NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Rhamnus cathartica L.	USDA Plants Code: RHCA3
Common names:	Common buckthorn	
Native distribution:	Eurasia	
Date assessed:	November 3, 2008; edited May 21, 2009 and March 11, 2010	
Assessors:	Steve Glenn, Gerry Moore	
Reviewers:	LIISMA SRC	
Date Approved:	November 19, 2008	Form version date: 25 August 2008

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

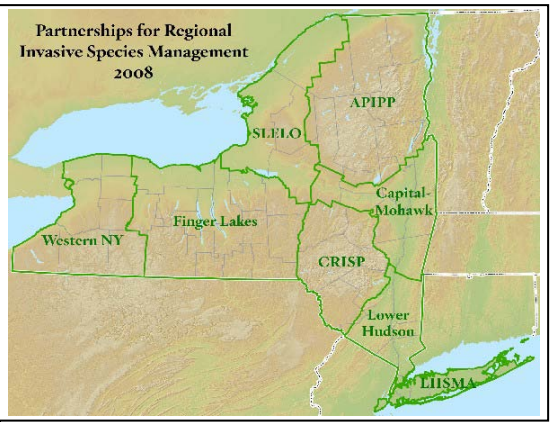
Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form*)			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive 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)	30
2	Biological characteristic and dispersal ability	25 (25)	18
3	Ecological amplitude and distribution	25 (25)	25
4	Difficulty of control	10 (10)	8
	Outcome score	100 (100)[b]	81[a]
	Relative maximum score †		81.00
	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:
Gill & Marks, 1991; Stover & Marks, 1998; Brown et al., 2001; Brooklyn Botanic Garden, 2008.

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)

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:
Converse, 1984; Gill & Marks, 1991; Stover & Marks, 1998; Brown et al., 2001; 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 7

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Inhibits growth under it and thus inhibits fire in fire-adapted communities (Wieseler in Killeffer, 2004). May alter soil properties in a way that promotes and sustains invasion by Eurasian earthworms. (Heneghan, et al., 2006).
Sources of information:
Killeffer, 2004; Heneghan, et al., 2006.

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:
Can form even-aged, dense thickets altering herbaceous understory composition by shading out natives and often eliminating them, and limiting growth of other woody seedling species.
Sources of information:
Killeffer, 2004.

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	10

species exotic to the natural community)

U. Unknown

Score 10

Documentation:
Identify type of impact or alteration:
Cover of young R. cathartica was negatively related to both species richness and cover of native species thus indicating a significant reduction in native species (Knight &Reisch). Dense stands in NY greatly reduce biodiversity and may shift community compositiion towards exotic plant species.
Sources of information:
Knight & Reich, 2005; S.Young NYNHP database; S.Bonano pers.comm ('Montezuma National Wildlife Refuge; alvar barrens.

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 3

Documentation:
Identify type of impact or alteration:
American robin (Turdus migratorius) nests constructed in Rhamnus cathartica experienced higher predation than nests built in comparable native shrub and tree species. Wieseler (2005) reported that this species serves as an alternate host for crown rust of oats, which can affect oat yield and quality. However, the impacts of this rust on native grass species are not known. Plant is also thorny.
Sources of information:
Schmidt & Whelan, 1999.

Total Possible 40
Section One Total 27

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):
Hundreds of fruits observed on mature specimens.
Sources of information:
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 2

Documentation:
Identify dispersal mechanisms:
Eaten by some birds and mice, the fruits have a severe laxative effect which hastens the distribution through animals. Although some studies found avian spp. had a low preference for Rhamnus cathartica fruits, another study found approximately 90% of the fruits and seeds collected were dispersed directly beneath the canopy of the mature shrubs.
Sources of information:
Converse, 1984; Harmata, 1987; Gill & Marks, 1991; Archibold et al. 1997; Killeffer, 2004; Wieseler, 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 1

Documentation:
Identify dispersal mechanisms:
Reported in the literature as cultivated for hedges, forestry uses, wildlife habitats, and shelter belt plantings. Seldom planted or sold in New York state.
Sources of information:
Converse, 1984.

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 with a long growing season, rapid growth rate, and reaches fruit bearing age quickly. Exhibits a fair amount of shade tolerance.
Sources of information:
Converse, 1984.

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 even-aged, dense thickets.
Sources of information:
Killeffer, 2004.

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:
One study found a mean germination rate of 85%; Seeds sown in Fall and given 2-3 months cold will germinate; germination in existing vegetation noted.
Sources of information:
Archibold et al., 1997; Dirr and Heuser (2006); 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:
Frangula alnus no longer in the genus Rhamnus; Weldy & Werier, 2005; Brooklyn Botanic Garden. 2008; USDA, 2008. Another complication- evidence of hybrid swarms of R. cathartica x R. utilis have been reported from Michigan (Gil-Ad & Reznicek, 1997). It's possible that the entity in New York may also yet prove to be of hybrid origin or contain hybrid swarms; and perhaps its success might be attributed to "hybrid vigor".

Total Possible 25
Section Two Total 18

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:
Large dense stands observed in the New York metropolitan area with few other invasive species present.
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: 6

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Converse, 1984; Gill & Marks, 1991; Stover & Marks, 1998; Brown et al., 2001; 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:
Studies have shown that seedlings can invade apparently stable habitats. However, recruitment is most successful where there is ample light and exposed soil.
Sources of information:

Converse, 1984; Gill & Marks, 1991.

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 and northern Asia.
Sources of information:
Converse, 1984.

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.
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:
Gill & Marks, 1991; Stover & Marks, 1998; Brown et al., 2001; Brooklyn Botanic Garden, 2008.

Total Possible	25
Section Three Total	25

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 dormancy lasts an average of 6 years.
Sources of information:
Archibold et al., 1997.

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:
Reported to resprout vigorously from extensive underground root system following top removal.
Sources of information:
Converse, 1984.

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:
Cultural controls include cutting, mowing, girdling, excavation, burning, and "underplanting."
Fire has had mixed results for control. Some data indicate limited effective use of fire management in a recovery phase. The season of a burn and vegetation of the area to be

burned most influence this phase of fire management. Because Rhamnus leafs out earlier than most native species, a late April or early May burn in the upper midwest (Wisconsin, Illinois, Michigan) potentially top kills Rhamnus. Because carbohydrate levels are low in roots at this time, resprouting vigor may be reduced. Unfortunately, there may be very little litter under the buckthorn to carry a fire due to the buckthorn's suppression or due to the habitat. For complete control, it may be necessary to burn every year or every other year for 5-6 years or more (Converse, 1984; Killeffer, 2004) .

Good chemical control is reported based on the following treatments:

1. Stump application of 20% glyphosate in August/September .
2. Wick application of 2 1/2 3% glyphosate in May.
3. Mist application of 2.4 kg/ha fosamine (ammonium salt) in September.
4. Frill application (applying herbicide into the cambial layer of fresh cuts on the tree trunk) of Picloram (ready to use) during the growing season.
5. Basal application of 2,4 D in diesel fuel at 2 4% or 12.5% during the first half of the growing season (Converse, 1984).

One study found that cutting and application of "Round-up" to the stumps, or spraying "Garlon 4" to the basal bark, proved to be an effective methods of killing European Buckthorn (Archibold et al. 1997).

Another srudy found a combination of cutting or girdling with certain herbicides was best. Roundup Pro (Roundup), Stalker, and Tordon RTU (Tordon) were more effective than either Garlon 4 or Brushmaster. Importantly, the data suggests that girdling or cutting of a single stem of multiple-stemmed buckthorn before using Roundup, Stalker, or Tordon usually results in the death of the entire shrub, thereby potentially saving a great deal of time and money (Oliver & Norton. 2006).

More recent controls have concentrated on only fruiting stems in an attempt to limit seed production- two control techniques have been used. In one treatment, glyphosate was applied to stems after cutting; alternatively Garlon 4 was applied as a chemical girdle directly to the stems using a streamline basal bark spray method. Results indicate good initial progress in limiting seed production in dense buckthorn sites, but at a high cost. (Delanoy & Archibold, 2007).

Another complication- evidence of hybrid swarms of R. cathartica x R. utilis have been reported from Michigan (Gil-Ad & Reznicek, 1997). It's possible that the entity in New York may also yet prove to be of hybrid origin or contain hybrid swarms; and perhaps its success might be attributed to "hybrid vigor".

Sources of information:

Converse, 1984; Archibold et al., 1997; Gil-Ad & Reznicek, 1997; Killeffer, 2004; Oliver & Norton, 2006: Delanoy & Archibold, 2007.

Total Possible	10
Section Four Total	8
Total for 4 sections Possible	100
Total for 4 sections	81

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:

Archibold, O. W., D. Brooks, & L. Delanoy. 1997. An investigation of the invasive shrub European Buckthorn, Rhamnus cathartica L., near Saskatoon, Saskatchewan. Canadian Field-Naturalist. 111(4):617-621.

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Brown, W. T., M. E. Krasny, & N. Schoch. 2001. Volunteer monitoring of nonindigenous invasive plant species in the Adirondack Park, New York, USA. Natural Areas Journal. 21(2):189-196.

Converse, C. 1984. TNC Element Stewardship Abstract for Rhamnus cathartica, Rhamnus frangula (syn. Frangula alnus). < http://tncweeds.ucdavis.edu/esadocs/documnts/franaln.html> [Accesssed on November 3, 2008].

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Gill, D. S. & P. L. Marks. 1991. Tree and shrub seedling colonization of old fields in central New York. Ecological Monographs. 61(2):183-205.

Gil-Ad, N. L. & A. A. Reznicek. 1997. Evidence for hybridization of two old world Rhamnus species - R. cathartica and R. utilis (Rhamnaceae) - in the new world. Rhodora 99(897): 1-22.

Harmata, W. 1987. On food in waxwing (Bombycilla garrulus L.). Field and laboratory observations. Przeglad Zoologiczny. 31(3):359-364.

Heneghan, L., J. Steffen, & K. Fagen. 2006. Interactions of an introduced shrub and introduced earthworms in an Illinois urban woodland: Impact on leaf litter decomposition. Pedobiologia. 50(6):543-551.

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Oliver, R. W. & J. E. Norton. 2006. Treating a single stem can kill the whole shrub: a scientific assessment of buckthorn control methods. Natural Areas Journal. 26(3):300-309.

Schmidt, K. A. &C. J. Whelan. 1999. Effects of exotic Lonicera and Rhamnus on songbird nest predation. Conservation Biology. 13(6):1502-1506.

Stover, M. E. & P. L. Marks. 1998. Successional vegetation on abandoned cultivated and pastured land in Tompkins County, New York. Journal of the Torrey Botanical Society. 125(2):150-164.

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 3, 2008].

Weldy, T. and 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 3, 2008]

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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.

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