by the introducer or qualified experts using emerging risk assessment methods that consider plant characteristics and prior observations or experience with the plant elsewhere in the world. Additional insights may be gained through extensive monitoring on the nursery site prior to further distribution.

2. Work with regional experts and stakeholders to determine which species in your region are either currently invasive or will become invasive. Identify plants that could be suitable alternatives in your region.

3. Develop and promote alternative plant material through plant selection and breeding.

4. Where agreement has been reached among nursery associations, government, academia, and ecology and conservation organizations, phase-out existing stocks of those specific invasive species in regions where they are considered to be a threat.

5. Follow all laws on importation and quarantine of plant materials across political boundaries.

6. Encourage customers to use, and garden writers to promote, non-invasive plants.

Draft Voluntary Codes of Conduct for the Gardening Public

1. Ask for only non-invasive species when you acquire plants. Plant only environmentally safe species in your gardens. Work towards and promote new landscape design that is friendly to regional ecosystems.

2. Seek information on which species are invasive in your area. Sources could include botanical gardens, horticulturists, conservationists, and government agencies. Remove invasive species from your land and replace them with non-invasive species suited to your site and needs.

3. Do not trade plants with other gardeners if you know they are species with invasive characteristics.

4. Request that botanical gardens and nurseries promote, display and sell only non-invasive species.

5. Help educate your community and other gardeners in your area through personal contact and in such settings as garden clubs and other civic groups.

6. Ask garden writers and other media to emphasize the problem of invasive species and provide information. Request that garden writers promote only non-invasive species.

7. Invite speakers knowledgeable on the invasive species issue to speak to garden clubs, master gardeners, schools and other community groups.

8. Seek the best information on control of invasive plant species and organize neighborhood work groups to remove invasive plant species under the guidance of knowledgeable professionals.

9. Volunteer at botanical gardens and natural areas to assist ongoing efforts to diminish the threat of invasive plants.

10. Participate in early warning systems by reporting invasive species you observe in your area. Determine which group or agency should be responsible for reports emanating from your area. If no 800 number exists for such reporting, request that one be established, citing the need for a clearinghouse with an 800 number and website links to information about invasive plant species.

11. Assist garden clubs to create policies regarding the use of invasive species not only in horticulture, but also in activities such as flower shows. Urge florists and others to eliminate the use of invasive plant material.

Draft Voluntary Codes of Conduct for Landscape Architects

1. Seek out education and information on invasive species issues:

a) Work with local plant ecologists, horticulturists, nurseries, botanic gardens, conservation organizations and others to determine what species in your region either are currently highly invasive or show aggressive potential. Investigate species under consideration that may present a threat.
b) Increase interaction with other professionals and non-professionals to identify alternative plant material and other solutions to problems caused by harmful invasive plants.
c) Take advantage of continuing education opportunities to learn more about invasive species issues.

2. Identify and specify non-invasive species that are aesthetically and horticulturally suitable alternatives to invasive species in your region.

3. Eliminate specification of species that are invasive in your region.

4. Be aware of potential environmental impacts beyond the designed and managed area of the landscape plan (e.g. plants may spread to adjacent natural area or cropland).

5. Encourage nurseries and other suppliers to provide landscape contractors and the public with non-invasive plants.

6. Collaborate with other local experts and agencies in the development and revision of local landscape ordinances. Promote inclusion of invasive species issues in these ordinances.

Draft Voluntary Codes of Conduct for Botanic Gardens and Arboreta

1. Conduct an institution-wide review examining all departments and activities that provide opportunities to stem the proliferation of invasive species and inform visitors. For example, review or write a collections policy that addresses this issue; examine such activities as seed sales, plant sales, bookstore offerings, wreath-making workshops, etc.

2. Avoid introducing invasive plants by establishing an invasive plant assessment procedure. Predictive risk assessments are desirable, and should also include responsible monitoring on the garden site or through partnerships with other institutions. Institutions should be aware of both direct and indirect effects of plant introduction, such as biological interference in gene flow, disruption of pollinator relationships, etc.

3. Consider removing invasive species from plant collections. If a decision is made to retain an invasive plant, ensure its control and provide strong interpretation to the public explaining the risk and its function in the garden.

4. Seek to control harmful invasive species in natural areas managed by the garden and assist others in controlling them on their property, when possible.

5. Promote non-invasive alternative plants or, when possible, help develop non-invasive alternatives through plant selection or breeding.

6. If your institution participates in seed or plant distribution, including through Index Seminum, do not distribute known invasive plants except for bona-fide research purposes, and consider the consequences of distribution outside your biogeographic region. Consider a statement of caution attached to species that appear to be potentially invasive but have not been fully evaluated.

7. Increase public awareness about invasive plants. Inform why they are a problem, including the origin, mechanisms of harm, and need for prevention and control. Work with the local nursery and seed industries to assist the public in environmentally safe gardening and sales. Horticulture education programs, such as those at universities, should also be included in education and outreach efforts. Encourage the public to evaluate what they do in their own practices and gardens.

8. Participate in developing, implementing, or supporting national, regional, or local early warning systems for immediate reporting and control. Participate also in the creation of regional lists of concern.

9. Botanical gardens should try to become informed about invasiveness of their species in other biogeographic regions, and this information should be compiled and shared in a manner accessible to all.

10. Become partners with other organizations in the management of harmful invasive species.

11. Follow all laws on importation, exportation, quarantine, and distribution of plant materials across political boundaries, including foreign countries. Be sensitive to conventions and treaties that deal with this issue, and encourage affiliated organizations (plant societies, garden clubs, etc.) to do the same.