FINAL REPORT

A Regulatory System for Non-Native Species

Prepared by the New York Invasive Species Council

10 June 2010

PART I - INTRODUCTION

Purpose

This report describes a proposed four-tier regulatory system for preventing the importation and/or release of non-native animal and plant species. This report fulfills the mandate set forth in New York Environmental Conservation Law (ECL) § 9-1705(5)(h), which directs the New York Invasive Species Council (Council) to submit to the Governor and Legislature "a report, produced in consultation with the [invasive species] advisory committee, recommending a four-tier system for non-native animal and plant species." As required by ECL § 9-1705(5)(h), the four-tier system proposed in this report includes (i) a list of prohibited species, which should be unlawful to possess, import, purchase, transport, or introduce except under a permit for disposal, control, research, or education; (ii) a list of regulated species, which should be legal to possess, sell, buy, and transport but not be introduced into a free-living state; (iii) a list of unregulated species which are non-native species that should not be subject to regulation; and (iv) a procedure for the review of a non-native species that is not on the prohibited, regulated, or unregulated lists before the use, distribution or release of such non-native species.

Background

ECL **§** 9-1705 establishes the New York Invasive Species Council. The Council is co-chaired by the Departments of Environmental Conservation and Agriculture and Markets and includes seven other State agencies: Transportation (DOT); Parks, Recreation and Historic Preservation (OPRHP); Education (SED); State (DOS); Thruway Authority (Thruway); Canal Corporation (Canals); and the Adirondack Park Agency (APA). Among other things, the Council is charged with:

> "submitting to the legislature and the governor prior to January first, two thousand ten a report, produced in consultation with the advisory committee, recommending a four-tier system for nonnative animal and plant species. The system shall contain:

(i) a list of prohibited species, which should be unlawful to possess, import, purchase, transport, or introduce except under a permit for disposal, control, research, or education;

(ii) a list of regulated species which should be legal to possess, sell, buy, and transport but not be introduced into a free-living state;

(iii) a list of unregulated species which are nonnative species that should not be subject to regulation; and

(iv) a procedure for the review of a nonnative species that is not on the prohibited, regulated, or unregulated lists before the use, distribution or release of such nonnative species.

Nothing contained in the report shall have the force of law. The council shall recommend legislation regarding the four-tier system, including penalties for violations of the four-tier system."

ECL § 9-1707 establishes the 25-member New York Invasive Species Advisory Committee (Advisory Committee). The Advisory Committee is directed to "provide information, advice and guidance to the council, including but not limited to providing assistance with the development of the four-tier classification system for nonnative animal and plant species."

PART II – DISCUSSION

The Process

Preparation of this report has been accomplished by a large network of professional staff from government agencies and stakeholder organizations. DEC's Office of Invasive Species Coordination has taken the lead administrative responsibility for assembling the report, including participation by the Advisory Committee and the public in its development and review.

The Office of Invasive Species Coordination commenced preparation of this report in the spring of 2008 by assembling a 17- member Steering Team comprised of representatives from State and Federal agencies, industry, conservation organizations, and academia. The Steering Team was organized into four "species" work groups: Plants, Fish & Aquatic Invertebrates, Terrestrial Vertebrates (non-fish), and Terrestrial Invertebrates. Membership of the Steering Team is contained in *Appendix A* to this report.

The Steering Team and each of the four work groups described above included representatives from a variety of stakeholder interests. Thus, experts from State and federal agencies, environmental organizations, industry and academia had opportunities to directly participate in and influence the development of this report and its recommendations. In addition, at numerous stages proposals and issues were presented to the Council and Advisory Committee. Each body had opportunities to understand the work and to provide comment and other input. Furthermore, Council and Committee representatives were encouraged to consult with their colleagues, members and constituencies to both spread awareness and bring additional ideas and concerns forward.

A preliminary draft of this *Report* was reviewed by the Steering team, the Advisory Committee and the Council, which ultimately approved a version for public review. Formal outreach began with release of this *Public Review Draft*. The release was announced formally through both a news release and publication in the *Environmental Notice Bulletin (ENB).* The public may submit formal comments through a dedicated e-mail address. After the close of the comment period, the Council will review all comments and, after consulting with the Advisory Committee, incorporate responsive changes into a *Final Report*.

The Four Tiers

The regulatory four-tier system required by statute and proposed in this report would, if fully implemented, assign one of three regulatory categories to all species of non-native plants and animals. The most restrictive category is "Prohibited Species" and would ban the commerce, use and purposeful introduction of non-native species that pose clear risks to New York's economic, ecological and/or human health. Another category is "Regulated Species"; it would restrict, but not prohibit, the commerce and other use of species that have the potential to cause significant harm and could be effectively contained through practicable and meaningful regulatory programs. A variety of regulatory approaches would be needed to achieve a balance of minimizing potential problems while providing for reasonable use. The final category,

"Unregulated Species", would identify those non-native species that are expected to pose no significant threat and so could be used freely.

It is important to note that the proposed system and its lists are primarily intended for the regulation of commerce: buying, selling and introducing non-native species. The lists are not intended to establish priorities for other management actions, such as for early detection, rapid response, eradication, spread prevention or restoration. While resource managers may consider many of the same biological traits or other information used in this proposed process, in most instances, management planning and decision-making would consider numerous other factors, such as distribution. Thus, a species listed here as "Prohibited" may not warrant management in certain settings. Likewise, "Regulated" or even "Unregulated" species could demand eradication or control in certain landscapes.

The Assessment Tools

The first task in developing the proposed four-tier regulatory system was to develop "assessment tools" for quantifying (i) the biological "invasiveness" of each non-native species, and (ii) the social and economic values, positive and negative, of each non-native species. The intent has been to develop assessment tools that are objective and efficient, rely upon available information, and provide outputs that are useful within the proposed regulatory system. Much of the preliminary development of these tools was accomplished by The Nature Conservancy, working with the Long Island Invasive Species Management Area (LIISMA) and the Brooklyn Botanic Gardens, and was based on similar assessment tools used by the State of Alaska (see *Appendix M*).

Invasiveness Ranking Form - The *Invasiveness Ranking Form* serves as the "invasiveness assessment tool" and considers the species' known and potential distribution within New York State; ecological impacts; biological characteristics and dispersal ability; distribution within both its native landscape and other places it has been introduced; difficulty of detection and control; and likelihood of hybridizing. Separate *Invasiveness Ranking Forms* were developed for Plants; Fish & Aquatic Invertebrates; Terrestrial Invertebrates; and Terrestrial Vertebrates.

The *Invasiveness Ranking Forms* yield numerical scores. Higher scores reflect a higher ecological risk associated with a particular invasive species and lead to an invasiveness assessment as follows:

Relative Maximum Score	Rank	Invasiveness Assessment
>80.00	Very High	Prohibited
70.00 – 80.00	High	Prohibited
50.00 – 69.99	Moderate	Regulated

40.00 – 49.99	Low	Unregulated
< 40.00	Insignificant	Unregulated

The association of Relative Maximum Scores with Ranks and Invasiveness Assessment was based on a combination of: systems used by others; and professional opinions of expert scientists; and ultimately by consensus of the Steering Team.

Invasive Species Socio-economic Assessment Form A second assessment tool gathers information about the socio-economic values of those non-native species (see *Appendices C* through *F*) that score Moderate or higher on the invasiveness assessment. This tool is needed to provide the weighing required by New York's statutory definition of "invasive species" at ECL 9-1703 (10): "Invasive species" means a species that is: (a) non-native to the ecosystem under consideration; and (b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. For the purposes of this paragraph, the harm must significantly outweigh any benefits." The "socio-economic" tool provides information about a species' value to human health, economy and culture. It does not monetize these values; rather, it requires qualitative assessments and then assigns values. As with the previous form, the Socio-economic Assessment was developed by the Steering Team. In addition to reviewing approaches used by others, the Team also consulted with natural resource economists.

Examples of completed Invasiveness Ranking Forms and Socioeconomic Ranking Forms for some species are attached as *Appendices B* through *F*. It is important to note that these Appendices are provided for the sole purpose of illustrating how the assessment tools work; the proposed rankings of these species have not been considered by the Council and no final determination has been made with respect to the listing of these species.

The Review Procedure

ECL § 9-1705 (5) (h) (iv) requires the Council to develop "…a procedure for the review of a nonnative species that is not on the prohibited, regulated, or unregulated lists before the use, distribution or release of such nonnative species." The following review procedure would be accomplished by an assessment team consisting of agency staff from both Environmental Conservation and Agriculture and Markets, with other Council agencies participating as they so desire. Environmental Conservation staff would lead the Invasiveness Assessment process and Agriculture and Markets staff would lead the Socio-Economic Assessment process. In each of the steps described below, experts would be consulted as needed including individuals from other government agencies, academia, agriculture, industry, and conservation organizations.

Step 1 – Federal List Review The review of any new unlisted non-native species would start with a check of Federal lists. If the Federal government has already determined that a species should be banned because of its invasive qualities, New York would generally follow suit without additional process. For example, the Lacey Act (18 USC 42) combats trafficking in "illegal" wildlife, fish, and plants and lists "Injurious Wildlife"(CFR Title 50 Part 16) such as the Northern Snakehead Fish. The Noxious Weed Act (7 USC 2801-2814) authorizes the Noxious

Weed Regulations (CFR Title 7 Part 360), which prohibit the movement of listed weeds, such as Giant Hogweed, into or throughout the United States; and the Plant Protection and Quarantine Pest List (CFR Title 7 Parts 300-399) safeguards agriculture and natural resources from the risks associated with the entry, establishment, or spread of animal and plant pests such as Emerald Ash Borer. A list of pertinent federal statutes is included in *Appendix G*.

Step 2 – Invasiveness Assessment The biological characteristics of a species would be assessed using the *Invasiveness Ranking Form.* The preliminary results would be completed by a team of experts. The rank on this form yields an invasiveness assessment.

Step 3 – Socio-economic Assessment For species that are ranked Moderate or higher in Step 1, a socio-economic assessment would next be completed. This tool gathers information about the beneficial human uses (if any) and non-ecological impacts of a species so it can be factored into the final determination. The socio-economic information gathered can be used to "move" a species to a higher or lower category.

Step 4 – Regulatory Determination The assessment team would present its recommended lists to the Advisory Committee. The comments and other information provided by the Advisory Committee review would then be presented by the assessment team to the Council, along with any suggested revisions. The *final* determination regarding the category to which a previously unlisted species is assigned would be made by the Council; the Council would prepare draft lists for rulemaking.

Step 5 – Rulemaking The Council would promulgate the lists through the normal State Administrative Procedures Act rulemaking process. Comments received during the formal public review period would be considered by the Council prior to completion of the rulemaking.

The Effects of Listing

Prohibited List When a species is listed as "Prohibited", that species, as set forth in ECL § 9-1705 (5) (h) (i), would be "unlawful to possess, sell, propagate, import, purchase, transport, or introduce except under a permit for disposal, control, research, or education."

The Regulated List When a species is listed as "Regulated", that species, as required in ECL § 9-1705 (5) (h) (ii), would be "legal to possess, sell, buy, propagate, and transport but not be introduced into a free-living state." The "regulated" designation denotes a wide range of possible requirements and ramifications. For example, some regulated animal species may be suitable as pets. Because such a species would present a moderate risk if released to a free-living state, a regulation could require that prospective buyers ensure the animal's secure confinement throughout its lifetime. Or, it may be that only sterile individuals of a species could be offered for sale. Alternatively, a warning label or other informational approach could be employed. These decisions should be worked out through a formal regulatory process on a species-specific basis. Regulated plants could be managed with a similar array of regulatory options. Plants used in certain ecological settings, such as for urban landscaping, may pose little risk to natural communities. The use of such plants could be restricted through licensing, labeling or other

approaches. As with animals, these decisions should be made within a formal regulatory process on a species-specific basis.

The Unregulated List When a non-native species is listed as "Unregulated", that species, as set forth in ECL § 9-1705 (h) (iii), would not be subject to regulation *as an invasive species.* It must be noted, though, that some "unregulated" species may nevertheless be subject to the requirements of other laws, such as laws that relate to farming, food, pets, captive wildlife, hunting, or fishing.

Application of the Proposed Four-Tier System

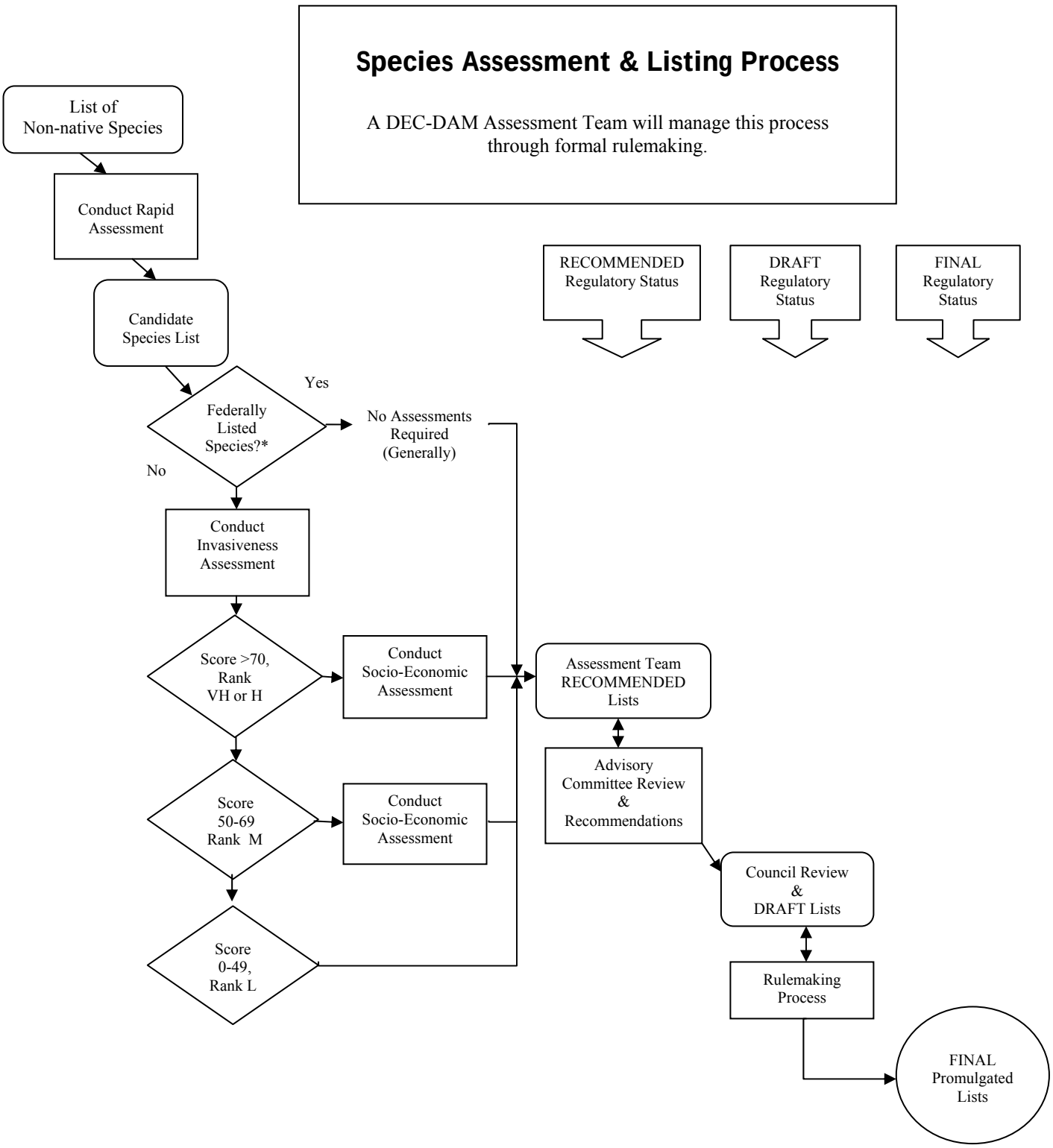
The determination of regulatory status for non-native invasive species, using the assessment tools described above, cannot be completed without the authority recommended later in this report. Nevertheless, the first step, the invasiveness assessment, has been completed for some of the plant species. These were performed and reviewed by the teams of scientific experts that were created for each major taxa group. A full list of the 180 plant species for which *Invasiveness Ranking Forms* have been completed can be found in *Appendix H* or at http://nyis.info/Resources/IS_Risk_Assessment.aspx It should be noted that *only* the *Invasiveness Ranking Form* has been completed for these species. The socio-economic assessment has not been performed, the proposed rankings of these species have not been considered by the Council, and no final determination has been made with respect to the listing of these species.

Given the number of non-native species yet to be assessed, the Council proposes the use of a "rapid assessment protocol" in the initial stages of the process to facilitate prioritizing species for full assessments. This Rapid Assessment Methodology, which appears in *Appendix I*, utilizes a three step process to 1) identify non-native species for screening, 2) prioritize species for detailed risk assessment, and 3) conduct agency risk assessments. The initial outcomes of this process, as conducted by three of the four taxa workgroups, appear in Appendix J. The Terrestrial Invertebrate workgroup listed 33 non-native insects and pathogens for assessment, of which seven were highlighted as priority species; the Terrestrial Vertebrate workgroup listed 84 species, of which 45 were highlighted as priority; and the Fish and Aquatic Invertebrate workgroup listed 112 species for assessment with 52 highlighted as priority species.

Examples of Applying the Proposed Four-Tier System

The following classifications are intended to demonstrate how the proposed assessment and four-tier listing process would work. A variety of plants and animals, with varying human uses and biological invasiveness ranks, has been selected to illustrate a variety of outcomes.

Northern Snakehead (*Channa argus*) is a non-native fish that has been used as an aquarium species and also in the live food trade. It is listed federally as "injurious wildlife" pursuant to the Lacey Act. Because it is federally listed, under the proposed four-tier system no further state assessments or determinations would be performed. The proposed listing process would



* Federally-listed species include Lacey Act, Noxious Weed and Plant Protection and Quarantine Action Required species.

"automatically" yield a "prohibited" outcome and thus Northern Snakehead would be "unlawful to possess, import, purchase, transport, or introduce except under a permit for disposal, control, research, or education."

Autumn Olive (*Eleaeganus umbellata*) is a non-native ornamental shrub that has been widely planted for wildlife habitat and erosion control. It is highly aggressive and has invaded numerous habitat types, especially old fields where it outcompetes native flora. It is not federally listed as a Noxious Weed., A biological assessment was completed and yielded a score of 94.00, which is in the "very high" range of invasiveness. This preliminary outcome suggests that this species should be listed as "prohibited". The *Socio-economic Assessment* identified only low economic benefits as an ornamental landscaping plant. Consequently, Autumn Olive would likely be listed as prohibited. The assessments of this species are presented in *Appendix B*.

Japanese Barberry (*Berberis thunbergii*, including all hybrids with other *Berberis* species) is a non-native shrub widely used as an ornamental. It forms dense stands in natural habitats and can alter pH, nitrogen levels, and biological activity in the soil; it can displace native plants and thereby reduce wildlife habitat value. Japanese Barberry is banned for sale and propagation in Massachusetts but it is not federally listed as a Noxious Weed. The biological assessment was completed and yielded a score of 91.00, which is in the "very high" range of invasiveness. The *Socio-economic Assessment* (see *Appendix C*) identified only low economic benefits as an ornamental landscaping plant. Consequently, Japanese Barberry would likely be listed as prohibited.

Timothy (*Phleum pratense*) is a non-native grass used for livestock forage. It is widespread within New York and was probably introduced by the earliest European settlers. It is not on the federal Noxious Weeds list. The *Invasiveness Ranking Form* yields a rank of "medium", a score of 63.75. The *Socio-economic Assessment* for this species attributes high economic benefits for its value as hay, especially for horses, and also identifies moderate cultural benefits, from the perspectives of history, heritage and aesthetics. These results provide the opportunity for the socio-economic assessment to override the invasiveness assessment. Thus, Timothy would likely be listed as Unregulated. The assessments of this species are presented in *Appendix D*.

Daylily (*Hemerocallis fulva*) is a non-native ornamental herb used in flower gardens. It is widespread within New York and is not on the federal Noxious Weeds list. The Invasiveness Ranking Form yields a score of 46.25. Because the rank is "low", a *Socio-economic Assessment* would not be conducted and Day Lily would likely be listed as Unregulated. The assessment of this species is presented in *Appendix E*.

Chinese Mystery Snail (*Cipangopaludina chinensis*) is a non-native mollusk used as fish food in aquaculture and also in aquaria, water gardens and fish ponds. It occurs widely across New York. It is not prohibited by the federal Lacey Act but is on the USDA "action list", which requires treatment of certain imported products. The *Invasiveness Ranking Form* yields a rank of "high", a score of 75.00. It can invade numerous lake and river habitat types and poses a threat to native mussels and other mollusks. The *Socio-economic Assessment* for this species attributes low to moderate economic benefits for its value in the aquarium trade. The Mystery Snail could be listed as either Prohibited or Regulated if the latter limited its use to confined

situations and warned against releases to the wild; its use in water gardens or aquaculture facilities would be prohibited. The assessments of this species are presented in *Appendix F*.

Updating Lists

The information used to assess both invasiveness and socio-economic values can change over time for any species. This is especially true if an organism invades successfully, either in New York itself or in comparable states or provinces. Risks and impacts can prove to be greater or less than known when an initial determination is made. Thus, it is important that a regulatory system include provisions for reassessing a species. In most cases, this could occur after a reasonable period of years. In other cases, provisions should allow for emergency reassessments and determinations. In addition, any member of the public should be able to appeal the regulatory status of a particular species or request that a species be added by making a written request directly to the Co-Chairs of the Council.

Penalties and Enforcement

Enforcement - The provisions of the *Prohibited* and *Regulated Lists* should reside in the Environmental Conservation Law, Agriculture and Markets Law, and Parks, Recreation and Historic Preservation Law so that they could be enforced by personnel in all three agencies. Each of the three agencies has existing authority and jurisdiction relating to specific aspects of invasive species control (*e.g.*, DAM has extensive survey and detection programs for forest and agricultural pests, inspects and regulates nurseries, retail establishments, and shipping of plant materials; DEC has authority to respond to forest pests and to regulate the release of fish and wildlife; and OPRHP responds to invasives affecting State parks). In the interest of efficiency, these agencies should continue to use existing enforcement resources and authority to enforce the provisions of the *Prohibited* and *Regulated* Lists.

Penalties - Fines and other penalties should be sufficient to serve as a deterrent and should clearly outweigh any economic benefit that would result from successful commerce in invasive plants or animals. Because invasion impacts tend to grow larger over time and not diminish or resolve without intervention, statutory language relative to sanctions should reflect the full potential costs of spread prevention, control and eradication. As an example, existing statute in Nassau County imposes civil penalties that start at warnings for first offenses but can rise to one thousand dollars for each plant specimen. Suffolk County sanctions rise to a maximum fine of two thousand dollars and up to thirty days in jail.

Injunctive Relief - Authority to obtain injunctive relief should be included, so that immediate action may be compelled through the courts to prevent the spread of an invasive species.

Cost Recovery - Provisions for recovering response costs and other natural resource damages resulting from illegal trafficking in invasive species should be included. Illegal traffickers in invasive species should be held liable for any costs and damages associated with the release of such species into the environment. Several recent examples illustrate the substantial public costs of responding to species invasions. The 2008 and 2009 eradications of northern snakehead from

a 2-mile section of Catlin Creek in Orange County cost DEC several hundred thousand dollars, mostly in staff time that was reallocated from other purposes. This population of invasive fish likely resulted from an intentional introduction.

Existing Authorities, Laws and Regulations

Because invasive species have caused significant problems for a long time, numerous invasive species laws and regulations already exist. These regulatory measures can be found in a number of federal and New York State statutes. In New York, they reside in Environment Conservation, Agriculture and Markets and Health laws.

The Department of Agriculture and Markets has broad authority to regulate and control the distribution of plant material and animals that are noxious, spread disease or otherwise threaten human health or the viability of our farms and forests. This authority includes the ability to confiscate plant materials or animals, stop sale of products, and quarantine or otherwise regulate commerce.

The proposed listing process would be New York's first comprehensive approach to prohibiting or regulating commerce in all invasive plants and animals. In developing the requisite laws and regulations, it is imperative that existing authorities be considered and accommodated to ensure that untenable contradictions or other weaknesses are not created. To that end, *Appendices G, L* and *M* present lists of existing laws and regulations that pertain to the commerce and use of invasive species.

Additional Considerations

Geography – New York is a large and diverse state. It varies physically, ecologically, economically and politically over its 62 counties and 47,200 square miles. This heterogeneity may complicate the regulation of invasive species. The Council considered and rejected the option of geographic variations in regulations for several reasons. First, the potential ranges vary among species and tailoring regulations to consider range differences would be onerous and of questionable benefit. Second, it is not always possible to accurately predict an invasive species' potential range, and thus regulations attempting to account for range would likely be speculative. Third, complex regulations covering a diverse array of species with different ranges would significantly complicate compliance and enforcement. Moreover, complex regulations, if not coordinated with surrounding jurisdictions, could create an "unlevel playing field" in the marketplace.

Climate – The invasiveness assessments used for this report are based on current climate conditions. Most climate change models predict that much of New York State will experience longer growing seasons and warmer average temperatures in future decades. It is likely that species now restricted to more southern states will be able to survive and even thrive in a warmer New York. Such expected changes should be borne in mind when assessing risk, especially with regard to potential range within New York.

Biology – The invasiveness assessments used for this report were completed for full species. In other words, assessments were not performed for sub-species, varieties, cultivars, and the like. In fact, it is possible that sterile varieties could provide viable alternatives to invasive species of plants or animals. Research is underway to develop 100 percent sterile cultivars for selected species. This research includes, but is not limited to, hybridizations, genetic engineering, and trait-selective breeding.

Business – The valid needs of the business community should be recognized and accommodated within any regulatory system. Specifically, existing investments made by growers should be reflected in grandfathering or grace period provisions, except in cases where doing so would present unacceptable ecological risks. In cases where a grace period is appropriate, the length of such period should be determined based on both biological and financial considerations.

Management Lists – Managers of lands or other natural resources commonly use lists of invasive or potentially invasive species when planning outreach, prevention, eradication, restoration and other management actions. Such uses will not and cannot be met by the process discussed here. Managers, be they public or private, have long had a need to manage, eradicate or prevent the spread of invasive species. For example, both government agencies and non-government organizations have historically allocated substantial time and money to the prevention, eradication or other control of species such as water chestnut, watermilfoil, purple loosestrife, common reed, garlic mustard, smooth buckthorn, carp, feral swine and many others. A fundamental task in any such endeavor is to identify the species that are being managed. The criteria for managing such species are frequently specific to the mission of the management organization. The missions range from statewide protection of food supply or forest health or biodiversity to the exclusion of non-natives from globally rare natural communities or Invasive Species Prevention Zones. Thus, lists developed for management purposes are typically focused on concerns other than commerce. The ability to prepare and rely upon such lists should not be in any way constrained by the listing process recommended in this report.

PART III – RECOMMENDATIONS

Proposed System

The following describes a comprehensive system that would provide New York State with the capacity to effectively manage non-native species of plants and animals.

A. Statutory Needs

1. ***Authority*** –The Council recommends that the lists of prohibited, regulated and unregulated species be created through regulations, based on new statutory authority.

   The Council recommends that the authority and responsibility to promulgate the three requisite lists should be conferred upon the Council. The Council should work in consultation with the Advisory Committee and the three lists should continue to be defined as they are in the current language of Title 17 at ECL §§ 9-1705 (5) (h) (*i*), (*ii*) and (*iii*), subject to the recommendations below.

2. ***Prohibited List*** - The current statutory language reads: "(i) a list of prohibited species, which should be unlawful to possess, import, [sell], purchase, [propagate], transport, or introduce except under a permit for disposal, control, research, or education." ECL § 9-1705(5)(h)(i). The term "sell" should be added to the list of prohibited activities. Because "sell" is included in the Title 17 description of "Regulated", it is likely that its omission from the "Prohibited" description was a simple oversight. Similarly, the term "propagate" should be added.

3. ***Possession*** - The term "possess" must be carefully defined by statute so as to exclude the mere occurrence of "prohibited" invasive species on lands or waters when such occurrence is not the result of purposeful introduction. This distinction is necessitated by the fact that many invasive species are already widely distributed on New York's landscape and that future invaders will likely become widely distributed after an initial introduction. Many landowners, both public and private, have invasive species living on or otherwise occurring on their lands through no fault or action of their own. Indeed, one of the major threats posed by most invasive species is their innate ability to spread, i.e., invade, and resist containment or other control. Most landowners are the victims of the introduction of invasive species and not the perpetrators. It is noteworthy that "possess" is a regulated activity in other laws and regulations with similar purposes, such as in ECL 11-1703, *Importation, possession and sale of fish without license or permit.*; and in 6 NYCRR Part 180.9 *Fish dangerous to indigenous fish populations.*

4. ***Regulated List*** – The current language reads: "(ii) a list of regulated species which should be legal to possess, sell, buy, [propagate] and transport but not be introduced into a free-living state." As above, the term "propagate" should be added to regulated activities.

The list *per se* should be augmented by rules regulating possession, sale, and transport that are developed for individual species or groups of similar species. Any new statutory language should reflect this need for regulations tailored to the biological and human use characteristics of particular species.

5. ***Unregulated List*** - The current language currently reads: "(iii) a list of unregulated species which are nonnative species that should not be subject to regulation." ECL § 9-1705(5)(h)(iii).

   The statutory language should make it clear that some species on this "unregulated" list may be regulated pursuant to other laws and/or regulations.

6. ***Single Statute*** - Authority and responsibility for promulgating and maintaining the four-tier system described above should be incorporated into a single statute, preferably ECL Article 9, Title 17.

7. ***Grace Periods*** - Statutory provisions pertaining to both the *Prohibited* and *Regulated Lists* should include a carefully circumscribed provision allowing the Council to establish "grace periods" so that businesses can be afforded the opportunity to plan the management of existing stocks. It is recommended that grace periods not be established in cases where, in the Council's judgment, doing so would present unacceptable ecological risks. In cases where a grace period is appropriate, the length of such period should be determined based on both biological and financial considerations.

8. ***Compensation Fund*** - In cases where a grace period is inappropriate, consideration should be given to a "Compensation Fund" to address potentially devastating impacts on farmers, forest owners, or other businesses who through no fault of their own may be forced to destroy crops to deal with an invasive pest. New York State currently provides compensation for the removal and economic losses from control and mitigation of the Plum Pox Virus, which originated in Europe.

9. ***Re-evaluations*** - Any statutory language pertaining to all the *Lists* should include provisions for periodically re-evaluating species and the ability to make changes based on new information.

10. ***Emergency Listings*** - Any statutory language pertaining to all the *Lists* should include provisions for emergency reassessments and determinations as needed.

11. ***Sterile Cultivar Exemptions*** - Consideration should be given to exempting from the prohibited and regulated lists 100 percent sterile subspecies, cultivars or organisms. For example, Suffolk County (Local Law No. 27-2009, Suffolk County, New York) currently has the following provision:

    "A cultivar of a Do-Not-Sell Listed invasive species may be exempted from Do-Not-Sell status if: 1. its primary means of reproduction is sexual, and 2. scientific, peer-reviewed criteria verify that a cultivar is effectively 100 % male and female sterile,

and 3. guaranteed by the producer to be sterile, and 4. enabling enforcement through appropriate safeguards to document the identity of the cultivar and source of the cultivar, including tagging individual plants and shipping and nursery invoices, and 5. it is deemed appropriate for exemption by the Advisory Board and the Long Island Invasive Species Management Area (LIISMA) Scientific Review Committee (SRC)."

12. ***State Pre-emption*** - In order to ensure uniformity of regulation across the State, the new statutory scheme should pre-empt local laws. However, a "grandfathering" exemption should be included for Nassau and Suffolk Counties, which have existing invasive species laws and lists. State pre-emption would establish a "level playing field" for industry and avoid a confusing regulatory environment.

13. ***Existing Authorities*** - The statute should also make clear that it does not change or supersede any existing authority or jurisdiction of any state agency. A number of invasives are already regulated as noxious or harmful to human health. This effort seeks to integrate and focus regulation of invasives as a category but must consider and integrate with existing regulatory authorities.

B. Implementation

The costs of implementing the proposed four-tier system could be managed in a variety of ways. Additional agency staff would need to be dedicated to the administration of this system. Most tasks, such as promulgating regulations, permit review and issuance, and compliance and enforcement, would require additional agency personnel and non-personal service resources.

Staffing Needs

Regulations – Developing and promulgating the overarching regulations and the initial lists would be a substantial workload for experienced staff in both DEC and DAM.

Assessments – The technical aspects of both invasiveness and socio-economic assessments should be completed with subject matter experts. Integration of work products into the full regulatory process would be accomplished by agency staff. The initial workload would be significant but would diminish as most of the species were assessed.

Permitting – Developing the regulations needed for numerous individual species or groups of species would require substantial collaboration with many stakeholder interests.

Compliance and enforcement – Compliance monitoring should be accomplished at both wholesale and retail levels. Although some of this workload would necessarily be added to the duties of existing staff in both DEC and DAM, additional positions, especially Environmental Conservation Officers and Horticultural Inspectors, should be created for this express purpose, as well as for the resulting enforcement activities.

Non-Personal Service Needs

Risk and socio-economic assessments should be performed by subject matter experts and would likely require a combination of agency staff and contractors.

Proposed Implementation Budget

Effective implementation of the proposed four-tier listing program would require, annually: approximately $560,000 for 6 staff positions (2 in DEC, 4 in DAM) and approximately $160,000 for expert services, agency staff support, and a compensation fund.

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APPENDICES

A. Steering Team Members

B. Sample Assessments – Autumn Olive

C. Sample Assessments – Japanese Barberry

D. Sample Assessments – Timothy

E. Sample Assessment - Day Lily

F. Sample Assessments - Chinese Mystery Snail

G. Federal Invasive Species Laws and Regulations

H. Invasiveness Assessment Results - Plants

I. Rapid Assessment Methodology

J. Assessment Priorities

K. New York State Invasive Species Laws and Regulations

L. Local Invasive Species Laws and Regulations

M. NYS Ranking System for Evaluating Non-native Plant Species for Invasiveness

N. Summary of Public Comments & Responses

Appendix A

Four-tier List Team Participants

The following people have contributed directly to the development of this *Report*:

Name	Organization
Dave Adams[2]	DEC Office of Invasive Species Coordination
Diane Goetke*	Ag & Markets
Kennoth Carnes	Ag & Markets
David Chico	Ag & Markets
Gerry Moore*	Brooklyn Botanical Garden
Nicole Willis*	New York Farm Bureau
David Linehan*	NYS Nursery & Landscape Association
Marshall Meyer	Pet Industry Joint Advisory Council
Jamie Reaser*	Pet Industry Joint Advisory Council
Laura Bavaro*	The Nature Conservancy
Bill Wellman*	Trout Unlimited
Yvonne De Marino	USDA APHIS Plant Protection and Quarantine
Barbara Hammerstone*	USDA APHIS Plant Protection and Quarantine
Martin Lowney*	USDA APHIS Wildlife Services
Gary Glath*	Department of Transportation
Mark Malchoff*	Lake Champlain Sea Grant
Antoinette Clemetson*	New York Sea Grant
Marcelo del Puerto*	DEC Division of Fish Wildlife & Marine Resources
Matt Schlesinger	NY Natural Heritage Program
Charlie De Quillfeldt	DEC Bureau of Marine Resources
Steve Hurst	DEC Bureau of Fisheries
Lou Berchielli	DEC Bureau of Wildlife
Rob Messenger*	DEC Division of Lands & Forest
Jerry Carlson	DEC Division of Lands & Forests
Scott Kishbaugh*	DEC Division of Water
Steve Young	NY Natural Heritage Program
George Robinson*	SUNY Albany Biodiversity Conservation & Policy
George Kraemer[1]	SUNY Purchase Department of Natural Sciences
Bernd Blossey[1]	Cornell University Department of Natural Resources
David Strayer[1]	Cary Institute of Ecosystem Studies
Richard Hoebeke[1]	Cornell University Department of Entomology

* Indicates official Four-tier List Team member.
[1] Indicates scientific advisor.
[2] Indicates Team Leader (tie-breaker vote only, substitute DEC rep. only).

Quorum = 9 member organizations.

Appendix B

Sample Assessment – Autumn Olive

Scientific name:	Elaeagnus umbellata	USDA Plants Code: ELUM
Common names:	Autumn olive	
Native distribution:	East Asia	
Date assessed:	April 11, 2008, May 16, 2008	
Assessors:	J. Ma; S. Clemants; G. Moore	
Reviewers:	LIISMA SRC	
Date Approved:	May 21, 2008	Form version date: 22 October 2008

New York Invasiveness Rank: Very High (Relative Maximum Score >80.00)

Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form***)**			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Widespread	Very High
6	Lower Hudson	Not Assessed	Not Assessed
7	Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8	Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	40
2	Biological characteristic and dispersal ability	25 (25)	25
3	Ecological amplitude and distribution	25 (25)	21
4	Difficulty of control	10 (10)	8
	Outcome score	100 (100)[b]	94[a]
	Relative maximum score †		94.00
	New York Invasiveness Rank §	Very High (Relative Maximum Score >80.00)	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00−80.00; Moderate 50.00−69.99; Low 40.00−49.99; Insignificant <40.00

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1
A1.2. In which PRISMs is it known (see inset map)?	
☒	Adirondack Park Invasive Program
☒	Capital/Mohawk
☒	Catskill Regional Invasive Species Partnership
☒	Finger Lakes

☒	Long Island Invasive Species Management Area
☒	Lower Hudson
☒	Saint Lawrence/Eastern Lake Ontario
☐	Western New York

Documentation:
Sources of information:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

A2.1. What is the likelihood that this species will occur and persist outside of cultivation given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Very Likely	Adirondack Park Invasive Program
Very Likely	Capital/Mohawk
Very Likely	Catskill Regional Invasive Species Partnership
Very Likely	Finger Lakes
Very Likely	Long Island Invasive Species Management Area
Very Likely	Lower Hudson
Very Likely	Saint Lawrence/Eastern Lake Ontario
Unknown	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

If the species does not occur and is not likely to occur with any of the PRISMs, then stop here as there is no need to assess the species.

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	Widespread
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Present

Documentation:
Sources of information:
Brooklyn Botanic Garden, 2008.

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
☐ Salt/brackish waters	☐ Salt/brackish marshes	☒ Cultivated*
☐ Freshwater tidal	☐ Freshwater marshes	☒ Grasslands/old fields
☐ Rivers/streams	☐ Peatlands	☒ Shrublands
☐ Natural lakes and ponds	☐ Shrub swamps	☒ Forests/woodlands
☐ Vernal pools	☐ Forested wetlands/riparian	☐ Alpine
☐ Reservoirs/impoundments*	☒ Ditches*	☒ Roadsides*
	☒ Beaches and/or coastal dunes	

Other potential or known suitable habitats within New York:

Documentation:
Sources of information:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score 10

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Species is capable of nitrogen fixation and thus altering soil chemistry and the nitrogen cycle.
Sources of information:
Fessenden, 1979; Pascke et al., 1980.

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score 10

Documentation:
Identify type of impact or alteration:
Increases shrub layer, and eradicates all of the layers below.
Sources of information:
Allan, & Steiner, 1965; Catling, 1997; Hamilton & Carpenter, 1975; ISSG, 2005; Zhang, 1981.

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7
D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score 10

Documentation:
Identify type of impact or alteration:
Completely alters the shrub layer and layers below.
Sources of information:
Allan, & Steiner, 1965; Catling, 1997; Hamilton & Carpenter, 1975; ISSG, 2005; Zhang, 1981.

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades. Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact	3
C.	Moderate impact	7
D.	Severe impact on other species or species groups	10
U.	Unknown	

Score 10

Documentation:
Identify type of impact or alteration:
Changes the abundance and composition of native plants.
Sources of information:
Allan & Steiner, 1965; Catling, 1997; Hamilton & Carpenter, 1975; ISSG, 2005; Zhang, 1981.

Total Possible 40
Section One Total 40

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2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction)	1
C.	Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)	2
D.	Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.)	4
U.	Unknown	

Score 4

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Copious seed production with as many as 44,000 seeds produced by a single plant.
Sources of information:
Allan & Steiner, 1965; Catling, 1997; Hamilton & Carpenter, 1975; ISSG, 2005; Zhang, 1981.

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

A.	Does not occur (no long-distance dispersal mechanisms)	0
B.	Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)	1
C.	Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant)	2
D.	Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant)	4
U.	Unknown	

Score: 4

Documentation:
Identify dispersal mechanisms:
Mainly by birds and small animals; dispersal can be more than 100 meters.
Sources of information:
ISSG, 2005.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

A.	Does not occur	0
B.	Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)	1
C.	Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)	2
D.	High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful)	3
U.	Unknown	

Score: 3

Documentation:
Identify dispersal mechanisms:
Species is still planted and sold; contaminated nursery stock.
Sources of information:
ISSG, 2005.

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	3
C.	Possesses two or more characteristics that increase competitive advantage	6
U.	Unknown	

Score: 6

Documentation:
Evidence of competitive ability:
Perennial habit, fast growth, and some shade tolerance.
Sources of information:
ISSG, 2005.

2.5. Growth vigor

A.	Does not form thickets or have a climbing or smothering growth habit	0

B.	Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms	2
U.	Unknown	

Score 2

Documentation:
Describe growth form:
Forms large stands but not what the authors would characterize as thickets.
Sources of information:
Authors' personal observations.

2.6. Germination/Regeneration

A.	Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules.	0
B.	Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions	2
C.	Can germinate/regenerate in existing vegetation in a wide range of conditions	3
U.	Unknown (No studies have been completed)	

Score 3

Documentation:
Describe germination requirements:
No special conditions are needed for the germination, but widely adapted.
Sources of information:
ISSG, 2005.

2.7. Other species in the genus invasive in New York or elsewhere

A.	No	0
B.	Yes	3
U.	Unknown	

Score 3

Documentation:
Species:
Elaeagnus angustifolia.

Total Possible 25
Section Two Total 25

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3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

A.	No large stands (no areas greater than 1/4 acre or 1000 square meters)	0
B.	Large dense stands present in areas with numerous invasive species already present or disturbed landscapes	2
C.	Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas)	4
U.	Unknown	

Score 2

Documentation:
Identify reason for selection, or evidence of weedy history:
Large density stands have been observed and documented with other non native plants.
Sources of information:
ISSG, 2005.

3.2. Number of habitats the species may invade

A.	Not known to invade any natural habitats given at A2.3	0
B.	Known to occur in two or more of the habitats given at A2.3, with at least one a natural habitat.	1
C.	Known to occur in three or more of the habitats given at A2.3, with at least two a natural habitat.	2
D.	Known to occur in four or more of the habitats given at A2.3, with at least three a natural habitat.	4
E.	Known to occur in more than four of the habitats given at A2.3, with at least four a natural habitat.	6
U.	Unknown	

Score: 6

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
Wetland and upland
Sources of information:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008; USDA, 2008.

3.3. Role of disturbance in establishment

A.	Requires anthropogenic disturbances to establish.	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.	2
C.	Can establish independent of any known natural or anthropogenic disturbances.	4
U.	Unknown	

Score: 2

Documentation:
Identify type of disturbance:
Generally becomes established in somewhat open areas following disturbance but can tolerate shaded conditions.
Sources of information:
Allan & Steiner, 1965; Catling, 1997; Hamilton & Carpenter, 1975; ISSG, 2005; Zhang, 1981.

3.4. Climate in native range

A.	Native range does not include climates similar to New York	0
B.	Native range possibly includes climates similar to at least part of New York.	1
C.	Native range includes climates similar to those in New York	3
U.	Unknown	

Score: 3

Documentation:
Describe what part of the native range is similar in climate to New York:
Native area in temperate Asia includes climates similar to those in New York.
Sources of information:
Allan & Steiner, 1965; Catling, 1997; Hamilton & Carpenter, 1975; ISSG, 2005; Zhang, 1981.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

A.	Not known from the northeastern US and adjacent Canada	0

B.	Present as a non-native in one northeastern USA state and/or eastern Canadian province.	1
C.	Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces.	2
D.	Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 1 northeastern state or eastern Canadian province.	3
E.	Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces. and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 2 northeastern states or eastern Canadian provinces.	4
U.	Unknown	

Score: 4

Documentation:
Identify states and provinces invaded:
CT, DC, DE, IA, IL, IN, KY, MA, MD, ME, MI, NH, NJ, NY, OH, PA, RI, VA, VT, WI, WV; ON.
Sources of information:
- See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.

USDA, 2008.

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Present in none of the PRISMs	0
B.	Present in 1 PRISM	1
C.	Present in 2 PRISMs	2
D.	Present in 3 PRISMs	3
E.	Present in more than 3 PRISMs or on the Federal noxious weed lists	4
U.	Unknown	

Score: 4

Documentation:
Describe distribution:
APIPP, Capital/Mohawk, CRISP, Finger Lake, Lower Hudson, SLELO and LHSMA
Sources of information:
New York Flora Association, 2008.

Total Possible: 25
Section Three Total: 21

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4. DIFFICULTY OF CONTROL

4.1. Seed banks

A.	Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules.	0
B.	Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years	2
C.	Seeds (or vegetative propagules) remain viable in soil for more than 10 years	3
U.	Unknown	

Score: 2

Documentation:
Identify longevity of seed bank:
Seeds remain viable for a few years; no evidence they survive more than ten years.

Sources of information:
ISSG, 2005.

4.2. Vegetative regeneration

A.	No regrowth following removal of aboveground growth	0
B.	Regrowth from ground-level meristems	1
C.	Regrowth from extensive underground system	2
D.	Any plant part is a viable propagule	3
U.	Unknown	

Score: 2

Documentation:
Describe vegetative response:
Growth from basal branches at ground level and root shoots.
Sources of information:
ISSG, 2005.

4.3. Level of effort required

A.	Management is not required: e.g., species does not persist without repeated anthropogenic disturbance.	0
B.	Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft^2).	2
C.	Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above).	3
D.	Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).	4
U.	Unknown	

Score: 4

Documentation:
Identify types of control methods and time-term required:
It is impossible to remove or eradicate once established.
Sources of information:
ISSG, 2005.

Total Possible	10
Section Four Total	8
Total for 4 sections Possible	100
Total for 4 sections	94

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain,

and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available:

References for species assessment:

Allan, P. F. &. W. F. Steiner, 1965. Autumn olive for wildlife and other conservation uses USDA, Leafl. No. 458.

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NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. Note that the order of authorship is alphabetical; all three authors contributed substantially to the development of this protocol.

Acknowledgments: The NY form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Long Island Invasive Species Management Area's Scientific Review Committee were incorporated in revisions of this form. Original members of the LIISMA SRC included representatives of the Brooklyn Botanic Garden; The Nature Conservancy; New York Natural Heritage Program, New York Sea Grant; New York State Office of Parks, Recreation and Historic Preservation; National Park Service; Brookhaven National Laboratory; New York State Department of Environmental Conservation Region 1; Cornell Cooperative Extension of Suffolk/Nassau Counties; Long Island Nursery and Landscape Association; Long Island Farm Bureau; SUNY Farmingdale Ornamental Horticulture Department; Queens College Biology Department; Long Island Botanical Society; Long Island Weed Information Management System database manager; Suffolk County Department of Parks, Recreation and Conservation; Nassau County Department of Parks, Recreation and Museums; Suffolk County Soil & Water Conservation District.

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NEW YORK INVASIVE SPECIES SOCIO-ECONOMIC ASSESSMENT FORM

Scientific name:	*Elaeagnus umbellata*[1]	USDA Code: ELUM
Common names:	Autumn Olive	
Native distribution:	China, Korea and Japan (intro 1830)	
Date assessed:	March 8, 2010	
Assessors:	D. Adams	
Reviewers:		
Date Approved:	*Form version date: 04 February 2010*	

Purpose

The purpose of this document is to serve as a "tool" for assessing the societal values of potentially invasive species as part of a New York State regulatory system. Title 17 of New York State Environmental Conservation Law Article 9, New York Invasive Species Council, defines: **"Invasive species" means a species that is:**

(a) nonnative to the ecosystem under consideration; and

(b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. For the purposes of this paragraph, the harm must significantly outweigh any benefits.

Title 17 further requires the development of a system to regulate the "use, distribution or release" of non-native species. The system must balance potential harm against potential benefits.

The "invasivity" value of any non-native species is based on biological traits. Socio-economic values, on the other hand, are based on based on economic, human health, cultural and other social traits. This *Socio-economic Assessment* was developed as part of a sequential process that would require its use only for those species whose biological invasivity assessments rate Moderate (50+) to Very High.

Using this Form

This *Assessment* should be completed by a multi-disciplinary team that includes both a species-expert and an economist or someone very familiar with the relevant industry or other uses. When answering the questions below, please identify:
1) each of the various stakeholders, using the Reference Worksheet, for which the species has value.

2) the economic, human health and cultural uses, and "non-uses, of the species by each stakeholder; Consider whether non-invasive alternatives are available and whether restricting the use of the subject species would create a market for another, non-invasive species?

3) the value assigned to the species, or otherwise realized, by each stakeholder for each use, if available.

[1] Elaeagnus umbellata NEW YORK NON-NATIVE PLANT INVASIVENESS RANKING FORM http://nyis.info/Resources/IS_Risk_Assessment.aspx

Please make responses must be species-specific and relevant to New York State. All information used to answer questions must be clearly documented.

Socio-Economic Ranking Summary

	Positive Values	Negative Values	Net Score
Human Health (Y / N)	10 / 15	-5 /-15	**+5**
Economic (Y / N)	50 / 70	-70 /-70	**-20**
Cultural (Y / N)	10 /15	-5 /-15	**+5**
Outcome Score	70 / 100	-80 / -100	**-10**
Relative Maximum Score†			
Socio-Economic Rank			**Insig. Neg.**

- For questions answered "unknown" do not include point value in "Total Answered Points Possible."
- If "Total Answered Points Possible" † is less than 70.00 points, then the overall socio-economic value rank should be listed as "Unknown."

†Calculated as 100(a/b) to two decimal places.

Very High Value	>80.00	or	Highlight those assessments with:
High Value	70.00−80.00		Significant Positive Outcome 70/-30
Moderate Value	50.00−69.99		Significant Negative Outcome 30/-70
Low Value	40.00−49.99		Equal Outcome 50/-50
Insignificant/Negative Value	<40.00		

HUMAN HEALTH VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

1. Does/ could this species provide <u>benefits</u> to human health, such as providing medicinal values?

A. No benefit	0	
B. Low benefit (benefits minor, few people utilize)	5	
C. Moderate benefit (benefits moderate, unlikely to be life saving)	10	X
D. High benefit (benefits life saving)	15	
U. Unknown	Unk	

Discussion: Berries used as a stimulant and are a rich source of vitamins and lycopene. Traditionally used in the mountainous regions of the Himalayas for medicinal purposes. Organic uses appear to be on the rise, though currently low demand.

Documentation & Sources of Information: J. Strax Autumn Olive: A Berry High in Lycopene. Plants for a future: Edible, medicinal and useful plants for a healthier world.

2. Could/ would escaped or released individuals harm people, or could irresponsible use of the species, or its products, pose a threat to human health or safety, such as physical harm, allergic responses, dermatitis, or poisoning?

A. No risk	0	
B. Low risk (injuries, harm or annoyance minor, few people exposed)	-5	X
C. Moderate risk (injuries/ harm moderate, unlikely to be fatal, few people at risk)	-10	
D. High risk* (injuries or harm severe or fatal)	-15	
U. Unknown	Unk	

** Species that pose a high risk to human health must be either Prohibited or Regulated, regardless of any benefits.*

Discussion: Pollen can cause minor allergies. Some varieties have thorns can be injurious to those passing by, or through, multiple plants.

Documentation & Sources of Information: PollenLibrary.com. USDA Invasive Plant Species: Autumn Olive.

HUMAN HEALTH SUBSCORE: +5

ECONOMIC VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

3. Does/ would this species provide direct economic benefits (sales and jobs translated into dollars) for a particular industry or industries? Are there indirect economic benefits as a result of the presence of this particular species? For example, are real estate values increased because of the presence of this species? Does the species provide shade in urban settings where other less invasive plants are not suitable? Are restaurant/ lodging revenues generated from tourists coming to an area to hunt/ fish/ view a particular nonnative species? Examples: Food, Forage, Fiber, Fuel, Timber, Landscaping, Nursery, Floral, Livestock, Pets, Bait, Recreation, other.

A. None	0	
B. Low Benefit (benefits minor and temporary)	30	
C. Moderate Benefit (benefits minor and long lasting or major and temporary)	50	X
D. High Benefit (benefits major and long lasting)	70	
U. Unknown	Unk	

Discussion: Planting of Autumn Olive as a ground cover can increase growth of hardwoods including White Ash, White Oak, and Black Walnut. Historically, a number of public and private nurseries supplied

this species for use as ornamental shrub plantings. As more information became available on the invasive nature and impacts of the species to native ecosystems, various public nurseries stopped growing and/ or began regulating the species.

Documentation / Sources of Information: Weed Control and Autumn Olive Effect Early Growth and Survival of Black Walnut Hardwood Clearcut, 1988, New Forests Vo. 2, No. 3. Missouri Department of Conservation: (Autumn Olive) Vegetation Management Guideline. USDA Invasive Plant Species: Autumn Olive.

4. Does/ would this species generate direct economic costs related to its use or release? Will responses be required for new and existing infestations in unwanted areas? Does/ could the species cause damage to buildings, vehicles, fences, roads, equipment, ornamental gardens, or agriculture, or be considered a nuisance? Does/ would this species generate indirect economic costs such as, public education, modifying standard practices, repairing damage or changing practices and reducing profits? Are real estate values and/or tourism reduced because of the presence of this species? Examples: Regulatory administration, Inspections and monitoring, Education and outreach, Containment, Eradication, Repair and maintenance, Restoration, other.

A. None	0	
B. Low Detriment (impacts minor and temporary)	-30	
C. Moderate Detriment (impacts minor and long lasting or major and temporary)	-50	
D. High Detriment (impacts major and long lasting)	-70	X
U. Unknown	Unk	

Discussion: Invades pastures and fallow fields and is an influential invasive in native habitats such as fields, prairies and savannahs. Alters soil properties, especially in poor soil sites, due to its nitrogen fixing capacity. Requires expensive control measures over large areas once well established, which is very labor-intensive.

Documentation / Sources of Information: Craig Stark, Control of *Elaeagnus umbellata* (Autumn Olive). Indiana IPSAWG Invasive Plant Species Fact Sheet. USDA Invasive Plant Species: Autumn Olive. Control of Autumn Olive, Multiflora, and Tartarian Honeysuckle, West Virginia University Extension Service.

ECONOMIC SUBSCORE: -20

CULTURAL VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

5. Does/ would this species serve positive cultural purposes? Examples: **Environmental Education,** Religious, Historic/ heritage, Recreation, Aesthetic, other.

A. None	0	
B. Low Benefit (important to few people)	5	
C. Moderate Benefit (important to moderate # of people)	10	X

D. High Benefit (important to a majority of people)	15	
Unknown	Unk	

Discussion: The species appears to have an historic and growing current use as a source for edible berries for preserves. Historically, and to a lesser extent currently, its vegetative and fruiting characteristics have appealed to those in the landscaping.

Documentation & Sources of Information: Internet; nursery catalogues; professional experience.

6. Does/ would this species reduce or interfere with cultural activities? For example, are recreational activities constrained or aesthetic values diminished because of the presence of this species?

A. None	0	
B. Low Detriment (impacts few people)	-5	X
C. Moderate Detriment (impacts a moderate # of people)	-10	
D. High Detriment (impacts a majority of people)	-15	
U. Unknown	Unk	

Discussion: As with other thorny shrubs, may interfere with trail and trailhead access public use hiking areas.

Documentation & Sources of Information: Personal observation; expert opinion; Internet descriptions; scientific research (e.g., John Tancredi at Gateway NP).

CULTURAL SUBSCORE: +5

TOTAL SOCIO-ECONOMIC ASSESSMENT SCORE: -10

Comments

Were the questions appropriate for the species under consideration? Yes X / No
If not, what are the characteristics involved that make the situation unique? Please provide Q & A that would increase its usefulness.

Reference Worksheet

Stakeholder

Issue	Growers/ Landscapers	Agriculture	Home owners	Recreationists	Natural Resource Managers	
Economic						
Health						
Cultural						

x presence of interest; +,++,+++ affected positively; -,--,--- affected negatively

Appendix C

Sample Assessments – Japanese Barberry

Scientific name:	Berberis thunbergii (includes all hybrids with other Berberis species) USDA Plants Code: BETH
Common names:	Japanese barberry
Native distribution:	Asia
Date assessed:	March 4, 2008; September 5, 2008
Assessors:	Jinshuang Ma; Gerry Moore
Reviewers:	LIISMA SRC
Date Approved:	9-24-2008 Form version date: 22 October 2008

New York Invasiveness Rank: Very High (Relative Maximum Score >80.00)

Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form***)**

	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Widespread	Very High
6	Lower Hudson	Not Assessed	Not Assessed
7	Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8	Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	37
2	Biological characteristic and dispersal ability	25 (25)	22
3	Ecological amplitude and distribution	25 (25)	25
4	Difficulty of control	10 (10)	7
	Outcome score	100 (100)[b]	91[a]
	Relative maximum score †		91.00
	New York Invasiveness Rank §	Very High (Relative Maximum Score >80.00)	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00−80.00; Moderate 50.00−69.99; Low 40.00−49.99; Insignificant <40.00

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1
A1.2. In which PRISMs is it known (see inset map)?	
☒	Adirondack Park Invasive Program
☒	Capital/Mohawk
☒	Catskill Regional Invasive Species Partnership

☒	Finger Lakes
☒	Long Island Invasive Species Management Area
☒	Lower Hudson
☒	Saint Lawrence/Eastern Lake Ontario
☒	Western New York

Documentation:
Sources of information:
Weldy & Werier,, 2005; Brooklyn Botanic Garden, 2008.

A2.1. What is the likelihood that this species will occur and persist outside of cultivation given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Not Assessed	Adirondack Park Invasive Program
Not Assessed	Capital/Mohawk
Not Assessed	Catskill Regional Invasive Species Partnership
Not Assessed	Finger Lakes
Very Likely	Long Island Invasive Species Management Area
Not Assessed	Lower Hudson
Not Assessed	Saint Lawrence/Eastern Lake Ontario
Not Assessed	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

If the species does not occur and is not likely to occur with any of the PRISMs, then stop here as there is no need to assess the species.

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	Widespread
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
☐ Salt/brackish waters	☐ Salt/brackish marshes	☒ Cultivated*
☐ Freshwater tidal	☐ Freshwater marshes	☒ Grasslands/old fields
☐ Rivers/streams	☐ Peatlands	☒ Shrublands
☐ Natural lakes and ponds	☐ Shrub swamps	☒ Forests/woodlands
☐ Vernal pools	☒ Forested wetlands/riparian	☐ Alpine
☐ Reservoirs/impoundments*	☐ Ditches*	☒ Roadsides*
	☐ Beaches and/or coastal dunes	

Other potential or known suitable habitats within New York:

Documentation:
Sources of information:

Ehrenfeld, 1997, 1999; Harrington et al., 2004; Silander & Klepeis, 1999; Maybury, 2003; Brooklyn Botanic Garden, 2008.

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score 10

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Soil under B. thunbergii had higher pH, higher nitrification rates (conversion of ammonium to nitrate), and often higher N mineralization rates than soil under Vaccinium pallidum (blueberry) in NJ; these findings were replicated in the greenhouse (Ehrenfeld et al. 2001). Barberry litter was higher in N, and decomposed more rapidly (with little N immobilization), than did native plant litter. These changes may lead to a positive feedback loop in which barberry increases the rate of nitrate production, which it preferentially takes up to support rapid growth and high biomass production (Ehrenfeld et al. 2001). B. thunbergii may facilitate non-native earthworm increases, which also alter soil chemistry and function (Kourtev et al. 1999)
Sources of information:
Ehrenfeld et al. 2001. Kourtev et al. 1999

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score 7

Documentation:
Identify type of impact or alteration:
Berberis thunbergii has been shown to significantly increase the shrub layer density and can, in some cases, come into areas where there is not currently a shrub layer, thus creating

a new layer; might also be eliminating layers below it but more information needed.
Sources of information:
Ehrenfeld, 1997, 1999; Ehrenfeld et al. 2001; Baskin, 2002; Maybury 2003.

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7
D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score: 10

Documentation:
Identify type of impact or alteration:
Altered soil pH, N concentrations and N cycling increases the likelihood of additional exotic invasions, which tend to prefer soils with higher pH and nutrient availability. Maybury (2003) reports that it replaces the understory Vaccinium layers but hard data or citations not presented. Since barberry is not a preferred deer food, deer browse pressure is increased on native plants which may prevent their recruitment (Eschtruth & Battles 2008; Rawinski unpub.).
Sources of information:
Ehrenfeld, 1997, 1999; Ehrenfeld et al 2001; Maybury, 2003; Eschtruth and Battles, 2008; Rawinksi 2008 unpublished.

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades. Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact	3
C.	Moderate impact	7
D.	Severe impact on other species or species groups	10
U.	Unknown	

Score: 10

Documentation:
Identify type of impact or alteration:
Causes "profound effects on the microbial community of the soil" which include altered microbial community structure and function (Kourtev et al. 2002). Also alters earthworm fauna. Possesses spines which decrease palatability to deer (Rawinski unpub).
Sources of information:
Kourtev et al, 1998; Kourtev et al, 1999; Kourtev et al., 2002; Rawinski 2008 unpub.

Total Possible: 40
Section One Total: 37

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2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or	0

asexual reproduction).

B. Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction) 1

C. Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented) 2

D. Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.) 4

U. Unknown

Score 4

Documentation:

Describe key reproductive characteristics (including seeds per plant):
Two thousand or more fruits (each fruit is one to few-seeded) can occur on a single plant, although some cultivars (e.g., 'Aurea', 'Bogozom', 'Crimson Pygmy', 'Kobold', 'Monlers') produce much less fruit and seed (Lovinger & Anisko, 2004; Lehrer et al., 2006a, 2006b). Viability reported to be high (Davis, 1927; Lovinger & Anisko, 2004; Lehrer et al., 2006a, 2006b) for the species but lower for some of the aforementioned ('Aurea', 'Crimson Pygmy') cultivars (Lehrer, 2006a, 2006b). One year old seedling of some cultivars (e.g., 'Aurea', 'Crimson Pygmy') also reported to have reduced growth vigor (Lehrer et al, 2006b). Branches reported to root freely when in contact with soil (WDNR, 2004).
Sources of information:
Davis, 1927;Wisconsin Department of Natural Resources, 2004; Lehrer, 2006a, 2006b; authors' personal observations.

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

A. Does not occur (no long-distance dispersal mechanisms) 0

B. Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations) 1

C. Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant) 2

D. Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant) 4

U. Unknown

Score 4

Documentation:

Identify dispersal mechanisms:
Fruits are eaten by birds, small mammals and wild turkeys and transported long distances by this means. Silander and Klepeis (1999) report that most seedlings are generally found beneath exisiting plants, with some found tens of meters away from nearest adult, but this is not direct evidence that there is not long-distance dispersal.
Sources of information:
Silander & Klepeis, 1999; Mehrhoff et al, 2003; Lehrer pers. comm.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

A. Does not occur 0

B. Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient) 1

C. Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate 2

extent)

D. High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful) 3

U. Unknown

Score 3

Documentation:
Identify dispersal mechanisms:
Commercially sold; can be transported indirectly through brush removal. [Note not related to scoring: Lehrer et al. (2006c) reported that some of the commonly grown purple- and yellow-leaf types readily produce green-leaf offspring resembling the wild type barberry, although the percentage of green-leaf offspring varied widely by genotype. The authors noted that their findings do not "provide any definitive link between cultivated and naturalized Japanese barberry."]
Sources of information:
Maybury, 2003; Lovinger & Anisko, 2004; Lehrer, 2006a, 2006b, 2006c; author's (Moore's) personal observations.

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

A. Possesses no characteristics that increase competitive advantage 0

B. Possesses one characteristic that increases competitive advantage 3

C. Possesses two or more characteristics that increase competitive advantage 6

U. Unknown

Score 6

Documentation:
Evidence of competitive ability:
Shade tolerant, perennial habit, grows on infertile soils, unpalatable to white-tailed deer.
Sources of information:
Ehrenfeld, 1997, 1999; Eschtruth and Battles, 2008; authors', Lehrer's and Jordan's personal observations.

2.5. Growth vigor

A. Does not form thickets or have a climbing or smothering growth habit 0

B. Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms 2

U. Unknown

Score 2

Documentation:
Describe growth form:
Can form thickets.
Sources of information:
Mehrhoff et al., 2003; Ehrenfeld 1997.

2.6. Germination/Regeneration

A. Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules. 0

B. Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions 2

C. Can germinate/regenerate in existing vegetation in a wide range of conditions 3

U. Unknown (No studies have been completed)

Score 3

Documentation:
Describe germination requirements:

Seeds readily germinate in varied habitat types, soil types and disturbance regimes.
Observed germinating in exisiting vegetation.
Sources of information:
Silander & Klepeis, 1999; Lehrer unpublished; author's (Moore's) personal observations.

2.7. Other species in the genus invasive in New York or elsewhere

A. No 0
B. Yes 3
U. Unknown

Score 0

Documentation:
Species:
Berberis vulgaris present in NY but assessed only as a moderate invasive; B. julianae also reported from state but not known if it is spreading from existing planted localities.

Total Possible 25
Section Two Total 22

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3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

A. No large stands (no areas greater than 1/4 acre or 1000 square meters) 0
B. Large dense stands present in areas with numerous invasive species already present or disturbed landscapes 2
C. Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas) 4
U. Unknown

Score 4

Documentation:
Identify reason for selection, or evidence of weedy history:
Has been reported and observed to become established in areas where few other invasive species are present.
Sources of information:
Ehrenfeld, 1997, 1999; Maybury, 2003; Mehrhoff et al., 2003; author's (Moore's) personal observations.

3.2. Number of habitats the species may invade

A. Not known to invade any natural habitats given at A2.3 0
B. Known to occur in two or more of the habitats given at A2.3, with at least one a natural habitat. 1
C. Known to occur in three or more of the habitats given at A2.3, with at least two a natural habitat. 2
D. Known to occur in four or more of the habitats given at A2.3, with at least three a natural habitat. 4
E. Known to occur in more than four of the habitats given at A2.3, with at least four a natural habitat. 6
U. Unknown

Score 6

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Ehrenfeld, 1997, 1999; Harrington et al., 2004; Silander & Klepeis 1999; Maybury, 2003; Brooklyn Botanic Garden, 2008.

3.3. Role of disturbance in establishment

A. Requires anthropogenic disturbances to establish. 0
B. May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances. 2
C. Can establish independent of any known natural or anthropogenic disturbances. 4
U. Unknown

Score 4

Documentation:
Identify type of disturbance:
Reported and observed to establish in areas without any recent natural or anthropogenic disturbances.
Sources of information:
Ehrenfeld, 1997, 1999; Maybury, 2003; Mehrhoff, 2003; author's (Moore's) personal observations.

3.4. Climate in native range

A. Native range does not include climates similar to New York 0
B. Native range possibly includes climates similar to at least part of New York. 1
C. Native range includes climates similar to those in New York 3
U. Unknown

Score 3

Documentation:
Describe what part of the native range is similar in climate to New York:
Temperate Asia.
Sources of information:
Maybury, 2003; Brooklyn Botanic Garden, 2008.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

A. Not known from the northeastern US and adjacent Canada 0
B. Present as a non-native in one northeastern USA state and/or eastern Canadian province. 1
C. Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces. 2
D. Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., “Noxious” or “Invasive”) in 1 northeastern state or eastern Canadian province. 3
E. Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces. and/or categorized as a problem weed (e.g., “Noxious” or “Invasive”) in 2 northeastern states or eastern Canadian provinces. 4
U. Unknown

Score 4

Documentation:
Identify states and provinces invaded:
CT, DC, DE, IA, IL, IN, KY, MA, MD, ME, MI, MN, NH, NJ, NY, OH, PA, RI, VA, VT, WI, WV; NB, NS, ON, PE, QC.
Sources of information:

- See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.

U.S.D.A., 2008.

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Present in none of the PRISMs	0
B.	Present in 1 PRISM	1
C.	Present in 2 PRISMs	2
D.	Present in 3 PRISMs	3
E.	Present in more than 3 PRISMs or on the Federal noxious weed lists	4
U.	Unknown	

Score: 4

Documentation:
Describe distribution:
See A1.1
Sources of information:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

Total Possible: 25
Section Three Total: 25

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4. DIFFICULTY OF CONTROL

4.1. Seed banks

A.	Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules.	0
B.	Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years	2
C.	Seeds (or vegetative propagules) remain viable in soil for more than 10 years	3
U.	Unknown	

Score: 2

Documentation:
Identify longevity of seed bank:
Seeds remain viable for at least a year. Seeds have physiological dormany requiring cold stratification. No evidence for viability of more than 10 years.
Sources of information:
Davis, 1927; Baskin et al., 1993.

4.2. Vegetative regeneration

A.	No regrowth following removal of aboveground growth	0
B.	Regrowth from ground-level meristems	1
C.	Regrowth from extensive underground system	2
D.	Any plant part is a viable propagule	3
U.	Unknown	

Score: 1

Documentation:
Describe vegetative response:
Resprouts readily from ground-level and slightly subterranean buds. Cutting it off at base will not kill the plant.
Sources of information:

Maybury, 2003; authors' and Lehrer's personal observations.

4.3. Level of effort required

A.	Management is not required: e.g., species does not persist without repeated anthropogenic disturbance.	0
B.	Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft^2).	2
C.	Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above).	3
D.	Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).	4
U.	Unknown	

Score: 4

Documentation:
Identify types of control methods and time-term required:
Hand pulling using thick gloves and weed wrench on smaller plants; repeated cuttings, treatment with glyphosphate, and control burning are all effective. Nonetheless, large stands will require major time investments.
Sources of information:
Swearingen et al, 2002; Maybury, 2003.

Total Possible	10
Section Four Total	7
Total for 4 sections Possible	100
Total for 4 sections	91

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available: 'Anderson', 'Antares', 'Aurea', 'Aurea Nana', 'Bagatelle', 'Bailgreen', 'Bailone', 'Bailsel', 'Bailtwo', 'Bogozam', 'Concorde', 'Crimson Dwarf', 'Crimson Pygmy', 'Crimson Velvet', 'Criruzam', 'Erecta', 'Gentry', 'Golden Devine', 'Golden Ring', 'Green Pygmy', 'Helmond Pillar', 'Inermis', 'Kelleriis', 'Kobold', 'Lime Glow', 'Marshall Upright', 'Minor', 'Monlers', 'Monomb', 'Monry', 'Rose Glow', 'Royal Cloak', 'Sparkle', 'Tara'.

Hybrid: Berberis thunbergii and B. vulgaris can hybridize, resulting in B. ottawensis. We don't have enough information to evaluate the hybrid separately. In this case we are considering the hybrid to have the same invasive nature as B. thunbergii**.**

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NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. Note that the order of authorship is alphabetical; all three authors contributed substantially to the development of this protocol.

Acknowledgments: The NY form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Long Island Invasive Species Management Area's Scientific Review Committee were incorporated in revisions of this form. Original members of the LIISMA SRC included representatives of the Brooklyn Botanic Garden; The Nature Conservancy; New York Natural Heritage Program, New York Sea Grant; New York State Office of Parks, Recreation and Historic Preservation; National Park Service; Brookhaven National Laboratory; New York State Department of Environmental Conservation Region 1; Cornell Cooperative Extension of Suffolk/Nassau Counties; Long Island Nursery and Landscape Association; Long Island Farm Bureau; SUNY Farmingdale Ornamental Horticulture Department; Queens College Biology Department; Long Island Botanical Society; Long Island Weed Information Management System database manager; Suffolk County Department of Parks, Recreation and Conservation; Nassau County Department of Parks, Recreation and Museums; Suffolk County Soil & Water Conservation District.

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NEW YORK INVASIVE SPECIES SOCIO-ECONOMIC ASSESSMENT FORM

Scientific name:	*Berberis thunbergii*[2]	USDA Code: BETH
Common names:	Japanese barberry	
Native distribution:	Japan (to Arnold Arboretum, 1875)	
Date assessed:	March 8, 2010	
Assessors:	G. Robinson, UAlbany	
Reviewers:		
Date Approved:		Form version date: 04 February 2010

Purpose

The purpose of this document is to serve as a "tool" for assessing the societal values of potentially invasive species as part of a New York State regulatory system. Title 17 of New York State Environmental Conservation Law Article 9, New York Invasive Species Council, defines: **"Invasive species" means a species that is:**

(a) nonnative to the ecosystem under consideration; and

(b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. For the purposes of this paragraph, the harm must significantly outweigh any benefits.

Title 17 further requires the development of a system to regulate the "use, distribution or release" of non-native species. The system must balance potential harm against potential benefits.

The "invasivity" value of any non-native species is based on biological traits. Socio-economic values, on the other hand, are based on based on economic, human health, cultural and other social traits. This *Socio-economic Assessment* was developed as part of a sequential process that would require its use only for those species whose biological invasivity assessments rate Moderate (50+) to Very High.

Using this Form

This *Assessment* should be completed by a multi-disciplinary team that includes both a species-expert and an economist or someone very familiar with the relevant industry or other uses. When answering the questions below, please identify:

1) each of the various stakeholders, using the Reference Worksheet, for which the species has value.

2) the economic, human health and cultural uses, and "non-uses, of the species by each stakeholder; Consider whether non-invasive alternatives are available and whether restricting the use of the subject species would create a market for another, non-invasive species?

3) the value[3] assigned to the species, or otherwise realized, by each stakeholder for each use, if available.

[2] Elaeagnus umbellata NEW YORK NON-NATIVE PLANT INVASIVENESS RANKING FORM http://nyis.info/Resources/IS_Risk_Assessment.aspx

[3] SEE: footnote 2.value

Please make responses must be species-specific and relevant to New York State. All information used to answer questions must be clearly documented.

Socio-Economic Ranking Summary

	Positive Values	Negative Values	Net Score
Economic (Y / N)	50 / 70	- 70 /-70	**-20**
Human Health (Y / N)	0 / 15	- 10 /-15	**- 10**
Cultural (Y / N)	10 /15	- 5 /-15	5
Outcome Score	60 / 100	- 85 / -100	**-25**
Relative Maximum Score†			
Socio-Economic Rank			**Insig. Neg.**

- For questions answered "unknown" do not include point value in "Total Answered Points Possible."
- If "Total Answered Points Possible" † is less than 70.00 points, then the overall socio-economic value rank should be listed as "Unknown."

†Calculated as 100(a/b) to two decimal places.

Very High Value	>80.00	or	Highlight those assessments with:	
High Value	70.00−80.00		Significant Positive Outcome	70/-30
Moderate Value	50.00−69.99		Significant Negative Outcome	30/-70
Low Value	40.00−49.99		Equal Outcome	50/-50
Insignificant/Negative Value	<40.00			

HUMAN HEALTH VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

1. Does/ could this species provide <u>benefits</u> to human health, such as providing medicinal values?

A. No benefit	0 **X**
B. Low benefit (benefits minor, few people utilize)	5
C. Moderate benefit (benefits moderate, unlikely to be life saving)	10
D. High benefit (benefits life saving)	15
U. Unknown	Unk

Discussion One variety has been used in Japan to treat eye diseases, but that variety does not seem to be cultivated here. Historic and current uses as traditional medicinal expanded to China,

Indian, Iran, and other countries in and around Asia. However, I could find no commercial sources for Japanese barberry seeds or extracts for medicinal purposes, in a brief search. It is important to note that our bearberry (*Arctostaphylos uva-ursi*), sometimes called "barberry," which has many recognized medicinal uses among enthusiastic herbalists in NY, is in a different plant family and has very different chemical properties.

Documentation & Sources of Information Internet searches for medicinal plant sources and descriptions.

2. Could/ would escaped or released individuals harm people, or could irresponsible use of the species, or its products, pose a threat to human health or safety, such as physical harm, allergic responses, dermatitis, or poisoning?

A. No risk	0	
B. Low risk (injuries, harm or annoyance minor, few people exposed)	-5	
C. Moderate risk (injuries/ harm moderate, unlikely to be fatal, few people at risk)	-10	**X**
D. High risk* (injuries or harm severe or fatal)	-15	
U. Unknown	Unk	

** Species that pose a high risk to human health must be either Prohibited or Regulated, regardless of any benefits.*

Discussion Minor injuries to pedestrians are reported, due to the very sharp spines, with small children most susceptible. The high concentrations of deer ticks associated with some barberry infestations could point to other, potentially more serious health concerns.

Documentation & Sources of Information Williams, Scott C. Ward, Jeffrey S., Worthley, Thomas E., Stafford, Kirby C. 2009. Managing Japanese Barberry (Ranunculales: Berberidaceae) Infestations Reduces Blacklegged Tick (Acari: Ixodidae) Abundance and Infection Prevalence With Borrelia burgdorferi (Spirochaetales: Spirochaetaceae). Environmental Entomology 38:977-984.

HUMAN HEALTH SUBSCORE: -10

ECONOMIC VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

3. Does/ would this species provide direct economic benefits (sales and jobs translated into dollars) for a particular industry or industries? Are there indirect economic benefits as a result of the presence of this particular species? For example, are real estate values increased because of the presence of this species? Does the species provide shade in urban settings where other less invasive plants are not suitable? Are restaurant/ lodging revenues generated from tourists coming to an area to hunt/ fish/ view a particular nonnative species? Examples: Food, Forage, Fiber, Fuel, Timber, Landscaping, Nursery, Floral, Livestock, Pets, Bait, Recreation, other.

A. None	0
B. Low Benefit (benefits minor and temporary)	30

C. Moderate Benefit (benefits minor and long lasting or major and temporary)	50 X
D. High Benefit (benefits major and long lasting)	70
U. Unknown	Unk

Discussion Remains a popular hedge shrub and has been used to stabilize slopes. An added value is its resistance to *Puccinia* wheat stem rust, unlike its European counterpart. Also resistant to deer browsing. Grows well in a wide range of site conditions. Research into sterile forms is intensifying, but remains inconclusive, and many less invasive horticultural substitutes have been identified.

Documentation / Sources of Information Internet (e.g., USDA, IPANE, misc nurseries; plant science databases), NY garden centers, personal experience.

4. Does/ would this species generate direct economic costs related to its use or release? Will responses be required for new and existing infestations in unwanted areas? Does/ could the species cause damage to buildings, vehicles, fences, roads, equipment, ornamental gardens, or agriculture, or be considered a nuisance? Does/ would this species generate indirect economic costs such as, public education, modifying standard practices, repairing damage or changing practices and reducing profits? Are real estate values and/or tourism reduced because of the presence of this species? Examples: Regulatory administration, Inspections and monitoring, Education and outreach, Containment, Eradication, Repair and maintenance, Restoration, other.

A. None	0
B. Low Detriment (impacts minor and temporary)	-30
C. Moderate Detriment (impacts minor and long lasting or major and temporary)	-50
D. High Detriment (impacts major and long lasting)	-70 X
U. Unknown	Unk

Discussion A highly influential invasive in native forests, altering soil properties, degrading avian nesting habitat, and requiring expensive control measures over large areas. Associated with high densities of deer ticks. Also hybridizes with European barberry, and hybrids are susceptible to wheat rust. Invades pastures and fallow fields. Control is very labor-intensive.

Documentation / Sources of Information Work by Joan Ehrenfeld (Rutgers), John Silander (UConn); personal experience; Internet (Google "Japanese barberry invasive" yields 64,000 hits; in Google Scholar: 1,000 hits).

ECONOMIC SUBSCORE: -20

CULTURAL VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

5. Does/ would this species serve positive cultural purposes? Examples: **Environmental Education,** Religious, Historic/ heritage, Recreation, Aesthetic, other.

A. None	0
B. Low Benefit (important to few people)	5
C. Moderate Benefit (important to moderate # of people)	10 X

D. High Benefit (important to a majority of people)	15
Unknown	Unk

Discussion In contrast to European barberry (*B. vulgaris*), it seems to have no historic or current use as a source for edible berries and dyes. However, its color combination has appeal in landscaping and its thorny habit is considered useful for protective hedges.

Documentation & Sources of Information Internet; nursery catalogues, personal experience.

6. Does/ would this species reduce or interfere with cultural activities? For example, are recreational activities constrained or aesthetic values diminished because of the presence of this species?

A. None	0
B. Low Detriment (impacts few people)	-5 X
C. Moderate Detriment (impacts a moderate # of people)	-10
D. High Detriment (impacts a majority of people)	-15
U. Unknown	Unk

Discussion May interfere with trail and trailhead access in low-use hiking areas, or limit shoreline access near some waterways. Considered an eyesore by some recreationists.

Documentation & Sources of Information Personal observation; expert opinion (Bob O'Brien, OPRHP); Internet descriptions; scientific research (e.g., John Tancredi at Gateway NP).

CULTURAL SUBSCORE: 5

TOTAL SOCIO-ECONOMIC ASSESSMENT SCORE: -25

Comments

Were the questions appropriate for the species under consideration? Yes X / No
If not, what are the characteristics involved that make the situation unique? Please provide Q & A that would increase its usefulness.

Reference Worksheet

Stakeholder

Issue	Growers/ Landscapers	Agriculture	Home owners	Recreationists	Natural Resource Managers	
Economic	++	-	+	**x**	---	
Health	**x**	-	**x**	-	--	
Cultural	+		+	-	--	

x presence of interest; +,++,+++ affected positively; -,--,--- affected negatively

Appendix D

Sample Assessments – Timothy

Scientific name:	Phleum pratense	USDA Plants Code: PHPR3
Common names:	Timothy	
Native distribution:	Eurasia	
Date assessed:	November 25, 2008	
Assessors:	Steve Glenn	
Reviewers:	LIISMA SRC	
Date Approved:	17 December 2008	Form version date: 22 October 2008

New York Invasiveness Rank: Moderate (Relative Maximum Score 50.00-69.99)

Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form***)**			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Widespread	Moderate
6	Lower Hudson	Not Assessed	Not Assessed
7	Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8	Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (20)	6
2	Biological characteristic and dispersal ability	25 (25)	20
3	Ecological amplitude and distribution	25 (25)	17
4	Difficulty of control	10 (10)	8
	Outcome score	100 (80)[b]	51[a]
	Relative maximum score †		63.75
	New York Invasiveness Rank §	Moderate (Relative Maximum Score 50.00-69.99)	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00−80.00; Moderate 50.00−69.99; Low 40.00−49.99; Insignificant <40.00

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1
A1.2. In which PRISMs is it known (see inset map)?	
☒	Adirondack Park Invasive Program
☒	Capital/Mohawk
☒	Catskill Regional Invasive Species Partnership
☒	Finger Lakes

☒	Long Island Invasive Species Management Area
☒	Lower Hudson
☒	Saint Lawrence/Eastern Lake Ontario
☒	Western New York

Documentation:
Sources of information:
Weldy & Werier, 2005:Brooklyn Botanic Garden, 2008

A2.1. What is the likelihood that this species will occur and persist outside of cultivation, given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Not Assessed	Adirondack Park Invasive Program
Not Assessed	Capital/Mohawk
Not Assessed	Catskill Regional Invasive Species Partnership
Not Assessed	Finger Lakes
Very Likely	Long Island Invasive Species Management Area
Not Assessed	Lower Hudson
Not Assessed	Saint Lawrence/Eastern Lake Ontario
Not Assessed	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
Well established in PRISM. Brooklyn Botanic Garden, 2008.

If the species does not occur and is not likely to occur with any of the PRISMs, then stop here as there is no need to assess the species.

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Widespread
Long Island Invasive Species Management Area	Not Assessed
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:
Brooklyn Botanic Garden, 2008

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
☐ Salt/brackish waters	☐ Salt/brackish marshes	☒ Cultivated*
☐ Freshwater tidal	☐ Freshwater marshes	☒ Grasslands/old fields
☐ Rivers/streams	☐ Peatlands	☒ Shrublands
☐ Natural lakes and ponds	☐ Shrub swamps	☐ Forests/woodlands
☐ Vernal pools	☐ Forested wetlands/riparian	☐ Alpine
☐ Reservoirs/impoundments*	☒ Ditches*	☒ Roadsides*
	☒ Beaches and/or coastal dunes	

Other potential or known suitable habitats within New York:
Swamp shores, moist supalpine forests.

Documentation:
Sources of information:
Cordeiro, 2006; Brooklyn Botanic Garden, 2008.

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score: U

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
P. pratense may enhance carbon accumulation in mineral soil under an increased atmospheric CO2 supply. In other words it may respond positively to global warming. However, detailed studies on species' effects on natural ecosystem processes and sytem-wide parameters not performed.
Sources of information:
Kettunen et al., 2007.

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score: 3

Documentation:
Identify type of impact or alteration:
Changes the density of herb layer; no evidence of significant impact in layers in Northeast.
Sources of information:
Cordeiro, 2006; authors' personal observations.

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7

D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score: 3

Documentation:
Identify type of impact or alteration:
Timothy can dominate the area it occupies decreasing both cover and diversity of native species. May hinder conifer seedling establishment by preemption of resources, allelopathy, attraction of insects and animals, and increased fire potential. P. pratense pollen extract also decreased mean seed set in sympatric grassland species. However, the latter two effects are reported from other parts of the country.
Sources of information:
Cordeiro, 2006.

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades. Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact	3
C.	Moderate impact	7
D.	Severe impact on other species or species groups	10
U.	Unknown	

Score: U

Documentation:
Identify type of impact or alteration:
Palatability of timothy is reported high for deer in the summer possibly facilitating excessive deer populations. However, hard data are lacking.
Sources of information:
Esser, 1993.

Total Possible: 20
Section One Total: 6

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2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction)	1
C.	Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)	2
D.	Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.)	4
U.	Unknown	

Score: 4

Documentation:
Describe key reproductive characteristics (including seeds per plant):
It is a prolific seeder (vigorous and fast-growing) with maximum germination usually occuring about 3 or 4 weeks after it is harvested, with nearly 100 percent germination. Germination rates remain high for 1 to 2 years.
Sources of information:
Cordeiro, 2006.

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

A.	Does not occur (no long-distance dispersal mechanisms)	0
B.	Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)	1
C.	Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant)	2
D.	Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant)	4
U.	Unknown	

Score: 4

Documentation:
Identify dispersal mechanisms:
Anemochory (wind) and epizoochory (outside of animals).
Sources of information:
Cordeiro, 2006.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

A.	Does not occur	0
B.	Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)	1
C.	Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)	2
D.	High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful)	3
U.	Unknown	

Score: 3

Documentation:
Identify dispersal mechanisms:
Timothy is cultivated for hay; small seeds can be dispersed by numerous indirect means.
Sources of information:
Cordeiro, 2006.

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	3
C.	Possesses two or more characteristics that increase competitive advantage	6
U.	Unknown	

Score: 6

Documentation:

Evidence of competitive ability:
Perennial; fast growth; alelopathis. Plants establish quickly, spread vigorously, and can escape early detection (Cordeiro, 2006). One study found a population with the ability to regrow rapidly after defoliation (Cheplick & Chui, 2001). One study found considerable phenotypic variation in one population (Sawada & Tsuda, 1985), perhaps enhancing ecological amplitude.
Sources of information:
Sawada & Tsuda, 1985. Cheplick & Chui, 2001; Cordeiro, 2006.

2.5. Growth vigor

A.	Does not form thickets or have a climbing or smothering growth habit	0
B.	Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms	2
U.	Unknown	

Score: 0

Documentation:
Describe growth form:
No climbing or smothering growth forms observed in NY.
Sources of information:
authors' personal observations

2.6. Germination/Regeneration

A.	Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules.	0
B.	Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions	2
C.	Can germinate/regenerate in existing vegetation in a wide range of conditions	3
U.	Unknown (No studies have been completed)	

Score: 3

Documentation:
Describe germination requirements:
Germination rates at nearly 100% for 1 to 2 years; no special conditions reported.
Sources of information:
Cordeiro, 2006.

2.7. Other species in the genus invasive in New York or elsewhere

A.	No	0
B.	Yes	3
U.	Unknown	

Score: 0

Documentation:
Species:
Phleum arenarium L.,P. paniculatum Huds., and P. subulatum (Savi) Asch. & Graebn. reported, but invasive status undetermined. Weldy & Werier, 2005; USDA, 2008.

Total Possible: 25
Section Two Total: 20

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3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in

Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

A.	No large stands (no areas greater than 1/4 acre or 1000 square meters)	0
B.	Large dense stands present in areas with numerous invasive species already present or disturbed landscapes	2
C.	Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas)	4
U.	Unknown	

Score: 0

Documentation:
Identify reason for selection, or evidence of weedy history:
Timothy occurs scattered in grassland communities but not as dense stands..
Sources of information:
Brooklyn Botanic Garden, 2008.

3.2. Number of habitats the species may invade

A.	Not known to invade any natural habitats given at A2.3	0
B.	Known to occur in two or more of the habitats given at A2.3, with at least one a natural habitat.	1
C.	Known to occur in three or more of the habitats given at A2.3, with at least two a natural habitat.	2
D.	Known to occur in four or more of the habitats given at A2.3, with at least three a natural habitat.	4
E.	Known to occur in more than four of the habitats given at A2.3, with at least four a natural habitat.	6
U.	Unknown	

Score: 4

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Cordeiro, 2006; Brooklyn Botanic Garden, 2008.

3.3. Role of disturbance in establishment

A.	Requires anthropogenic disturbances to establish.	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.	2
C.	Can establish independent of any known natural or anthropogenic disturbances.	4
U.	Unknown	

Score: 2

Documentation:
Identify type of disturbance:
Timothy usually occurs in early to mid seral stages, doing better following disturbance of sites in early successional stages compared with those in later successional stages, although can occasionally occur in undisturbed areas.
Sources of information:
Cordeiro, 2006; authors personal observations.

3.4. Climate in native range

A.	Native range does not include climates similar to New York	0
B.	Native range possibly includes climates similar to at least part of New York.	1
C.	Native range includes climates similar to those in New York	3
U.	Unknown	

Score 3

Documentation:
Describe what part of the native range is similar in climate to New York:
Northern Europe.
Sources of information:
Tutin et al., 1980.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

A.	Not known from the northeastern US and adjacent Canada	0
B.	Present as a non-native in one northeastern USA state and/or eastern Canadian province.	1
C.	Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces.	2
D.	Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 1 northeastern state or eastern Canadian province.	3
E.	Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces. and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 2 northeastern states or eastern Canadian provinces.	4
U.	Unknown	

Score 4

Documentation:
Identify states and provinces invaded:
All northeast states and provinces.
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
USDA, 2008.

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Present in none of the PRISMs	0
B.	Present in 1 PRISM	1
C.	Present in 2 PRISMs	2
D.	Present in 3 PRISMs	3
E.	Present in more than 3 PRISMs or on the Federal noxious weed lists	4
U.	Unknown	

Score 4

Documentation:
Describe distribution:
all PRISMs
Sources of information:
Weldy & Werier, 2005:Brooklyn Botanic Garden, 2008

Total Possible	25
Section Three Total	17

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4. DIFFICULTY OF CONTROL

4.1. Seed banks

A.	Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules.	0

B.	Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years	2
C.	Seeds (or vegetative propagules) remain viable in soil for more than 10 years	3
U.	Unknown	

Score: 2

Documentation:
Identify longevity of seed bank:
Seed banking capability is rated high for this species, but longevity beyond ten years not reported.
Sources of information:
Cordeiro, 2006.

4.2. Vegetative regeneration

A.	No regrowth following removal of aboveground growth	0
B.	Regrowth from ground-level meristems	1
C.	Regrowth from extensive underground system	2
D.	Any plant part is a viable propagule	3
U.	Unknown	

Score: 2

Documentation:
Describe vegetative response:
Timothy reproduces vegetatively from short rhizomes and occasionally short stolons.
Sources of information:
Cordeiro, 2006.

4.3. Level of effort required

A.	Management is not required: e.g., species does not persist without repeated anthropogenic disturbance.	0
B.	Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft^2).	2
C.	Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above).	3
D.	Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).	4
U.	Unknown	

Score: 4

Documentation:
Identify types of control methods and time-term required:
Fire has been shown to reduce flowering and yield. Moderately severe fires will top-kill timothy, and severe fires may cause damage to or kill the root crown, killing the plant. However, fire stimulates the production of reproductive tillers in timothy. Large stands require major effort of herbicide application.
Sources of information:
Cordeiro, 2006.

Total Possible	10
Section Four Total	8
Total for 4 sections Possible	80
Total for 4 sections	51

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available: There are at least 25 varieties of timothy used in agricultural practices today.

References for species assessment:

Brooklyn Botanic Garden. 2008. AILANTHUS database. [Accessed on November 25, 2008].

Cheplick, G. P. & T. Chui. 2001. Effects of competitive stress on vegetative growth, storage, and regrowth after defoliation in Phleum pratense. Oikos. 95(2):291-299.

Cordeiro, J. 2006. Phleum pratense. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer. <www.natureserve.org>. [Accessed on November 25, 2008].

Esser, L. L. 1993. Phleum pratense. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). <http://www.fs.fed.us/database/feis/>. [Accessed on November 25, 2008].

Kettunen, R., S. Saarnio, & J. Silvola. 2007. N2O fluxes and CO2 exchange at different N doses under elevated CO2 concentration in boreal agricultural mineral soil under Phleum pratense. Nutrient Cycling in Agroecosystems. 78(2):197-209.

Sawada, H. & C. Tsuda. 1985. Phenotypic variations of plant type of timothy (Phleum pratense) populations in a pasture. Memoirs of the Faculty of Agriculture Hokkaido University. 14(4):319-329.

Tutin, T. G., V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters, & D. A. Webb [eds.]. 1980. Flora Europaea. Volume 5. Cambridge University Press, Cambridge, UK. 452 pp.

United States Department of Agriculture, National Resources Conservation Service. 2008. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana. <plants.usda.gov>. [Accesssed on November 25, 2008].

Weldy, T. & D. Werier. 2005. New York Flora Atlas. [S.M. Landry, K.N. Campbell, and L.D. Mabe (original application development), Florida Center for Community Design and Research. University of South Florida]. New York Flora Association, Albany, New York. <atlas.nyflora.org/>. [Accesssed on November 25, 2008].

Citation: This NY ranking form may be cited as: Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. Note that the order of authorship is alphabetical; all three authors contributed substantially to the development of this protocol.

Acknowledgments: The NY form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Long Island Invasive Species Management Area's Scientific Review Committee were incorporated in revisions of this form. Original members of the LIISMA SRC included representatives of the Brooklyn Botanic Garden; The Nature Conservancy; New York Natural Heritage Program, New York Sea Grant; New York State Office of Parks, Recreation and Historic Preservation; National Park Service; Brookhaven National Laboratory; New York State Department of Environmental Conservation Region 1; Cornell Cooperative Extension of Suffolk/Nassau Counties; Long Island Nursery and Landscape Association; Long Island Farm Bureau; SUNY Farmingdale Ornamental Horticulture Department; Queens College Biology Department; Long Island Botanical Society; Long Island Weed Information Management System database manager; Suffolk County Department of Parks, Recreation and Conservation; Nassau County Department of Parks, Recreation and Museums; Suffolk County Soil & Water Conservation District.

References for ranking form:

Carlson, Matthew L., Irina V. Lapina, Michael Shephard, Jeffery S. Conn, Roseann Densmore, Page Spencer, Jeff Heys, Julie Riley, Jamie Nielsen. 2008. Invasiveness ranking system for non-native plants of Alaska. Technical Paper R10-TPXX, USDA Forest Service, Alaska Region, Anchorage, AK XX9. Alaska Weed Ranking Project may be viewed at: http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm.

Heffernan, K.E., P.P. Coulling, J.F. Townsend, and C.J. Hutto. 2001. Ranking Invasive Exotic Plant Species in Virginia. Natural Heritage Technical Report 01-13. Virginia Dept. of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 27 pp. plus appendices (total 149 p.).

Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity. Version 1. NatureServe, Arlington, Virginia. http://www.natureserve.org/getData/plantData.jsp

Randall, J.M., L.E. Morse, N. Benton, R. Hiebert, S. Lu, and T. Killeffer. 2008. The Invasive Species Assessment Protocol: A Tool for Creating Regional and National Lists of Invasive Nonnative Plants that Negatively Impact Biodiversity. Invasive Plant Science and Management 1:36–49

Warner, Peter J., Carla C. Bossard, Matthew L. Brooks, Joseph M. DiTomaso, John A. Hall, Ann M.Howald, Douglas W. Johnson, John M. Randall, Cynthia L. Roye, Maria M. Ryan, and Alison E. Stanton. 2003. Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands. Available online at www.caleppc.org and www.swvma.org. California Exotic Pest Plant Council and Southwest Vegetation Management Association. 24 pp.

Williams, P. A., and M. Newfield. 2002. A weed risk assessment system for new conservation weeds in New Zealand. Science for Conservation 209. New Zealand Department of Conservation. 1-23 pp.

NEW YORK INVASIVE SPECIES
SOCIO-ECONOMIC ASSESSMENT FORM

Scientific name:	*Phleum pratense*	USDA Code: PHPR
Common names:	Timothy	
Native distribution:	widespread throughout Europe	
Date assessed:	8-Feb-2010	
Assessors:	Marcelo J. del Puerto/Sandra Van Vranken	
Reviewers:		
Date Approved:	Form version date: 04 February 2010	

Purpose

The purpose of this document is to serve as a "tool" for assessing the societal values of potentially invasive species as part of a New York State regulatory system. Title 17 of New York State Environmental Conservation Law Article 9, New York Invasive Species Council, defines an invasive species as a non-native species "…whose introduction causes or is likely to cause economic or environmental harm or harm to human health" and, "…the harm must significantly outweigh any benefits". Title 17 further requires the development of a system to regulate the "use, distribution or release" of non-native species. The system must balance potential harm against potential benefits.

The "invasivity" value of any non-native species is based on biological traits. Socio-economic values, on the other hand, are based on based on economic, human health, cultural and other social traits, both positive and negative. This *Socio-economic Assessment* was developed as part of a sequential process that would require its use only for those species whose biological invasivity assessments rate Moderate (50+) to Very High.

Using this Form

This *Assessment* should be completed by a multi-disciplinary team that includes both a species-expert and an economist or someone very familiar with the relevant industry or other uses. When answering the questions below, please identify:

1) each of the various stakeholders, using the Reference Worksheet, for which the species has value, both positive and negative;

2) the economic, human health and cultural uses, and "non-uses", of the species by each stakeholder; Consider whether non-invasive alternatives are available and whether restricting the use of the subject species would create a market for another, non-invasive species?

3) the value assigned to the species, or otherwise realized, by each stakeholder for each use, if available.

Please make responses must be species-specific and relevant to New York State. All information used to answer questions must be clearly documented.

Socio-Economic Ranking Summary

	Positive Values	Negative Values	Net Score
Human Health (Y / N)	5 / 15	- 10 /-15	-5
Economic (Y / N)	70 / 70	- 30 /-70	40
Cultural (Y / N)	5/15	- 5 /-15	0
Outcome Score	80 / 100	- 45 / -100	35
Relative Maximum Score†			
Socio-Economic Rank			**Insig. Pos.**

- For questions answered "unknown" do not include point value in "Total Answered Points Possible."
- If "Total Answered Points Possible" † is less than 70.00 points, then the overall socio-economic value rank should be listed as "Unknown."

†Calculated as 100(a/b) to two decimal places.

Very High Value	>80.00	or	Highlight those assessments with:	
High Value	70.00−80.00		Significant Positive Outcome	70/-30
Moderate Value	50.00−69.99		Significant Negative Outcome	30/-70
Low Value	40.00−49.99		Equal Outcome	50/-50
Insignificant/Negative Value	<40.00			

HUMAN HEALTH VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

1. Does/ could this species provide <u>benefits</u> to human health, such as providing medicinal values?

A. No benefit	0	
B. Low benefit (benefits minor, few people utilize)	5	X
C. Moderate benefit (benefits moderate, unlikely to be life saving)	10	

D. High benefit (benefits life saving) 15
U. Unknown Unk

Discussion Polypeptides derived from timothy grass pollen display reduced allergenic activity and are useful as an allergy vaccine. (www.freepatentsonline.com/7425333)

3 Mar 2010, Associated Press: New allergy immunotherapy derived from timothy- "participants have 26% greater improvements in symptoms." Desensitization.

Documentation & Sources of Information

2. Could/ would escaped or released individuals harm people, or could irresponsible use of the species, or its products, pose a threat to human health or safety, such as physical harm, allergic responses, dermatitis, or poisoning?

A. No risk 0
B. Low risk (injuries, harm or annoyance minor, few people exposed) -5
C. Moderate risk (injuries/ harm moderate, unlikely to be fatal, few people at risk) -10 X
D. High risk* (injuries or harm severe or fatal) -15
U. Unknown Unk

** Species that pose a high risk to human health must be either Prohibited or Regulated, regardless of any benefits.*

Discussion: A common allergy and asthma trigger. (www.Asthma.about.com) Hay fever.

Documentation & Sources of Information: Personal: Hay fever was very common and sometimes severe at Queens Zoo where we worked with hay everyday for extended periods.

HUMAN HEALTH SUBSCORE: -5

(Note: the positive health effects of timothy grass are directly related to undoing or mitigating some of the adverse allergic effects-ie-not having a separate and unrelated health benefit- hence the neg. overall score)

ECONOMIC VALUE OF THE SPECIES:
Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

3. Does/ would this species provide direct economic benefits (sales and jobs translated into dollars) for a particular industry or industries? Are there indirect economic benefits as a result of the presence of this particular species? For example, are real estate values increased because of the presence of this species? Does the species provide shade in urban settings where other less invasive plants are not suitable? Are restaurant/ lodging revenues generated from tourists coming to an area to hunt/ fish/ view a particular nonnative species? Examples: Food, Forage, Fiber, Fuel, Timber, Landscaping, Nursery, Floral, Livestock, Pets, Bait, Recreation, other.

A. None 0
B. Low Benefit (benefits minor and temporary) 30

C. Moderate Benefit (benefits minor and long lasting or major and temporary)	50
D. High Benefit (benefits major and long lasting)	70 X
U. Unknown	Unk

Discussion: Used extensively as livestock feed because of palatability, nutrient content, reduced competition with legumes, and ease of bailing.

Timothy, along with other cool-season grasses provide habitat for NY's grassland bird species.

Documentation / Sources of Information: www.plants.usda.gov

4. Does/ would this species generate direct economic costs related to its use or release? Will responses be required for new and existing infestations in unwanted areas? Does/ could the species cause damage to buildings, vehicles, fences, roads, equipment, ornamental gardens, or agriculture, or be considered a nuisance? Does/ would this species generate indirect economic costs such as, public education, modifying standard practices, repairing damage or changing practices and reducing profits? Are real estate values and/or tourism reduced because of the presence of this species? Examples: Regulatory administration, Inspections and monitoring, Education and outreach, Containment, Eradication, Repair and maintenance, Restoration, other.

A. None	0
B. Low Detriment (impacts minor and temporary)	-30 X
C. Moderate Detriment (impacts minor and long lasting or major and temporary)	-50
D. High Detriment (impacts major and long lasting)	-70
U. Unknown	Unk

Discussion: "Timothy is of great concern to wildland managers because it establishes quickly and vigorously and usually escapes early detection. It has the highest ability of 34 exotics to invade closed vegetation areas"

Personal note: generally has not been a concern in NY due to lack of native prairies. Concern out west (eg. Yellowstone) where it can overtake native prairie ecosystems.

Documentation / Sources of Information www.fs.fed.us

ECONOMIC SUBSCORE: 40

CULTURAL VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

5. Does/ would this species serve positive cultural purposes? Examples: Religious, Historic/ heritage, Recreation, Aesthetic, other.

A. None	0

B. Low Benefit (important to few people)	5	X
C. Moderate Benefit (important to moderate # of people)	10	
D. High Benefit (important to a majority of people)	15	
U. Unknown	Unk	

Discussion: Aesthetic benefit to some. Component of bucolic and agricultural landscape in NY. No religious uses found.

Documentation & Sources of Information:

6. Does/ would this species reduce or interfere with cultural activities? For example, are recreational activities constrained or aesthetic values diminished because of the presence of this species?

A. None	0	
B. Low Detriment (impacts few people)	-5	X
C. Moderate Detriment (impacts a moderate # of people)	-10	
D. High Detriment (impacts a majority of people)	-15	
U. Unknown	Unk	

Discussion: Annoyance from hay fever. Crowds out native species along nature trails in Yellowstone.

Documentation & Sources of Information: www.parks.ca.gov.

CULTURAL SUBSCORE: 0

TOTAL SOCIO-ECONOMIC ASSESSMENT SCORE: **35**

Comments

Were the questions appropriate for the species under consideration? Yes X / No
But see below

If not, what are the characteristics involved that make the situation unique? Please provide Q & A that would increase its usefulness.
Timothy, along with other introduced cool-season grasses, provides habitat for wildlife, especially NY's ground-nesting grassland birds.

Reference Worksheet

Stakeholder

Issue							
	Economic						
	Health						
	Cultural						

x presence of interest; +,++,+++ affected positively; -,--,--- affected negatively

Appendix E

Sample Assessment – Day Lily

Scientific name:	Hemerocallis fulva	USDA Plants Code: HEFU
Common names:	Orange daylily	
Native distribution:	Asia	
Date assessed:	November 25, 2008	
Assessors:	Steve Glenn, Gerry Moore	
Reviewers:	LIISMA SRC	
Date Approved:	02-11-2009	Form version date: 22 October 2008

New York Invasiveness Rank: Low (Relative Maximum Score 40.00-49.99)

Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form***)**

	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Widespread	Moderate
6	Lower Hudson	Not Assessed	Not Assessed
7	Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8	Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (20)	6
2	Biological characteristic and dispersal ability	25 (25)	11
3	Ecological amplitude and distribution	25 (25)	15
4	Difficulty of control	10 (10)	5
	Outcome score	100 (80)[b]	37[a]
	Relative maximum score †		46.25
	New York Invasiveness Rank §	Low (Relative Maximum Score 40.00-49.99)	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00−80.00; Moderate 50.00−69.99; Low 40.00−49.99; Insignificant <40.00

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1
A1.2. In which PRISMs is it known (see inset map)?	
☒	Adirondack Park Invasive Program
☒	Capital/Mohawk
☒	Catskill Regional Invasive Species Partnership
☒	Finger Lakes
☒	Long Island Invasive Species Management Area

☒	Lower Hudson
☒	Saint Lawrence/Eastern Lake Ontario
☐	Western New York

Documentation:
Sources of information:
Weldy & Werier, 2005; Brooklyn Botanic Garden, 2008.

A2.1. What is the likelihood that this species will occur and persist outside of cultivation, given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Not Assessed	Adirondack Park Invasive Program
Not Assessed	Capital/Mohawk
Not Assessed	Catskill Regional Invasive Species Partnership
Not Assessed	Finger Lakes
Very Likely	Long Island Invasive Species Management Area
Not Assessed	Lower Hudson
Not Assessed	Saint Lawrence/Eastern Lake Ontario
Not Assessed	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
Brooklyn Botanic Garden, 2008.

If the species does not occur and is not likely to occur with any of the PRISMs, then stop here as there is no need to assess the species.

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	Widespread
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:
Brooklyn Botanic Garden, 2008.

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
☐ Salt/brackish waters	☐ Salt/brackish marshes	☒ Cultivated*
☐ Freshwater tidal	☐ Freshwater marshes	☒ Grasslands/old fields
☐ Rivers/streams	☐ Peatlands	☐ Shrublands
☐ Natural lakes and ponds	☐ Shrub swamps	☒ Forests/woodlands
☐ Vernal pools	☒ Forested wetlands/riparian	☐ Alpine
☐ Reservoirs/impoundments*	☒ Ditches*	☒ Roadsides*
	☐ Beaches and/or coastal dunes	

Other potential or known suitable habitats within New York:

Documentation:
Sources of information:
Fellows, 2004; Brooklyn Botanic Garden, 2008.

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score: U

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Fellows (2004):"No reported ecosystem-level effects, therefore a low or insignificant rank inferred." Since extensive publications (>10) are lacking for H. fulva's impact on natural ecosystem processes and system wide parameters, the question is scored as Unknown.
Sources of information:
Fellows, 2004.

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score: 3

Documentation:
Identify type of impact or alteration:
The species is known to increase the density of the herb layer. No evidence of creation or elimination of a layer.
Sources of information:
Authors' pers. obs.

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7

D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score: 3

Documentation:
Identify type of impact or alteration:
Can form dense clumps, reducing the number of native species. No evidence for significant reduction or extirpation of native species.
Sources of information:
APRS 2001; Fellows, 2004; authors' pers. obs.

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades. Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact	3
C.	Moderate impact	7
D.	Severe impact on other species or species groups	10
U.	Unknown	

Score: U

Documentation:
Identify type of impact or alteration:
Studies lacking on H. fulva's impact on other species or species groups.
Sources of information:

Total Possible: 20
Section One Total: 6

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2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction)	1
C.	Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)	2
D.	Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.)	4
U.	Unknown	

Score: 2

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Although it has bee n reported to produce seeds (< 10 /plant), seed set must be extremely

rare; no LIISMA SRC members could report seeing seed in populations. The primary mode of reproduction is through limited vegetative spread .
Sources of information:
Munson, 1989; Fellows, 2004; authors' pers. obs.

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

A.	Does not occur (no long-distance dispersal mechanisms)	0
B.	Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)	1
C.	Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant)	2
D.	Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant)	4
U.	Unknown	

Score 0

Documentation:
Identify dispersal mechanisms:
Not known to occur; capsules and seeds not adapted for long distance dispersal and seed set not reported in the area.
Sources of information:
Fellows, 2004; authors' pers. obs.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

A.	Does not occur	0
B.	Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)	1
C.	Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)	2
D.	High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful)	3
U.	Unknown	

Score 3

Documentation:
Identify dispersal mechanisms:
Genus is a popular ornamental thousands of cultivars known, but this species is not widely sold. Species is a "pass along plant", gardeners giving the plant to other gardeners. Indirect spread possible through discarded yard waste containing root material of the plant.
Sources of information:
Munson, 1989; Fellows, 2004.

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	3
C.	Possesses two or more characteristics that increase competitive advantage	6
U.	Unknown	

Score 6

Documentation:

Evidence of competitive ability:
Perennial habit, shade tolerant. Hemerocallis fulva is well adapted to secure the best soil position for survival by having two mechanisms to regulate soil depth: the pulling effect of contractile roots, and, as an emergency response, the opposite effect of upward growth of the facultative shoot elongation.
Sources of information:
Puetz, 1998; authors' pers. obs.

2.5. Growth vigor

A.	Does not form thickets or have a climbing or smothering growth habit	0
B.	Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms	2
U.	Unknown	

Score: 0

Documentation:
Describe growth form:
Does not posess a smothering or thicket-forming habit.
Sources of information:
Authors' personal observations.

2.6. Germination/Regeneration

A.	Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules.	0
B.	Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions	2
C.	Can germinate/regenerate in existing vegetation in a wide range of conditions	3
U.	Unknown (No studies have been completed)	

Score: 0

Documentation:
Describe germination requirements:
Seed or regeneration from vegetative propagules reported to require open soil.
Sources of information:
Fellows, 2004.

2.7. Other species in the genus invasive in New York or elsewhere

A.	No	0
B.	Yes	3
U.	Unknown	

Score: 0

Documentation:
Species:
Hemerocallis lilioasphodelus reported naturalizing in the northeastern US, though not reported as invasive. Weldy & Werier, 2005; USDA, 2008.

Total Possible: 25
Section Two Total: 11

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3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island,

New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

A.	No large stands (no areas greater than 1/4 acre or 1000 square meters)	0
B.	Large dense stands present in areas with numerous invasive species already present or disturbed landscapes	2
C.	Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas)	4
U.	Unknown	

Score: 0

Documentation:
Identify reason for selection, or evidence of weedy history:
Large stands observed in disturbed (usually roadside wood margins) in the New York metropolitan area, but always less than 1/4 acre in size.
Sources of information:
Authors' personal observations.

3.2. Number of habitats the species may invade

A.	Not known to invade any natural habitats given at A2.3	0
B.	Known to occur in two or more of the habitats given at A2.3, with at least one a natural habitat.	1
C.	Known to occur in three or more of the habitats given at A2.3, with at least two a natural habitat.	2
D.	Known to occur in four or more of the habitats given at A2.3, with at least three a natural habitat.	4
E.	Known to occur in more than four of the habitats given at A2.3, with at least four a natural habitat.	6
U.	Unknown	

Score: 4

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Fellows, 2004; Brooklyn Botanic Garden, 2008.

3.3. Role of disturbance in establishment

A.	Requires anthropogenic disturbances to establish.	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.	2
C.	Can establish independent of any known natural or anthropogenic disturbances.	4
U.	Unknown	

Score: 0

Documentation:
Identify type of disturbance:
Requires anthropogenic disturbance (e.g., dumping of yard waste) to establish.
Sources of information:
Authors' pers. obs.; LIISMA SRC pers. comm.

3.4. Climate in native range

A.	Native range does not include climates similar to New York	0
B.	Native range possibly includes climates similar to at least part of New York.	1
C.	Native range includes climates similar to those in New York	3
U.	Unknown	

Score: 3

Documentation:

Describe what part of the native range is similar in climate to New York:
North-central China. The original native range of H. fulva sensu lato in cultivation is a bit nebulous. Several clones and various wild types are included under H. fulva. This includes the clone 'Europa', established in European gardens by the 16th century and probably originating in Asia.
Sources of information:
Munson, 1989; Zhenyi & Raven, 2000.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

A.	Not known from the northeastern US and adjacent Canada	0
B.	Present as a non-native in one northeastern USA state and/or eastern Canadian province.	1
C.	Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces.	2
D.	Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 1 northeastern state or eastern Canadian province.	3
E.	Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces. and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 2 northeastern states or eastern Canadian provinces.	4
U.	Unknown	

Score: 4

Documentation:
Identify states and provinces invaded:
All northeastern states and provinces.
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
USDA, 2008.

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Present in none of the PRISMs	0
B.	Present in 1 PRISM	1
C.	Present in 2 PRISMs	2
D.	Present in 3 PRISMs	3
E.	Present in more than 3 PRISMs or on the Federal noxious weed lists	4
U.	Unknown	

Score: 4

Documentation:
Describe distribution:
All PRISMs except Western New York; see A1.1.
Sources of information:
Weldy & Werier, 2005.

Total Possible	25
Section Three Total	15

4. DIFFICULTY OF CONTROL

4.1. Seed banks

A.	Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules.	0

B.	Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years	2
C.	Seeds (or vegetative propagules) remain viable in soil for more than 10 years	3
U.	Unknown	

Score: 0

Documentation:
Identify longevity of seed bank:
Seeds have not been observed and it is not known to be able to produce persistent vegetative propagules.
Sources of information:
Fellows, 2004; LIISMA SRC, pers. comm..

4.2. Vegetative regeneration

A.	No regrowth following removal of aboveground growth	0
B.	Regrowth from ground-level meristems	1
C.	Regrowth from extensive underground system	2
D.	Any plant part is a viable propagule	3
U.	Unknown	

Score: 2

Documentation:
Describe vegetative response:
Thick tuberous root system.
Sources of information:
Fellows, 2004; authors' pers. obs.

4.3. Level of effort required

A.	Management is not required: e.g., species does not persist without repeated anthropogenic disturbance.	0
B.	Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft^2).	2
C.	Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above).	3
D.	Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).	4
U.	Unknown	

Score: 3

Documentation:
Identify types of control methods and time-term required:
Thick tuberous roots make this taxon somewhat difficult to control. Mechanical removal of the entire root system is needed to prevent resprouting.
Sources of information:
Fellows, 2004.

Total Possible	10
Section Four Total	5
Total for 4 sections Possible	80
Total for 4 sections	37

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available: 'Kwanso' (extra tepals). The most common form is 'Europa' which is self-sterile with a triploid chromosome complement. It spreads readily by asexual stolons (Source: Hemerocallis: Day lilies by W. Erhardt, 1992, Batsford: London.) Also 'Kwanso' (extra tepals).

References for species assessment:

.Brooklyn Botanic Garden. 2008. AILANTHUS database. [Accessed on November 25, 2008].

Fellows, M. 2004. Hemerocallis fulva. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer. <www.natureserve.org>. [Accessed on November 25, 2008].

Munson, R. W. 1989. Hemerocallis, the daylily. Timber Press, Portland, OR. 144 pp.

Puetz, N. 1998. Underground plant movement. V. Contractile root tubers and their importance to the mobility of Hemerocallis fulva L. (Hemerocallidaceae). International Journal of Plant Sciences. 159(1):23-30.

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Acknowledgments: The NY form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Long Island Invasive Species Management Area's

Scientific Review Committee were incorporated in revisions of this form. Original members of the LIISMA SRC included representatives of the Brooklyn Botanic Garden; The Nature Conservancy; New York Natural Heritage Program, New York Sea Grant; New York State Office of Parks, Recreation and Historic Preservation; National Park Service; Brookhaven National Laboratory; New York State Department of Environmental Conservation Region 1; Cornell Cooperative Extension of Suffolk/Nassau Counties; Long Island Nursery and Landscape Association; Long Island Farm Bureau; SUNY Farmingdale Ornamental Horticulture Department; Queens College Biology Department; Long Island Botanical Society; Long Island Weed Information Management System database manager; Suffolk County Department of Parks, Recreation and Conservation; Nassau County Department of Parks, Recreation and Museums; Suffolk County Soil & Water Conservation District.

References for ranking form:

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Appendix F

Sample Assessments – Chinese Mystery Snail

Scientific name:	*Bellamya (Cipangopaludina) chinensis, Cipangopaludina japonica, Viviparous malleatus* USDA Code:
Common names:	Chinese Mystery Snail
Native distribution:	Burma, Thailand, South Vietnam, China, Korea, Japan, the Philippines, and Java.
Date assessed:	4 March 2010
Assessors:	D. Adams
Reviewers:	
Date Approved:	8 March 2010 Form version date: 8 June 2009

New York Invasiveness Rank: High (Relative Maximum Score 76.00)

Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form***)**			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program		
2	Capital/Mohawk	x	
3	Catskill Regional Invasive Species Partnership		
4	Finger Lakes	x	
5	Long Island Invasive Species Management Area	x	
6	Lower Hudson	x	
7	Saint Lawrence/Eastern Lake Ontario		
8	Western New York	x	

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	30 (30)	21
2	Biological characteristic and dispersal ability	30 (30)	25
3	Ecological amplitude and distribution	30 (30)	25
4	Difficulty of control	10 (10)	5
	Outcome score	100 (100)[b]	76[a]
	Relative maximum score †		76.00
	New York Invasiveness Rank §	High	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00−80.00; Moderate 50.00−69.99; Low 40.00−49.99; Insignificant <40.00

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented in NY? (reliable source; voucher not required)	
x	Yes – continue to A1.2
	No – continue to A2.1; Yes ☐ NA; Yes ☐ USA
A1.2. In which PRISMs is it known (see inset map)?	
	Adirondack Park Invasive Program
x	Capital/Mohawk

	Catskill Regional Invasive Species Partnership
x	Finger Lakes
x	Long Island Invasive Species Management Area
x	Lower Hudson
	Saint Lawrence/Eastern Lake Ontario
x	Western New York

Documentation:
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

A2.0. Is this species listed on the Federal Injurious Fish and Wildlife list?
Yes – the species will automatically be listed as Prohibited, no further assessment required.
x No – continue to A2.1

A2.1. What is the likelihood that this species will occur and persist given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form and/ or Climatch score)

Not Assessed	Adirondack Park Invasive Program
Not Assessed	Capital/Mohawk
Not Assessed	Catskill Regional Invasive Species Partnership
Not Assessed	Finger Lakes
Not Assessed	Long Island Invasive Species Management Area
Not Assessed	Lower Hudson
Not Assessed	Saint Lawrence/Eastern Lake Ontario
Not Assessed	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

If the species does not occur and is not likely to survive and reproduce within any of the PRISMs, then stop here as there is no need to assess the species.

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	
Capital/Mohawk	x
Catskill Regional Invasive Species Partnership	
Finger Lakes	x
Long Island Invasive Species Management Area	x
Lower Hudson	x
Saint Lawrence/Eastern Lake Ontario	
Western New York	x

Documentation:
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
Marine	Salt/brackish marshes	Cultivated*
Salt/ brackish waters	**x** Freshwater marshes	Grasslands/old fields
x Freshwater tidal	Peatlands	Shrublands
Rivers/streams	**x** Shrub swamps	Forests/woodlands
x Natural lakes and ponds	Forested wetlands/riparian	Alpine
x Vernal pools	**x** Ditches*	Roadsides*
x Reservoirs/ impoundments*	Beaches/or coastal dunes	Cultural*

Other potential or known suitable habitats within New York:

Documentation:
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes (e.g., water cycle, energy cycle, mineral and cycle)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree, has a perceivable but mild influence	3
C.	Significant alteration of ecosystem processes	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes	10
U.	Unknown	

Score 7

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Reduce periphyton biomass, increase water column N:P ratio.
Sources of information: Oecologia 159:161-170

1.2. Impact on Natural Habitat/ Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals of one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7
D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score 7

Documentation:
Identify type of impact or alteration:
Reduce periphyton biomass, compete with native snail, negatively affecting abundance and biomass.
Sources of information:
Oecologia 159:161-170

1.3. Impact on other species or species groups, including cumulative impact of this species on other organisms in the community it invades. (e.g., interferes with native predator/ prey dynamics; injurious components/ spines; reduction in spawning; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact (e.g. impacts 1 species, <20% population decline, limited host damage)	3
C.	Moderate impact (e.g. impacts 2-3 species and/ or 20-29% population decline of any 1 species, kills host in 2-5 years, ,)	7

D.	Severe impact on other species or species groups (e.g. impacts >3 species and/ or ≥30% population decline of any 1 species, kills host within 2 years, extirpation)	10
U.	Unknown	

Score 7

Documentation:
Identify type of impact or alteration:
Compete with native snail, negatively affecting abundance and biomass.
Sources of information:
Oecologia 159:161-170

Total Possible 30
Section One Total 21

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2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

A.	No reproduction (e.g. sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (e.g., intrinsic rate of increase <10%, low fecundity, complete one life cycle)	1
C.	Moderate reproduction (e.g., intrinsic rate of increase between 10-30%, moderate fecundity, complete 2-3 life cycles)	2
D.	Abundant reproduction (e.g., intrinsic rate of increase >30%, parthenogenesis, large egg masses, complete > 3 life cycles)	4
U.	Unknown	

Score 2

Documentation:
Describe key reproductive characteristics:

Sources of information:

2.2. Migratory behavior

A.	Always migratory in its native range	0
B.	Non-migratory or facultative migrant in its native range	2
U.	Unknown	

Score 2

Documentation:
Describe migratory behavior:
Shallow water during breeding season, deeper water in winter.
Sources of information:
See references.

2.3. Biological potential for colonization by long-distance dispersal/ movement (e.g., veligers, resting stage eggs, glochidia)

A.	No long-distance dispersal/ movement mechanisms	0
B.	Adaptations exist for long-distance dispersal, but studies report that most individuals (90%) establish territories within 5 miles of natal origin or within a distance twice the home range of the typical individual, and tend not to cross major barriers such as dams and watershed divides	1
C.	Adaptations exist for long-distance dispersal, movement and evidence that offspring often disperse greater than 5 miles of natal origin or greater than twice the home range of typical individual and will cross major barriers such as dams and watershed divides	2
U.	Unknown	

Score 1

Documentation:

Identify dispersal mechanisms:
Transport live via wildlife, live young bearing within shell of adult, can tightly seal operculum.
Sources of information:
Solomon et al. Bio Invasions DOI 10.1007/s10530-009-9572-7, 10 September 2009. Estimating the probability of long-distance overland dispersal of invading aquatic species. Ecol Appl 9:254-265

2.4. Practical potential to be spread by human activities, both directly and indirectly – possible vectors include: commercial bait sales, deliberate illegal stocking, aquaria releases, boat trailers, canals, ballast water exchange, live food trade, rehabilitation, pest control industry, aquaculture escapes, etc.)

A.	Does not occur	0
B.	Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)	1
C.	Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)	2
D.	High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful)	4
U.	Unknown	

Score 2

Documentation:
Identify dispersal mechanisms:
Boat transport, intentional release from aquaria and water gardens.
Sources of information:
Solomon et al. Bio Invasions DOI 10.1007/s10530-009-9572-7, 10 September 2009.

2.5. Non-living chemical and physical characteristics that increase competitive advantage (e.g., tolerance to various extremes, pH, DO, temperature, desiccation, fill vacant niche, charismatic species)

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	4
C.	Possesses two or more characteristics that increase competitive advantage	8
U.	Unknown	

Score 8

Documentation:
Evidence of competitive ability:
Tolerates desiccation, temperature and DO fluctuations, sodium concentrations, and to a lesser extent pH fluctuations.
Sources of information:
Rebekah M. Kipp. 2007. GLANSIS; Solomon et al. Bio Invasions DOI 10.1007/s10530-009-9572-7, 10 September 2009.

2.6. Biological characteristics that increase competitive advantage (e.g., high fecundity, generalist/ broad niche space, highly evolved defense mechanisms, behavioral adaptations, piscivorous, etc.)

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	4
C.	Possesses two or more characteristics that increase competitive advantage	8
U.	Unknown	

Score 8

Documentation:
Evidence of competitive ability:

High fecundity, live young bearing, generalist.

Sources of information:
Solomon et al. Bio Invasions DOI 10.1007/s10530-009-9572-7, 10 September 2009.

2.7. Other species in the family and/ or genus invasive in New York or elsewhere?

A.	No	0
B.	Yes	2
U.	Unknown	

Score: 2

Documentation:
Identify species:
Bellamya japonica

Total Possible: 30
Section Two Total: 25

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3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Current introduced distribution in the northern latitudes of USA and southern latitude of Canada (e.g., between 35 and 55 degrees).

A.	Not known from the northern US or southern Canada.	0
B.	Established as a non-native in 1 northern USA state and/or southern Canadian province.	1
C.	Established as a non-native in 2 or 3 northern USA states and/or southern Canadian provinces.	2
D.	Established as a non-native in 4 or more northern USA states and/or southern Canadian provinces, and/or categorized as a problem species (e.g., "Invasive") in 1 northern state or southern Canadian province.	3
U.	Unknown	

Score: 3

Documentation:
Identify states and provinces:
California, Massachusetts, Texas, Wisconsin, Pennsylvania, New York, etc.
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007
Evans and Ray. Amer. Malac Bull. 28:135-150 (2010)

3.2. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Established in none of the PRISMs	0
B.	Established in 1 PRISM	1
C.	Established in 2 or 3 PRISMs	3
D.	Established in 4 or more PRISMs	5
U.	Unknown	

Score: 3

Documentation:
Describe distribution:
Hudson Valley, Western NY, Capital/ Mohawk, Long Island, etc.
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

3.3. Number of known, or potential (each individual possessed by a vendor or consumer), individual releases and/ or release events

A.	None	0
B.	Few releases (e.g., <10 annually).	2
C.	Regular, small scale releases (e.g., 10-99 annually).	4
D.	Multiple, large scale (e.g., ≥100 annually).	6
U.	Unknown	

Score 4

Documentation:
Describe known or potential releases:
Regular intentional and accidental releases from water garden, aquaculture and aquarium trade, in addition to boat transport.
Sources of information:
See references

3.4. Current introduced population density, or distance to known occurrence, in northern USA and/ or southern Canada.

A.	No known populations established.	0
B.	Low to moderate population density (e.g., ≤1/4 to < 1/2 native population density) with few other invasives present and/ or documented in 1 or more non-adjacent state/ province and/ or 1 unconnected waterbody.	1
C.	High or irruptive population density (e.g., ≥1/2 native population density) with numerous other invasives present and/ or documented in 1 or more adjacent state/ province and/ or 1 connected waterbody.	2
U.	Unknown	

Score 2

Documentation:
Describe population density:
At least 27 states and Quebec; 19+ sites in Delaware and Susquehanna watershed (PA); most frequently occurring species in WI survey.
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007; Amer. Malac. Bull. 28:135-150 (2010); Biological Invasions, 10 September 2009.

3.5. Number of habitats the species may invade

A.	Not known to invade any natural habitats given at A2.3.	0
B.	Known to occur in 2 or 3 of the habitats given at A2.3, with at least 1 or 2 natural habitat(s).	2
C.	Known to occur in 4 or more of the habitats given at A2.3, with at least 3 natural habitats.	3
U.	Unknown.	

Score 3

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
Can be found in lakes, ponds, rice paddies, irrigation ditches, roadside ditches, and slower portions of streams.
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

3.6. Role of anthropogenic (human related) and natural disturbance in establishment (e.g. water level management, man-made structures, high vehicle traffic, major storm events, etc).

A.	Requires anthropogenic disturbances to establish.	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.	2

C. Can establish independent of any known natural or anthropogenic disturbances. 3
U. Unknown.

Score 2

Documentation:
Identify type of disturbance:
Positive relationship between occurrence and distance to population centers, shoreline housing density, and boat launch sites.
Sources of information:
Biol Invasions 10 September 2009

3.7. Climate in native range (e.g., med. to high, ≥5, Climatch score; within 35 to 55 degree latitude; etc.)

A. Native range does not include climates similar to New York (e.g., <10%). 0
B. Native range possibly includes climates similar to portions of New York (e.g., 10-29%). 4
C. Native range includes climates similar to those in New York (e.g., ≥30%). 8
U. Unknown.

Score 8

Documentation:
Describe known climate similarities:
Native to Burma, Thailand, South Vietnam, China, Korea, the Philipines, and Java
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

Total Possible 30
Section Three Total 25

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4. DIFFICULTY OF CONTROL

4.1. Re-establishment potential, nearby propagule source, known vectors of re-introduction (e.g. biological supplies, pets, aquaria, aquaculture facilities, connecting waters/ corridors, mechanized transportation, live wells, etc.)

A. No known vectors/ propagule source for re-establishment following removal. 0
B. Possible re-establishment from 1 vector/ propagule source following removal and/ or viable <24 hours. 1
C. Likely to re-establish from 2-3 vectors/ propagule sources following removal and/ or viable 2-7 days. 2
D. Strong potential for re-establishment from 4 or more vectors/ propagule sources following removal and/or viable >7 days. 3
U. Unknown.

Score 2

Documentation:
Identify source/ vectors:
Readily controlled using copper based chemicals, though not species specific.
Sources of information:
See references.

4.2. Status of monitoring and/ or management protocols for species

A. Standardized protocols appropriate to New York State are available. 0
B. Scientific protocols are available from other countries, regions or states. 1
C. No known protocols exist. 2
U. Unknown

Score 1

Documentation:

Describe protocols:
Late summer survey, 10 minute "rapid assessment" of the lake shoreline.
Sources of information:
Mystery Snails Monitoring Protocol, Wisconsin DNR Citizen Lake Monitoring Program, 2009.

4.3. Status of monitoring and/ or management resources (e.g. tools, manpower, travel, traps, lures, ID keys, taxonomic specialists, etc.)

A.	Established resources are available including commercial and/ or research tools	0
B.	Monitoring resources may be available (e.g. partnerships, NGOs, etc)	1
C.	No known monitoring resources are available	2
U.	Unknown	

Score: 1

Documentation:
Describe resources:
PRISMs
Sources of information:
OISC

4.4. Level of effort required

A.	Management is not required. (e.g., species does not persist without repeated human mediated action.)	0
B.	Management is relatively easy and inexpensive; invasive species can be maintained at low abundance causing little or no ecological harm. (e.g., 10 or fewer person-hours of manual effort can eradicate a local infestation in 1 year.)	1
C.	Management requires a major short-term investment, and is logistically and politically challenging; eradication is difficult, but possible. (e.g., 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/ year for 2-5 years to suppress a local infestation.)	2
D.	Management requires a major investment and is logistically and politically difficult; eradication may be impossible. (e.g., more than 100 person-hours/ year of manual effort, or more than 10 person hours/year for more than 5 years to suppress a local infestation.)	3
U.	Unknown	

Score: 1

Documentation:
Identify types of control methods and time required:
Biological control and or chemical control (copper compounds).
Sources of information:
USGS Aquatic Invasive Species Fact Sheet: Chinese Mystery Snail 2005/ 2007

Total Possible	10
Section Four Total	5
Total for 4 sections Possible	100
Total for 4 sections	76

C. STATUS OF GENETIC VARIANTS AND HYBRIDS:

At the present time there is no protocol or criteria for assessing the invasiveness of genetic variants independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Genetic variants of the species known to exist: Yes. Rebekah M. Kipp. 2007. GLANSIS.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Hybrids of uncertain origin known to exist: Yes. Rebekah M. Kipp. 2007. GLANSIS.

References for species assessment:

Evans, R. and S. Ray. 2010. Distribution and environmental influences on freshwater gastropods from lotic systems and springs in Pennsylvania, USA, with conservation recommendations. Amer. Malac. Bull. 28:135-150.

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Citation: The New York Fish & Aquatic Invertebrate Invasiveness Ranking Form is an adaptation of the New York Plant Invasiveness Ranking Form. The original plant form may be cited as: Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY.

Acknowledgments: The New York Terrestrial Vertebrate Invasiveness Ranking Form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Invasive Species Council and Invasive Species Advisory Committee were incorporated in revisions of this form. Members of the Office of Invasive Species Coordination's Four-tier Team, who coordinated the effort, included representatives of the New York State Depart. of Environmental Conservation* (Division of Fish, Wildlife and Marine Resources, Division of Lands and Forests, Division of Water); The Nature Conservancy; New York Natural Heritage Program; New York Sea Grant*; Lake Champlain Sea Grant*; New York State Depart. of Agriculture and Markets; Cornell University (Dept. of Natural Resources and Dept. of Entomology); New York State Nursery and Landscape Association; New York Farm Bureau; Brooklyn Botanic Garden; Pet Industry Joint Advisory Council*; Trout Unlimited*; USDA APHIS (Plant Protection and Quarantine and Wildlife Services); New York State Depart. of Transportation; SUNY Albany and Plattsburgh*; and Cary Institute of Ecosystem Studies. Those organizations listed with an asterisk comprised the Fish & Aquatic Invertebrate Working Group.

Background References for ranking form:

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Copp, G. H., R. Garthwaite and R. E. Gozlan. 2005. Risk Identification and Assessment of Non-native Freshwater Fishes: Concepts and Perspectives on Protocols for the UK. Sci. Ser. Tech Rep., Cefas Lowestoft, 129: 32pp.

Cooperative Prevention of Invasive Wildlife Introduction in Florida. 2008. The Environmental Law Institute, Washington, DC.

Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process. 1996. Risk Assessment and Management Committee, Aquatic Nuisance Species Task Force.

International Conference on Marine Bioinvasions. 2007. The Massachusetts Institute of Technology, Cambridge, Massachusetts.

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Molnar, J., R. Gamboa, C. Revenga, and M. Spalding. 2008 Assessing the Global Threat of Invasive Species to Marine Biodiversity. Front. Ecol. Environ.

Natural Resources Board Order No. IS-34-06, Invasive Species Identification, Classification and Control. 2008. Wisconsin Department of Natural Resources, Madison Wisconsin.

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NEW YORK INVASIVE SPECIES SOCIO-ECONOMIC ASSESSMENT FORM

Scientific name:	*Cipanopaludina chinensis, Bellayma chinensis, viviparous malleatus*
	USDA Code:
Common names:	Chinese Mystery Snail, Japanese Trapdoor Snail
Native distribution:	Burma, Thailand, South Vietnam, China, Korea, Japan, the Philippines, and Java
Date assessed:	5 March, 2010
Assessors:	Leslie Surprenant
Reviewers:	
Date Approved:	Form version date: 04 February 2010

Purpose

The purpose of this document is to serve as a "tool" for assessing the societal values of potentially invasive species as part of a New York State regulatory system. Title 17 of New York State Environmental Conservation Law Article 9, New York Invasive Species Council, defines an invasive species as a non-native species "…whose introduction causes or is likely to cause economic or environmental harm or harm to human health" and, "…the harm must significantly outweigh any benefits". Title 17 further requires the development of a system to regulate the "use, distribution or release" of non-native species. The system must balance potential harm against potential benefits.

The "invasivity" value of any non-native species is based on biological traits. Socio-economic values, on the other hand, are based on based on economic, human health, cultural and other social traits, both positive and negative. This *Socio-economic Assessment* was developed as part of a sequential process that would require its use only for those species whose biological invasivity assessments rate Moderate (50+) to Very High.

Using this Form

This *Assessment* should be completed by a multi-disciplinary team that includes both a species-expert and an economist or someone very familiar with the relevant industry or other uses. When answering the questions below, please identify:

1) each of the various stakeholders, using the Reference Worksheet, for which the species has value, both positive and negative;

2) the economic, human health and cultural uses, and "non-uses", of the species by each stakeholder; Consider whether non-invasive alternatives are available and whether restricting the use of the subject species would create a market for another, non-invasive species?

3) the value assigned to the species, or otherwise realized, by each stakeholder for each use, if available.

Please make responses must be species-specific and relevant to New York State. All information used to answer questions must be clearly documented.

Socio-Economic Ranking Summary

	Positive Values	Negative Values	Net Score
Human Health (Y / N)	0 / 15	- 5 /-15	-5
Economic (Y / N)	30 / 70	- 50 /-70	-20
Cultural (Y / N)	5/15	- 0 /-15	5
Outcome Score	35 / 100	- 55 / -100	-20
Relative Maximum Score†			
Socio-Economic Rank			**Insig. Neg.**

- For questions answered "unknown" do not include point value in "Total Answered Points Possible."
- If "Total Answered Points Possible" † is less than 70.00 points, then the overall socio-economic value rank should be listed as "Unknown."

†Calculated as 100(a/b) to two decimal places.

Very High Value	>80.00	or	Highlight those assessments with:	
High Value	70.00−80.00		Significant Positive Outcome	70/-30
Moderate Value	50.00−69.99		Significant Negative Outcome	30/-70
Low Value	40.00−49.99		Equal Outcome	50/-50
Insignificant/Negative Value	<40.00			

HUMAN HEALTH VALUE OF THE SPECIES:

Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

1. Does/ could this species provide <u>benefits</u> to human health, such as providing medicinal values?

A. No benefit	0	X
B. Low benefit (benefits minor, few people utilize)	5	
C. Moderate benefit (benefits moderate, unlikely to be life saving)	10	

D. High benefit (benefits life saving)	15
U. Unknown	Unk

Discussion: Chinese mystery snail is known to host *Echinostoma cinetorchis* (human intestinal flukes) in Korea.

Documentation & Sources of Information :
The Oriental Mystery Mollusc (*Cipangopaludina chinensis*) at Buckhorn Island State Park, Erie County, New York P. M. Eckel Missouri Botanical Garden Res Botanica August 3, 2004)
http://www.mobot.org/plantscience/ResBot/niag/Misc/Mollusc/Mollusc.htm
US Geological Service Nonindigenous Species Database:
http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1045

2. Could/ would escaped or released individuals harm people, or could irresponsible use of the species, or its products, pose a threat to human health or safety, such as physical harm, allergic responses, dermatitis, or poisoning?

A. No risk	0	
B. Low risk (injuries, harm or annoyance minor, few people exposed)	-5	X
C. Moderate risk (injuries/ harm moderate, unlikely to be fatal, few people at risk)	-10	
D. High risk* (injuries or harm severe or fatal)	-15	
U. Unknown	Unk	

** Species that pose a high risk to human health must be either Prohibited or Regulated, regardless of any benefits.*

Discussion: "Low" risk assumes few people raise and consume this species.

Documentation & Sources of Information:

HUMAN HEALTH SUBSCORE: -5

ECONOMIC VALUE OF THE SPECIES:
Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

3. Does/ would this species provide direct economic benefits (sales and jobs translated into dollars) for a particular industry or industries? Are there indirect economic benefits as a result of the presence of this particular species? For example, are real estate values increased because of the presence of this species? Does the species provide shade in urban settings where other less invasive plants are not suitable? Are restaurant/ lodging revenues generated from tourists coming to an area to hunt/ fish/ view a particular nonnative species? Examples: Food, Forage, Fiber, Fuel, Timber, Landscaping, Nursery, Floral, Livestock, Pets, Bait, Recreation, other.

A. None	0	
B. Low Benefit (benefits minor and temporary)	30	X
C. Moderate Benefit (benefits minor and long lasting or major and temporary)	50	
D. High Benefit (benefits major and long lasting)	70	

U. Unknown	Unk

Discussion: An internet search revealed this species is "the most widely sold fresh water [snail] species" , in part because it survives northern winters. This species is popular with water gardeners because it does not consume vascular plants and consumes detritus and algae. It is also sold as a component of fish pond stocking packages as algae/detritus control and a fish food source.

Documentation / Sources of Information: www.squidoo.com
http://www.liveaquaria.com/product/prod_display.cfm?c=1075+1077&pcatid=1077
http://www.smithcreekfishfarm.com/id1.html

4. Does/ would this species generate direct economic costs related to its use or release? Will responses be required for new and existing infestations in unwanted areas? Does/ could the species cause damage to buildings, vehicles, fences, roads, equipment, ornamental gardens, or agriculture, or be considered a nuisance? Does/ would this species generate indirect economic costs such as, public education, modifying standard practices, repairing damage or changing practices and reducing profits? Are real estate values and/or tourism reduced because of the presence of this species? Examples: Regulatory administration, Inspections and monitoring, Education and outreach, Containment, Eradication, Repair and maintenance, Restoration, other.

A. None	0	
B. Low Detriment (impacts minor and temporary)	-30	
C. Moderate Detriment (impacts minor and long lasting or major and temporary)	-50	X
D. High Detriment (impacts major and long lasting)	-70	
U. Unknown	Unk	

Discussion Little data exist regarding the ecosystem effects of this species, it likely competes intensely with native mollusks. Shells may clog water intake pipes.

Documentation / Sources of Information
Indiana Dept Natural Resources: http://www.in.gov/dnr/files/CHINESE_MYSTERY_SNAIL.pdf

US. Geological Survey Nonindigenous Aquatic Species Database:
http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=1045

ECONOMIC SUBSCORE: -20

CULTURAL VALUE OF THE SPECIES:
Is at least one question answerable? If yes, answer and document as well as possible. If No, proceed to next section.

5. Does/ would this species serve positive cultural purposes? Examples: Religious, Historic/ heritage, Recreation, Aesthetic, other.

A. None	0	
B. Low Benefit (important to few people)	5	X
C. Moderate Benefit (important to moderate # of people)	10	
D. High Benefit (important to a majority of people)	15	
U. Unknown	Unk	

Discussion This assumes Chinese Mystery Snail is not purchased and raised by a significant percent of New York's citizenry as a pond element or food source.

Documentation & Sources of Information

6. Does/ would this species reduce or interfere with cultural activities? For example, are recreational activities constrained or aesthetic values diminished because of the presence of this species?

A. None	0	X
B. Low Detriment (impacts few people)	-5	
C. Moderate Detriment (impacts a moderate # of people)	-10	
D. High Detriment (impacts a majority of people)	-15	
U. Unknown	Unk	

Discussion This assumes the presence of Chinese Mystery Snail does poses little or no interfere with fishing, boating, hobby gardening, recreational, religious or other activities or aesthetics.

Documentation & Sources of Information

CULTURAL SUBSCORE: 5

TOTAL SOCIO-ECONOMIC ASSESSMENT SCORE: 15

Comments

Were the questions appropriate for the species under consideration? Yes X / No

If not, what are the characteristics involved that make the situation unique? Please provide Q & A that would increase its usefulness.

Reference Worksheet
Stakeholder

Economic						

Issue

Health						
Cultural						

x presence of interest; +,++,+++ affected positively; -,--,--- affected negatively

Appendix G

Federal Invasive Species Laws and Regulations

Executive Order 13112: Invasive Species

Section 1 Definitions
Section 2 Federal Agency Duties
Section 3 Invasive Species Council
Section 4 Duties of the Invasive Species Council
Section 5 Invasive Species Management Plan
Section 6 Judicial Review and Administration

Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (amended 2000)

Subtitle A: General Provisions
Subtitle B: Prevention of Unintentional Introductions of Nonindigenous Aquatic Species
Subtitle C: Prevention and Control of Aquatic Nuisance Species Dispersal
Subtitle D: Authorizations of Appropriation
Subtitle E: Cooperative Environmental Analyses

US Fish and Wildlife Service

18 USC 42-43; 16 USC 3371-3378; Lacey Act

Title 18 Crimes and Criminal Procedures; Chapter 3 Animals, Birds, Fish and Plants; Section 42 Importation or shipment of injurious mammals, birds, fish (including mollusks and crustacean), amphibian, and reptiles; permits, specimens for museums; regulations

CFR Title 50 Part 16; The regulations contained in this part implement the Lacey Act (18 U.S.C. 42)

Final List of Bird Species to Which the Migratory Bird Treaty Act (16 U.S.C. 703) Does Not Apply. 70 FR 12710.

US Department of Agriculture APHIS

7 U.S.C. 150 Federal Plant Pest Act
CFR Title 7 Part 319; Importation of Plants for Planting

7 U.S.C. 2801-2814; Federal Noxious Weed Act
CFR Title 7 Part 360; Noxious Weed Regulations

CFR Title 7 Parts 300-399; Regulated Pest List

Appendix H

Invasiveness Assessment Results – Plants

NOTE: The species on this list have been assessed for invasiveness only. Socio-economic assessments have not been completed and regulatory determinations have not been made. The final regulatory status of each species is subject to public input and the Council's final determination.

New York State Office of Invasive Species Coordination
Plant Species Reviewed With Invasiveness Assessment Scores and Ranks
Assessments by LIISMA's Scientific Review Committee

April 13, 2010

VH=Very High; H=High; M=Moderate; L=Low; I=Insignificant
U = Unknown: not enough questions (fewer than 70 points on assessment form) could be answered.
NA = Not Assessable (not persistent, or not outside of cultivation in New York)

Species assessments are available on http://nyis.info/Resources/

SCIENTIFIC NAME	COMMON NAME	NY RANK	REL MAX SCORE
Acer ginnala Maxim.	Amur maple	M	66.22
Acer palmatum Thunb.	Japanese maple	M	50.00
Acer platanoides	Norway maple	VH	82.00
Acer pseudoplatanus	sycamore maple	H	71.11
Aegopodium podagraria L.	goutweed	M	67.50
Agrostis gigantea Roth	redtop, black bentgrass	M	67.50
Agrostis stolonifera L.(A. stolonifera ssp. gigantea)	creeping bentgrass	M	67.50
Ailanthus altissima (Miller) Swingle	tree-of-Heaven, ailanthus	M	68.00
Akebia quinata (Houtt.) Dcne.	chocolate vine	M	52.38
Albizia julibrissin Durazz.	silk tree	L	40.00
Alliaria petiolata (Bieb.) Cavara & Grande	garlic mustard	VH	84.00
Alnus glutinosa (L.) Gaertner	European (black) alder	M	64.44
Ampelopsis brevipedunculata (Maxim.) Trautv.	porcelain berry	H	71.26
Anthriscus sylvestris (L.) Hoffmann	wild chervil	H	78.75
Aralia elata (Miq.) Seem.	Japanese angelica tree	VH	80.46
Artemisia vulgaris L. var. vulgaris	mugwort, common wormwood	H	79.31
Arthraxon hispidus (Thunberg) Makino	arthraxon	H	75.68
Berberis thunbergii (includes all hybrids with other Berberis species)	Japanese barberry	VH	91.00
Arundinaria gigantea (Walt.) Muhl. (including	bamboo, canebreak,	M	62.23

ssp. giantea and ssp. tecta)	giant cane		
Berberis thunbergii de Candolle (incl. hybrids)	Japanese barberry	VH	91.00
Berberis vulgaris L.	common barberry	M	68.75
Brachypodium sylvaticum (Huds.) P. Beuv. spp sylvaticum	slender false brome	VH	86.60
Bromus tectorum L.	cheat grass	M	50.00
Buddleja davidii Franch.	Orange-eye Butterfly-bush	L	45.45
Cabomba caroliniana A. Gray, Ann	Carolina fanwort	H	72.34
Callitriche stagnalis Scop.	pond water starwort	L	48.75
Cardamine impatiens L.	narrowleaf bittercress	H	76.32
Carex kobomugi Ohwi	Japanese sedge, Asiatic sand sedge	M	68.60
Caulerpa taxifolia (Vahl) C. Agardh	killer alga	NA	NA
Celastrus orbiculatus Thunberg	Oriental bittersweet	VH	86.67
Centaurea jacea s.l. (C. nigra, C. nigrescens, C. xmoncktonil)	black knapweed, black star-thistle, tyrol knapweed	M	62.34
Centaurea stoebe ssp. micranthos s.l (C. biebersteinii, C. diffusa, C. maculosa misapplied, C. xpsammogena,)	spotted knapweed, spotted star-thistle	H	78.89
Cirsium arvense (L.) Scop. *(C. setosum, C. incanum, Carduus arduus, Serratula arvensis)*	Canada thistle	H	71.00
Cirsium palustre (L.) Scop. *(Carduus palustris)*	marsh thistle, European swamp thistle	M	67.90
Clematis terniflora de Candolle	Japanese virgin's bower, yam-leaf clematis	H	72.60
Coronilla varia L. Coronilla varia *(Securigera varia)*	Crown vetch	M	62.07
Cynanchum louiseae Kartesz & Gandhi *(C. nigrum, Vincetoxicum nigrum)*	black Swallow-wort	VH	89.69
Cynanchum rossicum (Kleop.) Borh. *(C. medium, Vincetoxicum medium, V. rossicum)*	pale Swallow-wort	VH	87.63
Cyperus difformis L.	variable flatsedge	M	51.95
Datura stramonium L.	Jimsonweed, common thorn-apple, Jamestown weed, Purple thorn-apple	M	50.00
Digitalis lanata Ehrh.	Grecian foxglove	I	36.78
Digitalis purpurea L.	purple foxglove	M	53.33
Dioscorea polystachya Turczaninow *D.batatas*	Chinese yam; cinnamon vine	H	77.50
Dipsacus laciniatus L.	cut-leaf Teasel	H	75.56
Egeria densa Planchon	Brazilian waterweed	H	74.71
Eichornia crassipes (Martius) Solms-Laubach	common water-hyacinth	NA	NA
Elaeagnus angustifolia L.	Russian olive	M	68.00
Elaeagnus umbellata Thunberg	autumn olive	VH	94.00

Epilobium hirsutum L.	hairy willow herb, codlins and cream	M	62.50
Eragrostis curvula (Schrader) Nees von Esenbeck	weeping lovegrass	M	57.14
Euonymus alatus (Thunberg) Siebold	winged euonymus	VH	81.25
Euonymus europaeus L.	European spindletree	M	60.00
Euonymus fortunei (Turcz.) Hand. var. radicans (Siebold ex Miq.) Rehd.	winter creeper	H	77.78
Euphorbia cyparissias L.	Cypress spurge	H	75.32
Euphorbia esula L.	leafy spurge	H	75.90
Euphorbia lathyris L.	caper spurge	M	56.98
Fallopia baldschuanica (Regel) *Holub (F. aubertil, Polygonum aubertii)*	Chinese fleece vine, silver lace vine	M	50.60
Fallopia japonica (Hout.) Dcne. var. *japonica (F. sachalinensis/ xbohemica) (Polygonum cuspidatum / sachalinense/ xboehmicum)*	Japanese knotweed, giant knotweed	VH	97.94
Festuca filiformis Pourret *(F. brachyphylla, F. tenuifolia, F. onina ssp. tenuifolia, F. ovina var capillata/ tenuifolia)*	hair fescue, fineleaf sheep fescue	M	60.27
Frangula alnus P. Mill. *(Rhamnus frangula)*	smooth buckthorn	H	72.73
Froelichia gracilis (Hooker) Moq.	slender cottonweed	M	53.25
Galega officinalis L.	professor Weed, goat's rue	M	59.72
Galium odoratum (L.) Scop. *(Asperula odorata L.)*	sweet bedstraw (wwodruff)	L	47.78
Glaucium flavum Crantz	yellow hornpoppy	M	65.75
Glossostigma cleistanthum (G. diandrum (L.) *Kunze)*	mudmats	I	34.88
Glyceria maxima (Hartman) Holmburg	tall glyceria, English watergrass, reed mannagrass	H	79.52
Hedera helix L.	English ivy	M	66.00
Hemerocallis fulva (L.) L.	day lily	L	46.25
Heracleum mantegazzianum Sommier & Levier	giant hogweed	H	72.00
Hesperis matronalis L.	dame's rocket	M	56.98
Humulus japonicus Sieb. & Zucc.	Japanese hops	H	74.03
Hydrilla verticillata (L. f.) Royle	water thyme	VH	91.40
Hydrocharis morus-ranae L.	frogbit	VH	85.57
Hypericum perforatum L.	St. John's Wort	L	46.75
Ilex crenata Thunb.	Japanese holly	L	46.67
Impatiens glandulifera Royle	Ornamental jewelweed	L	49.35
*Imperata cylindrica (*L.) P. Beuv. *(I. arundinacea, Lagurus cylindricus)*	Cogon grass	H	79.00
Iris pseudacorus L.	yellow iris	H	76.00
Kochia scoparia (L.) *Schrader ssp. scoparia*	Mexican summer-cypress	M	68.75
Lepidium latifolium L.	broad-leaf pepper-grass	H	79.38
Lespedeza bicolor Turcz.	shrubby bush clover	M	63.33
Lespedeza cuneata (Dum.-Cours.) G. Don	Chinese lespedeza	H	74.44

Ligustrum amurense Caar.	Amur privet	NA	NA
Ligustrum obtusifolium Siebold & Zuccarini	border privet	H	76.67
Ligustrum ovalifolium Hassk.	California privet	L	44.83
Ligustrum sinense Lour	Chinese privet	NA	NA
Ligustrum vulgare L.	European privet	M	67.82
Lobelia chinensis Lour.	Chinese lobelia	I	36.99
Lonicera japonica Thunberg	Japanese honeysuckle	VH	83.51
Lonicera maackii (Rupr.) Maxim.	Amur honeysuckle	VH	84.44
Lonicera morrowii A. Gray *(L. tatarica, L. xbella*	morrow's honeysuckle	VH	85.54
Lonicera xylosteum L.	European fly honeysuckle	U	Unk
Lotus corniculatus L.	bird's foot trefoil	M	59.00
Ludwigia grandiflora (Michx.) Greuter & Burdet ssp. hexapetala (Hook. & Arn.) G.L. Nesom & Kartesz	Uruguayan primrose willow	VH	88.30
Ludwigia peploides (Kunth) *Raven ssp. glabrescens* (Kuntze) Raven	floating primrose willow	VH	89.36
Lysimachia clethroides Duby	gooseneck yellow loosestrife	NA	NA
Lysimachia nummularia L.	moneywort	VH	84.52
Lysimachia punctata L. var. verticillata (Bieb.) Klatt	spotted loosestrife	M	57.14
Lysimachia vulgaris L.	garden loosestrife	H	72.73
Lythrum salicaria L.	purple loosestrife	VH	91.00
Marsilea quadrifolia L.	European water fern	U	Unk
Microstegium vimineum (Trinius) A. Camus	Japanese stilt grass	VH	85.00
Miscanthus sacchariflorus (Maxim.) Hack	Japanese silvergrass	NA	NA
Miscanthus sinensis Andersss.	Chinese silver grass; eulalia	H	77.78
Morus alba L.	white mulberry	M	68.67
Murdannia keisak (Hassk.) Hand.-Maz.	marsh dewflower, wart-removing herb	H	78.16
Myosotis scorpioides L.	true forget-me-not	U	Unk
Myriophyllum aquaticum (Vellozo) Verdcourt	parrot-feather	H	76.67
Myriophyllum heterophyllum Michx. *(including x M. pinnatum*	broadleaf water-milfoil	VH	93.62
Myriophyllum spicatum	Eurasian water-milfoil	VH	100.00
Najas minor Allioni	brittle water nymph	M	64.84
Nasturtium officinale R. Br. ex Aiton *(Rorippa nasturtium-aquaticum* (Linnaeus) Hayek, Sched. Fl. Stiriac. 22.1904)	watercress	M	65.75
Nelumbo nucifera Gaertner	sacred lotus	M	64.38
Nymphoides peltata (Walt. ex Gmel.) Kuntze	yellow floating heart	H	74.47
Oplismenus hirtellus (L.) P. Beauv. *spp. undulatifolius* (Ard.) U. Scholz	wavy leaf basketgrass	H	70.27
Paulownia tomentosa (Thurnberg) Siebold & Zuccarini ex Steudel	princess tree	M	51.11
Persicaria longiseta (Bruijn) Kitagawa *(Polygonum caespitosum var. longiseta)*	creeping smartweed	M	60.27

Persicaria perfoliata (L.) H. Gross *(Polygonum perfoliatum)*	mile a minute weed	VH	91.11
Phalaris arundinacea L. (European genotype)	Reed canary-grass	H	77.78
Phellodendron amurense Rupr./ *P. japonicum* Maxim.	Amur Cork Tree	H	74.00
Phleum pratense L.	timothy	M	63.75
Phragmites australis (Cav.) Trin. ex Steud *ssp. Australis*	common reed grass (nonnative genotype)	VH	92.00
Phyllostachys species Seibold. & Zucc. (includes *P. aurea* Carriere ex A. Riviere & C. Riviere, *P. aureosulcata* McClure, *P. bambusoides* Siebold & Zucc., *P. dulcis*	bamboo	M	61.90
Pinellia ternata (Thunb.) Makino ex Breitenbach	crowdipper, green gragon	I	39.73
Pinus thunbergii Parl.	Japanese black pine	M	58.62
Pistia stratiotes L.	water lettuce	NA	NA
Poa bulbosa L.	bulbous bluegrass	L	48.75
Poa compressa L.	Canada bluegrass	M	68.75
Poa pratensis L.	Kentucky bluegrass	M	67.78
Populus alba L.	white poplar	M	55.95
Potamogeton crispus L.	curly pondweed	H	79.79
Prunus avium L.	sweet cherry	M	55.00
Prunus cerasus L.	sour red cherry	M	55.00
Prunus padus L.	European bird cherry	M	51.11
Pseudosasa japonica (Siebold & Zucc. ex Steud.) Makino ex Nakai	arrow bamboo	M	57.47
Pueraria montana (Lour.) Merr. var. lobata (Willdenow) Maesen & S. Almeida	kudzu	VH	84.44
Pyrus calleryana Descne.	Bradford pear	M	65.06
Ranunculus ficaria L. var. bulbifera Marsden-Jones	lesser celandine	VH	85.56
Ranunculus repens L.	creeping buttercup	M	63.22
Rhamnus cathartica L.	common buckthorn	VH	81.00
Rhodotypos scandens (Thunberg) Makino	jetbead	M	69.33
Robinia hispida L. (var. fertilis & hispida)	bristly locust	L	48.28
Robinia pseudoacacia L.	black locust	VH	81.11
*Rorippa amphibia (*L.) Besser *(Nasturtium amphibium* (L.) W.T. Alt.)	water yellowcress, great yellowcress	U	Unk
Rosa multiflora Thunberg	multiflora rose	VH	89.00
Rosa rugosa Thunberg	Japanese (rugosa) rose	M	63.44
Rubus bifrons Vest. ex Tratt. *(R. armeniacus Frocke, R. discolor* Weihe & Nees, *R. fruticosus* exclusive of its type as per USDA)	Himalyan blackberry	M	56.67
Rubus laciniatus Willdenow	evergreen blackberry	M	63.22
Rubus phoenicolasius Maxim.	wineberry	VH	85.56
Rumex acetosella L. *ssp. pyrenaicus* (Pourret ex Lapeyr.) Akeroyd	sheep sorrel	M	66.25
Salix atrocinerea Brotero	gray florist's willow	VH	84.44
Salvinia molesta Mitchell	water fern	NA	NA

Saponaria officinalis L.	bouncing-bet	M	52.50
Schedonorus arundinaeceus (Schreb.) Dumort *(Lolium arundinaceum)*	tall fescus, Kentucky fescue, reed fescue, course fescue, alta fescue	M	65.00
Senecio jacobaea L.	tansy ragwort	M	60.00
Silphium perfoliatum L. var. *perfoliatum*	cup-plant	H	77.78
Solanum dulcamara L. var. *dulcamara*	trailing nightshade	M	50.52
Spiraea japonica L. f.	Japanese spirea	M	62.34
Stratiotes aloides L.	water soldiers	NA	NA
Tanacetum vulgare L.	common tansy	M	52.38
Trapa natans L.	water chestnut	VH	82.00
Tussilaga farfara L.	coltsfoot	M	57.50
Ulmus pumila L.	Siberian elm	M	52.50
Valeriana officinalis L.	common valerian	M	62.16
Verbena bonariensis L. var. *bonariensis*	purpletop vervain	NA	NA
Veronica beccabunga L.	European speedwell	M	61.84
Veronica officinalis L.	speedwell, gypsy-weed	M	51.95
Viburnum dilatatum Thunb.	linden arrowwood	M	57.14
Viburnum lantana L.	wayfaring-tree	M	53.75
Viburnum opulus var. *opulus* (nonnative variety)	European cranberry bush	M	67.09
Viburnum setigerum Hance	tea viburnum	L	41.25
Viburnum sieboldii Miq.	Siebold viburnum	M	62.50
Vicia cracca L. s.l.	cow vetch	M	54.44
Vinca minor L.	Periwinkle	M	57.14
Vitex rotundifolia L. f.	beach vitex, roundleaf chastetree	H	73.00
Wisteria sinensis Sweet, *W. floribunda* (Willdenow) DC.	Chinese wisteria	M	58.76

Species not selected for assessment

SCIENTIFIC NAME	COMMON NAME
Aira caryophyllea (Aspris caryophyllea)	Silvery hairgrass
Allium vineale	Field garlic
Amorpha fruticosa	False indigo
Ampelopsis aconitifolia	monkshoodvine
Butomus umbellatus (B. junceus)	Flowering Rush
Capsella bursa-pastoris	Shepherd's purse
Caragana arborescens	Siberian peashrub
Catalpa speciosa	Northern catalpa
Cercidiphyllum japonicum	Katsura tree
Colutea arborescens	bladder-senna
Commelina communis	Asiatic dayflower
Convolvulus arvensis	field bindweed
Cuscuta sp (epithymum?)	dodder
Cyperus iria	rice field flat sedge
Daucus carota	Queen Anne's lace
Didymosphenia geminata	rock snot

Digitaria ischaemum	Smooth crabgrass
Digitaria sanguinalis	Hairy crabgrass
Dipsacus fullonum	Fuller's teasel
Daucus carota	Queen Anne's lace
Echinops sphaerocephalus	Great Globethistle
Elsholtzia ciliata	Crested Elsholtzia
Emex spinosa	spiny threecornerjack
Filipendula ulmaria	Queen-of-the-meadow
Geranium thunbergii	thunberg's geranium
Geranium nepalense (G. ibericum)	Nepalese Crane's-bill
Glechoma hederacea	Ground ivy
Halimodendron halodendron	common salttree
Hieracium piloselloides	King-Devil
Houttuynia cordata	chameleon
Ipomoea hederacea	Morning glory
Lathyrus latifolia	sweet pea
Linaria dalmatica	Dalmatian toadflax
Lychnis flos-cuculi (Coronaria flos-cuculi, Silene flos-cuculi)	ragged Robin
Malus species	crabapple
Melia azederach	Chinaberry, Umbrella tree
Melilotus alba	white sweet clover
Mycelis muralis	Wall lettuce
Najas guadalupensis	southern naid
Nasturtium microphyllum [Rorippa microphylla(um)]	(combined with N. officinale)
Nelumbo lutea	American Lotus, Yellow Lotus
Nitellopsis obtusa	starry stonewort
Onopordum acanthium	Scotch cotton-thistle
Ornithogalum umbellatum	common Star-of-bethlehem
Paspalum scrobiculatum	kodomillet (scrobic)
Petasites japonicus	Sweet Coltsfoot, Giant Japanese Butterbur
Picea abies	Norway spruce
Pinus sylvestris	scotch pine
Rubus armeniacus	Himalyan blackberry
Styrax japonicus	Japanese snowbell
Tamarix ramosissima	saltcedar
Trifolium repens	white clover

Appendix I

Rapid Assessment Methodology

Step 1 – Identify Species for Screening

- Is the species listed as injurious under the Lacey Act or recognized as a noxious plant by USDA?
- Is the species listed as restricted, invasive, etc., by a neighbour State or region?
- Nonnative species in the waters of the State or region that have not been reviewed
- Nonnative species that are in nearby States, Provinces, or regions that have been problematic
- Nonnative species that are problematic in areas of similar climate to the State or regions where this process is applied, and that are in high risk pathways
- Nonnative species ranked, by the applicable State Invasive Species Council or other similar entity, as potentially impacting ecosystems, economies, infrastructure, and human health
- Nonnative species either currently traded or proposed for trade in the State, neighbouring jurisdiction, or region

Step 2 Prioritization for Detailed Risk Assessment

This step will prioritize the list of species recommended for detailed risk assessment **(result of Step 2).** Detailed risk assessments **(Step 4)** will be conducted as staff and fiscal resources allow. Some criteria include the following.

- Is the species in the State or region (either in waters of the State or region, or presently traded)?
- How many pathways (i.e., bait, live food, aquarium, water garden, aquaculture, or other) are used to trade or transport the species and fellow travelers?
- What is the amount of the species in each pathway(s)?
- What is the extent of potential geographic range (survival and recruitment) in the State or region?
- What is the potential for significant, negative ecological impacts?
- What is the potential for significant, negative economic impact?
- What is the potential for significant, negative human health impacts?
- Is there a scientific basis that the organism can be effectively and efficiently controlled **after introduction occurs**? Include cost-effectiveness of control mechanism.
- Is there a scientific basis that negative consequences of the importation/introduction can be effectively and efficiently **prevented**? (For example, importation of only triploid fish)
- Is a self-sustaining population established in a neighbouring State or interjurisdictional water body?
- What are the economic, social, etc., benefits of the species?

- Does the organism possess ease of movement via non-trade pathways (boats, animals, etc)
- Is the life history of the organism known and documented?

Step 3 –Agency Risk Assessment

In this step, detailed risk assessments will be conducted beginning with the highest priority species ranked in **Step 3**, and continuing until fiscal and staff resources are exhausted.

Three general approaches have been used to assess the risk of invasiveness. The three approaches listed below rely on identifying patterns in species traits that are predictive of invasion.

1. Statistical approaches (e.g., Keller et al. 2007, Kolar and Lodge 2002)

2. Quantitative questions (or trait ranking systems: e.g., Australian [Pheloung et al. 1999], New Zealand [Champion and Clayton 2000], and Florida (Gordon et al. 2008) weed and plant risk assessment tools), and

3. Detailed literature surveys, reviews, analysis and risk categorization (Aquatic Nuisance Species Task Force 1996).

Appendix J

Assessment Priorities

* Indicates priority species for initial assessments

Terrestrial Invertebrate Workgroup (33 species)

Insects

1. *Anoplophora glabripennis* Asian Longhorned Beetle*
2. *Agrilus planipennis* Emerald Ash Borer*
3. *Adelgid Adelges tsugae* Hemlock Woolly
4. *Apis mellifera scutellata* x *A. m. ligustica/ A. m. iberiensis* Africanized Honey Bee
5. *Contarinia nasturtii* Swede Midge
6. *Epiphyas postvittana* Light Brown Apple Moth*
7. *Halyomorpha halys* Brown Marmorated Stinkbug
8. *Hylurgus ligniperda* Red-haired Bark Beetle
9. *Pyrrhalta viburni* Viburnum Leaf Beetle
10. *Lymantria dispar* L. European Gypsy Moth
11. *Lymantria dispar dispar* Asian Gypsy Moth*
12. *Operophtera brumata* Winter Moth
13. *Popillia japonica* Japanese Beetle
14. *Sirex noctilio* European Wood Wasp
15. *Solenopsis invicta* Imported Fire Ant
16. *Thaumatotibia leucotreta* False Codling Moth
17. *Tipula paludosa, T. oleracea* European Cranefly
18. *Tomicus piniperda* Pine Shoot Beetle

Pathogens

19. *Aesculus* x hybrid Bacterial Leaf Scorch
20. *Ceratocystis fagacearum* Oak Wilt*
21. *Cronartium ribicola* White Pine Blister Rust
22. *Cryptococcus fagisuga* Beech Scale
23. *Nectria coccinea* Beech Bark Disease
24. *Phytophthora ramorum* Sudden Oak Death
25. *Potyviridae* Potyviruses: Plum Pox Virus
26. *Puccinia horiana* Chrysanthemum White Rust
27. *Ralstonia solanacearum* race 3 biovar 2 Southern Bacterial Wilt*

Assessment Priorities (continued)

Other

28. *Achatina achatina*, *Achatina fulica* Giant African Snail
29. *Aerolepiopsie assectella* Leek Moth*
30. *Globodera rostochiensis* Golden Nematode (cyst)
31. *Globodera pallida* Pale Cyst Nematode
32. *Lumbricus terrestris* Earthworm
33. *Steneotarsonemus spinki* Panicle Rice Mite

Terrestrial Vertebrate Workgroup (84 species)

Mammals

1. *Ammotragus lervia* Barbary Sheep
2. *Babyrousa babyrussa* Babirusa*
3. *Beamys hindei* Long-tailed Pouched rat
4. *Bison bison* Bison, Buffalo
5. *Canis latrans ssp* Coyote hybrids
6. *Capra hircus* Feral Goat*
7. *Capreouls capreolus* Roe Deer*
8. *Cervus axis* Axis Deer*
9. *Cervus dama* Fallow Deer*
10. *Cervus elaphus* Red Deer, elk*
11. *Cervus nippon* Sika Deer*
12. *Chinchilla brevicaudata, Chinchilla lanigera* Chinchilla*
13. *Chiroptera* Fruit Bats Order
14. *Cricetomys emini* Emin's Pouched Rat*
15. *Cricetomys gambianus* Gambian Pouched Rat*
16. *Erinaceus europeus* Hedgehog*
17. *Felis catus* Feral Cat
18. *Herpestis javanicus* Mongoose*
19. *Hylochoerus meinertzhageni* Forest Hogs*
20. *Lepus californicus* Black-tailed Jackrabbit*
21. *Macaca fascicularis* Crab-eating or Long-tailed Macaque*
22. *Macaca fuscata* Snow Monkey, Japanese macaque*
23. *Macropodidae* Wallaby (a small macropod)
24. *Martes foina* Stone Marten
25. *Mus musculus* House Mouse Norway rat
26. *Mustela eversmanii* Steppe Polecat
27. *Mustela putori* Domestic Ferret*
28. *Mustela putorius* European Polecat*
29. *Mustela sibirica* Siberian weasel
30. *Myocastor coypus* Nutria*

Assessment Priorities – Mammals (continued)

31. *Ochotona* subgenus *Chonotona* Mountain Pikas*
32. *Ochotona* subgenus *Ochotona* Shrub-Steppe (non-native) Pikas*
33. *Ochotona* subgenus *Pika* Northern Pikas*
34. *Odocoileus hemionus* Mule Deer
35. *Oryctolagus cuniculus* European Rabbit*
36. *Ovis ammon* Mouflan Sheep
37. *Petaurus breviceps* Sugar Glider*
38. *Phacochoerus africanus* Warthogs*
39. *Potamochoerus larvatus, porcus* Bushpig, Red River Hog*
40. *Pseudocheirus peregrinus* Ring-tailed Possum*
41. *Rattus norvegicus* Black Rat
42. *Saccostomus campestris* Pouched Mouse*
43. *Saccostomus meamsi* Pouched Mouse*
44. *Saimiri boliviensis* Squirrel Monkey
45. *Sus scrofa (all spp)* Wild Hog, Feral Hog, Russian Boar*
46. *Trichosurus vulpecula* Brush-tailed Possum
47. *Viverridae* Family Civet, palm civet
48. *Vulpes vulpes* European Red Fox*

Birds

49. *Alectoris chukar* Chuka
50. *Alopochen aegyptiacus* (7 spp) Egyptian Goose
51. *Anas penelope* Eurasian Wigeon
52. *Anas peking* Pekin Duck*
53. *Anus platyrhynchos domestica* Domestic Mallard*
54. *Anser anser* Greylag Goose
55. *Anser anser domesticus* White Goose
56. *Branta canadensis maxima* Giant Canada Goose*
57. *Cairina moschata* Muscovy Duck*
58. *Carduelis carduelis* Eurasian Goldfinch
59. *Columbia livia* Rock Dove, Pigeon, Rock Pigeon
60. *Coturnix coturnix* Common, European Quail
61. *Cygnus olor* Mute Swan*
62. *Myiopsitta monachus* Monk Parakeet
63. *Nandayus nenday* Black-hooded Parakeet, Nanday conure
64. *Numida meleagris* Guinea Hens
65. *Padda oryzivora* Java Sparrow
66. *Parius major* Great Tit
67. *Passer domesticus* House Sparrow
68. *Perdix perdix* Hungarian Partridge
69. *Phasianus colchicus* Ring-necked Pheasant
70. *Phasianus* genus various species
71. *Psittacula kramen* Rose-ringed Parakeet
72. *Streptopelia decaocto* Eurasian Collared Dove*

Assessment Priorities – Birds (continued)
73. *Sturnus vulgaris* European starling
74. *Tadorna tadorna* Shelducks (old-world)

Reptiles

75. *Ablepharus kitaibelii* European Copper Skink
76. *Apalone ferox* Florida Softshell*
77. *Boiga irregularis* Brown Tree Snake*
78. *Bufo marinus* Marine Toad, Cane Toad*
79. *Natrix spp.*Eurasian Grass or Water snake*
80. *Podarcis scila* Italian wall lizard, Istanbul lizard*
81. *Trachemys scripta elegans* Red-eared Slider*
82. *Trachemys scripta scripta* Yellow-bellied Sliders*
83. *Trionyx sinensis* Chinese Softshell Turtle*
84. *Xenopus laevis* African Clawed Toad*

Fish and Aquatic Invertebrate Workgroup (112 species)

Fish
1. *Alosa pseudoharengus* Alewife
2. *Astronotus ocellatus* Oscar*
3. *Carassius auratus* Goldfish
4. *Cephalopholis argus* Peacock Hind*
5. *Channa argus* Northern Snakehead*
19. *Channa marulius* Bullseye Snakehead
6. *Channa micropeltes* Giant Snakehead
7. *Chitala ornate* Clown Knife
8. *Clarias batrachus* Walking Catfish
9. *Cichla ocellaris* Butterfly Ppeacock bass
10. *Cichlasoma bimaculatum* Black Acara
11. *Cichlasoma citrinellum* Midas Cichlid*
12. *Cichlasoma cyanoguttatum* Rio Grande Cichlid
13. *Cichlasoma festae* Guayas Cichlid*
14. *Cichlasoma labiatum* Red Devil
15. *Cichlasoma meeki* Firemouth Cichlid
16. *Cichlasoma nigrofasciatum* Convict Cichlid*
17. *Cichlasoma urophthalmus* Mayan Cichlid*
18. *Clarias batrachus spp.*Walking Catfish*
19. *Colossoma macropomum* Red-bellied Pacu*
20. *Ctenopharyngodon idella* Grass Carp
21. *Cyprinus carpio* Common Carp
22. *Dascyllus aruanus* Whitetail Damselfish*
23. *Dorosoma cepedianum* Gizzard Shad*
24. *Etheostoma caeruleum* Rainbow Darter
25. *Fundulus diaphanus* Banded Killifish

Assessment Priorities – Fish (continued)

26. *Gasterosteus aculeatus* Threespine Stickleback
27. *Glyptoperichthys gibbiceps* Leopard Pleco*
28. *Gymnocephalus cernuus* Ruffe
29. *Gymnocorymbus ternetzi* Black Tetra*
30. *Gyrinocheilus aymonieri* Chinese Algae-eater
31. *Hemichromis letourneuxi* African Jewelfish
32. *Hoplosternum littorale* Brown Hoplo
33. *Hypophthalmichthys molitrix* Silver Carp*
34. *Hypophthalmichthys nobilis* Bighead Carp
35. *Hypostomus plecostomus* Suckermouth Catfish
36. *Macrognathus siamensis* Spotfin Spiny Eel
36. *Misgurnus anguillicaudatus* Oriental Weatherfish
37. *Monopterus albus* Asian Swamp Eel *
38. *Morone americana* White Perch
39. *Mylopharyngodon piceus* Black Carp
40. *Neogobius melanostomus* Round Goby
41. *Noturus gyrinus* Tadpole Madtom
43. *Oreochromis aureus* Blue Tilapia
44. *Oreochromis niloticus* Nile Tilapia*
45. *Osteoglossum bicirrhosum* Arawana, Arowana, Aruana
46. *Parachromis dovii* Wolf Cichlid*
47. *Parachromis* [*Cichlasoma*] *managuense* Jaguar Guapote*
48. *Phenacogrammus interruptus* Congo Tetra*
49. *Phractocephalus hemioliopterus* Redtail Catfish
50. *Piaractus Brachypomus* Pirapatinga, red-bellied pacu*
51. *Piaractus mesopotamicus* Parana River Pacu*
52. *Pimephales promelas* Fathead Minnow
53. *Poecilia latipinna* Sailfin Molly
54. *Poecilia latipinna* x *velifera* Black Molly*
55. *Pomoxis nigromaculatus* Black Crappie
56. *Pomacanthus imperator* Emperor Angelfish*
57. *Pterois volitans/ miles* Lionfish*
58. *Pterygoplichthys anisitsi* Southern Sailfin Catfish
59. *Pterygoplichthys disjunctivus* Vermiculated sailfin catfish*
60. *Pterygoplichthys multiradiatus spp.* Orinoco Sailfin Catfish*
61. *Pterygoplichthys pardalis* Amazon Sailfin Catfish*
62. *Puntius conchonius* Rosy Barb
63. *Puntius tetrazona* Tiger Barb
64. *Pylodictis olivaris* Flathead Catfish
65. *Rhinogobius brunneus* Amur Goby
66. *Salmo salar* Atlantic Salmon*
67. *Scardinius erythrophthalmus* Rudd
68. *Sorubim lima spp*. Shovelnose Catfish*
69. *Sorubimichthys planiceps* Firewood Catfish
70. *Tanichthys albonubes* White Cloud Mountain Minnow

Assessment Priorities – Fish (continued)

71. *Tetraodon fluviatilis* Spotted Green Pufferfish
72. *Tilapia buttikoferi* Zebra Tilapia*
73. *Trichogaster trichopterus sumatranus* Blue Gourami*
74. *Xiphophorus helleri* Green Swordtail*
75. *Xiphophorus maculatus* Southern Platyfish
76. *Zebrasoma scopas* Brown Tang

Invertebrates

77. *Bithynia tentaculata* Faucet Snail
78. *Bythotrephes cederstroemi* Spiny Water Flea*
79. *Cercopagis pengoi* Fishhook Water Flea*
80. *Cipangopaludina chinensis* Chinese Mystery Snail*
81. *Cipangopalundia japonica* Oriental Mystery Snail*
82. *Corbicula fluminea* Asian clam
83. *Crassostrea ariakensis* Suminoe Oyster*
84. *Daphnia lumholtzi* Water Flea
85. *Didemnum spp.*Carpet Tunicate*
86. *Dreissena polymorpha* Zebra Mussel*
87. *Dreissena rostriformis* Quagga Mussel*
88. *Eriocheir sinensi* Chinese Mitten Crab*
89. *Gillia altilis* Buffalo Pebblesnail
90. *Hemigrapsus penncillatus* Grapsid crab*
91. *Hemigrapsus sanguineus* Asian shore crab*
92. *Hemimysis anomala* Bloody Red Shrimp*
93. *Lasmigona subvividis* Green Floater Mussel
94. *Orconectes rusticus* Rusty CrayFish*
95. *Ostrea edulis* European Flat Oyster
96. *Pisidium amnicum* Greater European pea Clam
97. *Pisidium henslowanum* Henslow's Pea Clam
98. *Pisidium supinum* Humpback pea Clam
99. *Potamopyrgus antipodarum* New Zealand Mud Snail*
100. *Radix auricularia* European Earsnail
101. *Rapana venosa* Veined Rapa Whelk*
102. *Spaerium corneum* European Fingernail Clam
103. *Styela plicata* Asian Tunicate
104. *Teredo bartschi* Bartschi Shipworm
105. *Valvata piscinalis* European Valve Snail
106. *Viviparus georgianus* Banded Mystery Snail

Other

107. *Caulerpa taxifolia* Killer Green Algae*
108. *Grateloupia turuturu* Red Alga*
109. *Pfiesteria spp.* Pfiesteria spp.

Assessment Priorities – Other (continued)

110. *Sargassum muticum* Asian Rockweed*
111. *Styela plicata* Asian Sea Squirt*
112. *Undaria pinnatifida* Wakame*

Appendix K

New York State Invasive Species Laws and Regulations

Environmental Conservation Law (ECL)

ECL Article 3 – Department of Environmental Conservation

3-0301 General functions, powers and duties of the department and the commissioner:
(1) (j) Promote control of pests…
(k) Promote control of weeds and aquatic growth…
(w) "Aquatic Nuisance Species Task Force" comprehensive management plans...

ECL Article 9 - Lands and Forests

Title 13 Forest insect and disease control.
9-1301. White pine blister rust and currant rust.
9-1303. Forest insects and other forest tree diseases.

Title 17 New York Invasive Species Council
9-1701 Legislative findings.
9-1703 Definitions.
9-1705 New York invasive species council.
9-1707 New York Invasive species advisory committee.
9-1709 General powers and duties.

ECL Article 11 - Fish and Wildlife

Title 5 Fish and Wildlife Management
11-0507. Liberation of fish, shellfish and wildlife.
11-0509. Water chestnut.

Title 17 Importation and Sale of Fish, Wildlife and Game
11-1703. Importation, possession and sale of fish without license or permit

Regulations:

6 NYCRR Part 10.1 (c) (3) Round Goby (*Neogobius melanostomus*)
6NYCRR Part 44.11 Chinese Mitten Crabs (*Eriocheir sinensis*).
6 NYCRR part 180.9 Fish Dangerous to Indigenous Fish Populations.
6 NYCRR part 188 Fish Health Inspection Requirements
6 NYCRR part 192 Forest Insect Disease Control

Department of Agriculture and Markets (AML)

AML Article 9: Inspection and Sale of Seed

136 Definitions.
137 Label requirements of all seeds, including lawn-seeding.
138 Prohibitions.
139 Exemptions.
140 Samples; publication of results of tests.
141 Certification.
142 Implementation.

AML Article 11: Integrated Pest Management Program

148 Establishment of integrated pest management program.
149 Enactment of compact.

AML Article 14: Prevention and Control of Disease in Trees and Plants; Insect Pests; Sales of Fruit Bearing Trees.

161 Definitions.
162 Nursery stock; common carriers.
163 Prevention of introduction of injurious insects, noxious weeds, and plant diseases.
164 Control and eradication of injurious insects, noxious weeds, and plant diseases.
165 Damage for property destroyed.
166 Examination and certification of nurseries and nursery stock.
167 Access to premises; quarantines; rules and regulations.
168 Sale of fruit-bearing trees and grapevines; labels; damages.
169 Delegation of powers and immunities in regard to dutch elm disease in municipalities.

Regulations

1 NYCRR Chapter II - Animal and Industry
Subchapter A - Diseases of Domestic Animals

1 NYCRR Chapter III Plant Industry
Subchapter A Inspection and Sale of Seeds
Subchapter C Prevention and Control of Disease in Trees and Plants; Insect Pests; Sale of Fruit-Bearing Trees

Department of Health (PHL)

PHL Article 32 Live Pathogenic Microorganisms or Viruses

3200 Handling; registration required; exceptions.
3201 Sale or other disposal; permission required.
3202 Sale or other disposal; labeling containers.
3202 Violations; penalties.

Regulations

10 NYCRR Chapter II - Administrative Rules and Regulations
Subchapter E Food and Drug Products; Research
Subpart 61-1 Recombinant DNA Research and Activities

Appendix L

Local Invasive Species Laws and Regulations

Suffolk County

Resolution No. 985-2005: Established the Suffolk County Water and Land Invasives Control Task Force.

Resolution No. 1144-2007: Established the Suffolk County Water and Land Invasives Advisory Board.

Local Law 22-2007: Established a "Do Not Sell" List.

Resolution No. 1144-2007: Adopted Local Law 22-2007.

Local Law 27-2009: A Local Law Amending Chapter 278A of the Suffolk County Code Addressing Invasive Non-Native Plant Species.

Resolution No. 645-2009: Adopted Local Law 27-2009.

Nassau County

Local Law 24-2007: A local law in relation to preventing the spread of invasive species in Nassau County.

Westchester County

Executive Order 2002 January; County Executive Andrew J. Spano; Requires all landscaping on County-owned property to use only plants native to the county wherever possible.

Village of Sleepy Hollow

Resolution No. 10/182/09; Resolution of the Mayor and Board of Trustees of the Village of Sleepy Hollow Adopting Native Plant Policies.

Appendix M

New York State Ranking System for Evaluating Non-Native Plant Species for Invasiveness

Marilyn J. Jordan[1], Gerry Moore[2] and Troy W. Weldy[3]. [1]The Nature Conservancy, 250 Lawrence Hill Road, Cold Spring Harbor, NY 11724. [2]Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, NY 11225. [3]The Nature Conservancy, 195 New Karner Rd., Albany, NY 12205.

Revised May 21, 2010

INTRODUCTION

A ranking system designed to assess the invasive nature of non-native plant species was developed by The Nature Conservancy (TNC) in New York and the Brooklyn Botanic Garden (BBG) in 2008. The New York State Invasive Species Council, in consultation with the Invasive Species Advisory Committee, adopted the plant ranking system for use statewide in 2009. In addition, results of this work have informed invasive species legislation in Nassau and Suffolk Counties.

Consequences to the native species and natural ecosystems of New York are the focus of the ranking system. The system can be used to assess the invasive nature of non-native plant species that are established in NYS, and also to assess the potential invasiveness of species that are new arrivals or are not yet present. The system is designed to be repeatable, based on the best available science, clearly explained and fully documented. Use of this system has made more analytic and transparent the process of creating lists of invasive species to be prohibited from sale. Assessment results and documentation should also be useful in prioritizing control efforts, and developing early detection/rapid response species lists.

DEFINITIONS

For the purpose of the New York Invasive Plant Ranking System, an invasive plant species is a species that is: "1) nonnative to the ecosystem under consideration, and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health." (Federal Executive Order 13112, signed in 1999 and adopted by the New York State Invasive Species Task Force in 2005). Further, for purposes of this Invasive Plant Ranking System, invasive plants are non-native species that have spread into native or minimally managed plant systems in New York. 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. Non-native genotypes of a species (e.g. *Phragmites australis* ssp. *australis*) may be considered separate from the parent species on a case-by-case basis.

At the present time there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the appropriate expertise should address this issue as soon as possible. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and/or species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

RATIONALE

Numerous ranking systems exist, but the authors felt that none were completely suitable for both assessing and predicting negative impacts to natural systems in New York State and regions in NYS due to differences in scale, purpose and emphasis. We created a ranking system that incorporates components from other systems, primarily the system adopted in Alaska (Carlson et al. 2008), the system developed by NatureServe (Morse et al. 2004; Randall et al. 2008), and plant characteristics used by Williams and Newfield (2002). Scores are given to a series of questions, and the overall point total determines the invasiveness category for NYS. As is the case for the Alaska system, the New York system requires clear documentation for answers to each question, but allows for species to be evaluated when some information is lacking. Outcomes from the system should generally agree with present knowledge and understanding.

NYS RANKING SYSTEM

The New York System ranks species in a two stage process. First the species are ranked at the state level using a form that contains a series of questions in four broad categories:

	Section categories	Points
1	Ecological impact	40
2	Biological characteristic and dispersal ability	25
3	Ecological amplitude and distribution	25
4	Difficulty of control	10
	Total	100

Questions in categories 1, 2 and 4 primarily address inherent ecological and biological characteristics of the species, and its impacts and control feasibility, which are largely or entirely independent of geographical location within the species' introduced range. Questions in category 3 address the distribution and abundance of the species in the northeastern United States, eastern Canada and New York State, and the similarity of climates in the species' native range to climates in New York.

Questions apply to areas similar in climate and habitats to New York unless specified otherwise. Therefore, questions can be answered based on a species' behavior in areas beyond the borders

of New York. Without this provision it would not be possible to assess the potential invasiveness of species that are new arrivals or are not yet present. The authors consider only the present climate in the various regions of New York. We have not attempted to incorporate possible changes in future climate that might alter the assessed invasive potential of species. Climate model projections today are still too uncertain, and too difficult to apply at local scales. Perhaps such models can be used in the future. Regardless, species assessments should always be revisited and revised as required by changing circumstances and knowledge.

Points are assigned to the answers to each question. If a species' impact, characteristics, abundance or feasibility of control are known to vary in different regions of the State, answers to questions should apply to the region(s) in which the species appears to be the most invasive (i.e. has the greatest impacts, most rapid growth, greatest abundance and distribution, etc.).

The maximum possible total score for a species, if all questions can be answered, is 100 points. A "New York Invasiveness Rank" is assigned based on the "Relative maximum score" (points accrued as a percent of the maximum possible points for questions that could be answered). For example, if the maximum possible points for the questions that could be answered are 80, and the species received an Outcome Score of 60, then the species "Relative Maximum Score" would be 60/80 or 75. If the total answered points possible are fewer than 70, an invasiveness rank cannot be assigned. For justifications of impact questions and categories see (Heffernan et al. 2001 and Warner et al. 2003).

New York Invasiveness Rank	Relative Maximum Score
Very High	> 80.00
High	70.00-80.00
Moderate	50.00-69.99
Low	40.00-49.99
Insignificant	<40.00
Not Assessable	Not persistent in NY, or not found outside of cultivation

The second stage focuses on regions within NYS, designated as a "Partnership for Regional Invasive Species Management" (PRISM). Factors considered are (1) the current abundance and distribution of the species in the PRISM, and (2) the likelihood of the species occurring or expanding within the PRISM based on suitability of habitats and climate. A combination of the NYS Score, distribution in the PRISM and likelihood of spread are used to assign an invasiveness rank to the species for that PRISM. Invasiveness ranks for a PRISM may be the same as, or lower than, the NYS rank, but cannot be higher.

The Long Island Invasive Species Management Area (LIISMA) was the first PRISM to use the ranking forms (see below). Changes to the forms were frequent during the first years of use (2008-2009). As of this writing, the most recent NYS "form version date" is September 25, 2009 and the most recent PRISM "form version date" is April 13, 2009. Most of the species assessed during the first months of 2008 have been updated to at least the August 22, 2008 version of the NYS form.

PROCESS FOR SPECIES ASSESSMENT AND REVIEW ON LONG ISLAND:

Staff of the Brooklyn Botanic Garden completed the initial plant species assessments for New York State, and for LIISMA. Information sources used included published literature, unpublished reports, the NYS Flora Atlas, and observations of qualified botanists, ecologists and taxonomic experts from across NYS and beyond. Assessment forms were reviewed, edited and approved by the Scientific Review Committee (SRC), which was established by the LI Invasive Species Management Area in March 2008. The SRC is composed of botanically and horticulturally qualified stakeholders from the 14 organizations, agencies and educational institutions listed below. Representatives from four additional organizations and agencies participated as visiting experts on an occasional basis.

Voting Members of the LIISMA Scientific Review Committee 2009

Name	***Organization / Agency***
Marilyn Jordan Ph.D., Chair	The Nature Conservancy, Long Island, NY
Gerry Moore Ph.D., Vice Chair	Brooklyn Botanic Garden
Dwight Andrews/ Ellen Talmage	Long Island Nursery and Landscape Association / NYS Flower Industry
Tim Green Ph.D.	Brookhaven National Laboratory
Jonathan Lehrer Ph.D.	Farmingdale State College (SUNY); Ornamental Horticulture
Gary Lawton	New York State Office of Parks, Recreation, Preservation
Al Lindberg/ Lois Lindberg	Nassau County Department of Parks, Recreation and Museums
Jordan Raphael/ Michael Bilecki	Fire Island National Seashore (US National Park Service)
Andrew Senesac/ Tamson Yeh	Cornell University Cooperative Extension; Long Island Horticultural Research & Extension Center
Charles Scheer	NYS Farm Bureau
Kathy Schwager	Long Island Weed Information Management System database manager for LIISMA
Bill Titus/ Margaret Conover	Long Island Botanical Society
Polly Weigand	Suffolk County Soil and Water Conservation District
Visiting Experts (non-voting)	
Andrew Greller Ph.D.	Professor Emeritus, Queens College (CUNY); Biology
Steve Young	New York Natural Heritage Program
Charles Hamilton	New York State Department of Environmental Conservation
Nick Gibbons	Suffolk County Department of Parks, Recreation and Conservation
Charles O'Neill/ Robert Kent	New York Sea Grant

SRC meetings were usually held twice a month, from March 2008 through March 2010 for a total of 40 meetings and 180 species. At most meetings four to six species were reviewed, revised, and either approved or postponed until essential missing information could be obtained. All species approvals by the SRC were unanimous.

Future meetings of the SRC may be held on an "as needed" basis for at least the next year to consider species new to NYS or the northeast that appear to be invasive, species present in NYS for which assessments are requested by the NYS Office of Invasive Species Coordination, or to revisit previously assessed species in light of new information that could change the species' invasiveness rank.

PROCESS FOR SPECIES ASSESSMENT AND REVIEW BY NEW YORK STATE AND OTHER PRISMs:

NYS species assessment forms approved by the SRC are made available on the NY Invasive Species Information website (http://nyis.info/Resources/IS_Risk_Assessment.aspx). Botanists and other experts in all PRISMs were invited to provide feedback. Forms are revised by BBG and TNC when appropriate based on new information and opinions. In the few cases where a species' invasiveness rank would change, the assessment will again be reviewed by the SRC. When final, species forms will be submitted to the NYS Office of Invasive Species Coordination for use in statewide regulatory processes.

Citation: This document may be cited as: Jordan, M.J., G. Moore and T.W. Weldy. 2008. New York State Ranking System for Evaluating Non-Native Plant Species for Invasiveness.
The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. Note that the order of authorship is alphabetical; all three authors contributed substantially to the development of this protocol.

Acknowledgments: The NY form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Long Island Invasive Species Management Area's Scientific Review Committee, and botanical experts in NYS PRISMs and beyond (S. Young, D. Werier, J. Fridley, N. Bassuk, S. Flint, B. Gilman, G. Goff, R. O'Brien, D. Peters, J. Randall, K. Verschoor, and T. Wenskus) were incorporated in revisions of this form.

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Appendix N

Summary of Public Comments & Responses

Comments were received from 25 individuals or organizations during the March 31 through May 14 comment period on the *Public Review Draft* of *A Regulatory System for Non-native Species*. The overwhelming majority expressed support for the *Report* and the efforts of the New York Invasive Species Council, the advisory Committee, the Office of Invasive Species Coordination and the many other contributors. Following is a summary of the comments and the Council's responses to them.

Advisory Committee

Numerous comments suggested that the New York Invasive Species Advisory Committee review the proposed lists before the Council adopts final versions. The Council agrees that the Advisory Committee should have a defined role in the development of proposed lists prior to the deliberations of the Council. The *Report* has been revised to reflect this change.

The New York State Seed Association suggested that it be added to the Advisory Committee. Although the size of the Advisory Committee is limited by statute, the Council could consider adding NYSSA or other organizations to Advisory Committee as opportunities arise. Also, there will be other, informal opportunities for organizations to participate in the development of lists.

Assessment Tools

Several comments related to the potential costs of responding to invasions. Some suggested the costs are under-valued in the Socio-economic Assessment tool; others have suggested that response costs be included in the Invasiveness Assessment tool. The costs of response to invasions, which could include rapid responses such as spread prevention and eradication and also long-term forms of management, are appropriately considered in the Socio-economic Assessment. Whereas the Invasiveness Assessments requires the expertise of experts in species biology, the Socio-economic Assessment requires expertise in management and commerce.

Another comment suggested that the Invasiveness Assessment tool should include positive values. The Council is aware of no other invasiveness ranking systems that consider benefits. Such purported benefits as soil development by non-native earthworms or erosion control by non-native plants are social and economic benefits and may even protect some ecological benefits but, because they involve non-native species, always represent a change to natural systems and their biodiversity.

Regulatory Scope

One comment recommended that "propagation" be included among regulated activities for Prohibited species. Similarly, two comments recommended that the exemption for sterile

cultivars be expanded to include sterile organisms, such as triploid grass carp. The *Report* has been changed to reflect these suggestions.

Two comments stressed the need to regulate both mail-order and retail nursery businesses. As proposed, both forms of commerce would be subject to the proposed regulatory system.

One comment recommended that known occurrences of invasive species be mapped so that the information could be made available for management. The Council is supporting the *i*Map geographic information system. It maps the locations of invasive species in and around New York State and will ultimately include all known invasive species and will be accessible to the public on the web.

One comment suggested that landowners be required to eradicate invasive plants on their property. The *Report* expressly does not support any requirement or obligation for landowners to treat or remove any invasive species.

One comment recommended against State pre-emption of local lists. Such pre-emption is needed to maintain a fair and predictable regulatory environment for both retailers and consumers.

Another suggested that the *Report* include direction for managing existing populations Prohibited species. The management of existing populations of Prohibited or Regulated species is beyond the scope of this *Report*.

One comment suggested that an additional designation be created to identify species that are invasive but would be listed as Unregulated. Such a designation is beyond the statutory authority but could be used in a voluntary awareness/information campaign developed in collaboration with the nursery, pet and other retailers.

Similarly, a comment suggested that the unintentional import of invasives, as in soil or packaging, be regulated. This activity is beyond the scope of the statutory charge. Moreover, existing federal programs do provide such oversight.

Two comments identified the risk posed by the movement of boats among waterbodies. While the transport of aquatic invasive species on boats and trailers is beyond the scope of this *Report*, the Council is currently considering legislation that would regulate such movement.

List Promulgation

Some suggested that particular species be considered during the first listing process. The Advisory Committee will be advised to solicit nominations from their memberships in the early stages of list development.

Several comments suggested that the first lists be promulgated within 6 months of receiving the statutory authority. The Council supports the notion of promulgating the first lists as soon as possible after the authority is granted. However, the Council remains committed to the quality of the necessary process and is concerned about the risks posed by an arbitrary timeframe. The

process would likely include: contracting with experts; collaborating with a wide variety of interested parties in developing proposed lists; and observing the operating procedures of both the Advisory Committee and the Council with respect to their roles in the list promulgation process. The Council supports a provision that would require that the first lists be promulgated within one year of receiving the statutory authority.

Numerous comments suggested that lists be updated every 3 years. As with the above suggestion, the Council supports the concept of updating lists both "after a reasonable period of years" as well as in emergency situations. The complexity of the process and uncertainties about resources availability for agencies argue against a strict statutory requirement.

One comment asked how a specific regulatory listing could be contested. Lists could be contested in several ways. First, any concerned person could approach the Advisory Committee organizations or Council agencies early in the list development process. Next, once the proposed list is published during the normal regulatory promulgation process, concerns could be expressed during the formal comment period. Finally, any member of the public could appeal the regulatory status of a particular species or request that a species be added by making a written request directly to the Co-Chairs of the Council.

Individual Species

Several comments suggested regulatory designations for individual species. Such designations would be determined through the formal promulgation process only once authority is granted.

Some requested that Canada Geese be listed as invasive. Canada Geese are native to New York State and so cannot be listed as invasive pursuant to the statutory definition (ECL 9-1703) which requires that invasive species be "nonnative to the ecosystem in question." Instead, Canada Geese, which are protected as gamebirds under both federal and New York state laws, are managed as nuisance species.

One comment suggested that Day Lilies are not invasive and should be listed as Unregulated; this is consistent with the original *Report* text.

A number of comments suggested revisions to individual Socio-economic Assessments. The Socio-economic Assessments were completed to serve as examples in this *Report* but are not final. They will be completed and reviewed for each species as proposed lists are developed in the future.

~ END ~