NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Tanacetum vulgare L.	USDA Plants Code: TAVU
Common names:	Common tansy	
Native distribution:	Eurasia	
Date assessed:	April 23, 2009	
Assessors:	Steve Glenn, Gerry Moore	
Reviewers:	LIISMA SRC	
Date Approved:	April 29, 2009	Form version date: 3 March 2009

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	Restricted	Low
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 (30)	9
2	Biological characteristic and dispersal ability	25 (22)	14
3	Ecological amplitude and distribution	25 (25)	19
4	Difficulty of control	10 (7)	2
	Outcome score	100 (84)[b]	44[a]
	Relative maximum score †		52.38
	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:
McVaugh, 1957; Brooklyn Botanic Garden, 2009; Weldy & Werier, 2009.

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
Moderately 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):
Some studies suggests a preference for neutral to alkaline soils (Turner, 1928; Bocher, 1954). A perusal of the Nassau and Suffolk Co. Soil Surveys show only four out of 44 (9.1%) soil series with a pH greater than 6.0. The one area covered on Staten Island exhibited pHs ranging from 5-6.4.

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	Restricted
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:
Brooklyn Botanic Garden, 2009.

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:
Waste places; stream sides and river banks, wetlands, open field near salt swamp, riparian sand flats.

Documentation:
Sources of information:
McVaugh, 1957; Nilsson et al., 1989; Lu, 2004; Brooklyn Botanic Garden, 2009.

B. INVASIVENESS RANKING

Questions apply to areas similar in climate and habitats to New York unless specified otherwise.

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)
Reported to restrict water flow in irrigation ditches in Colorado. This not observed in Northeast. Other specific studies on natural ecosystem processes and system-wide parameters not known.
Sources of information:
Lu, 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:
Changes the density in the herb layer.
Sources of information:
Lu, 2004; 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:
Dense clumps crowd out native plants and large infestations may reduce biodiversity particularly in riparian areas. No evidence of significant or major alterations in community composition.
Sources of information:
Jacobs, 2008.

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:
Common tansy infestations may reduce the habitat of pollinating insects (Jacobs, 2008). One study found tansy flowers and their odor inhibit oviposition behavior and mating behavior and reduce adult longevity of certain Lepidoptera (Tortricidae) (Gabel & Thiery, 1994).
Other sources state that it is very poisonous to animals, producing a condition similar to rabies (Woodcock, 1925; Williams, 1980; Bryson, 1996); although elk have been observed to browse tansy, and research indicates that herbivores have a toxin blood-level feedback mechanism for some of the oils produced by common tansy that, when threshold levels are reached, deters further grazing. This natural feedback mechanism may be sufficient to prevent poisoning, but tansy is generally considered to reduce wildlife habitat (Jacobs, 2008).
Sources of information:
Woodcock, 1925; Williams, 1980; Gabel & Thiery, 1994;Bryson, 1996; Jacobs, 2008.

Total Possible 30

Section One Total 9

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, 2

then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)

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):
Reportely exhibits "profuse seed production" (Lu, 2004). Tanacetum species in general have 60-300+ florets per head (Flora of North America Editorial Committee, 2006), inferring the possibility of over 100 propagules per plant. One study in Montanafound the estimated number of filled achenes per plant was 2,550 and estimated achenes per square meter of area infested was 198,625 (Jacobs, 2008).
Also reported to exhibit clonal growth (Prach & Pysek, 1994).
Sources of information:
Prach & Pysek, 1994; Lu, 2004; Flora of North America Editorial Committee, 2006; Jacobs, 2008.

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:
Hydrochory. Water reported to spread the seeds for miles downstream (Elpel in Lu, 2004), but species does not always grown near water.
Sources of information:
Lu, 2004.

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 2

Documentation:
Identify dispersal mechanisms:
Sold via seed cataloges in the United States since the 19th century (Mack, 1991) and

commonly cultivated for ornamental and medicinal purposes (Sievers, 1947; Kopecky, 1978). Experiments have been conducted to assess the feasability of planted tansey to attract and retain predacious and parasitoid arthropods in apple orchards (Bostanian et al., 2004) and lettuce fields (Sengonca et al., 2002).
Sources of information:
Sievers, 1947; Kopecky, 1978; Mack, 1991; Sengonca et al., 2002; Bostanian et al., 2004; Lu, 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, also reported to exhibit clonal growth (Prach & Pysek, 1994). Reported to thrive on poor soils (Rebele, 2000); some studies suggests a preference for neutral to alkaline soils (Turner, 1928; Bocher, 1954). One of the essential oils from the leaves and flowers of common tansy, 1,8-cineole, may be allelopathic (Jacobs, 2008).
Sources of information:
Turner, 1928; Prach & Pysek, 1994; Rebele, 2000; Flora of North America Editorial Committee, 2006; Jacobs, 2008.

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 reports of tansey exhibiting a smothering or climbing growth habit.
Sources of information:
Flora of North America Editorial Committee, 2006; authors' pers. obs.

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 U

Documentation:
Describe germination requirements:
Laboratory studies have found germination rates as high as 96% (Mitchell, 1926); 75% after one month of cold stratification (Jacobs, 2008); to 30% (Kleijn & Snoeijing, 1997); but germination vis a vis existing vegetation/disturbance was not addressed.
Sources of information:
Mitchell, 1926; Kleijn & Snoeijing, 1997; Jacobs, 2008.

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:
Tanacetum balsamita, T. coccineum, T. parthenium reported naturalized in New York; none tracked as invasive. Weldy & Werier, 2009.

Total Possible 22
Section Two Total 14

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:
No large stands over 0.25 acres known..
Sources of information:
Lu, 2004; 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:
Lu, 2004; Brooklyn Botanic Garden, 2009.

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:
Readily establishes in disturbed sites. Not known to require anthropogenic disturbance to establish.
Sources of information:
Flora of North America Editorial Committee, 2006; authors' pers. obs..

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:
Eurasia, as far north as Finland.
Sources of information:
Keskitalo et al., 1998; Flora of North America Editorial Committee, 2006.

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:
Documented from 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., 2009.

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:
Brooklyn Botanic Garden, 2009; Weldy & Werier, 2009.

Total Possible 25
Section Three Total 19

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 U

Documentation:
Identify longevity of seed bank:
No seed banking studies known.
Sources of information:
Lu, 2004.

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 exhibit clonal growth and regeneration from root system.
Sources of information:
Prach & Pysek, 1994; Lu, 2004; Jacobs, 2008.

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 4

herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).

U. Unknown

Score	0

Documentation:

Identify types of control methods and time-term required:
Species in New York has not been shown to require management. In the western United States, where larger stands are known numerous management protocols have been developed and they are discussed below.

Chemical: Metsulfuron and clorsulfuron are the most effective herbicides for controlling common tansy when applied to actively growing plants before bloom at 0.5 oz./acre (Escort®, Cimarron®, or Telar®) or metsulfuron plus chlorsulfuron (0.5 oz. Cimmeron® X-tra). Picloram (1 qt./acre Tordon® or Picloram 22K®) plus dicamba (1-2 qt./acres Clarity®) applied to actively growing plants in the bud to bloom stage can be used to control common tansy. However, reports indicate this treatment is less effective than the metsulfuron treatment and may be cost prohibitive. (Jacobs, 2008).
The paper by Ferrell & Whitson, 1987, could not be located.

Mechanical: Persistent hand pulling and grubbing that removes the rhizomes will reduce small-scale populations. Mowing before bloom and repeated whenever plants initiate flowering will reduce seed production and over time may reduce populations where there are competitive grasses (Jacobs, 2008).

Fire: There is no indication that prescribed burning by itself will control common tansy, predominantly because it can regenerate from rhizomes not affected by heat (Jacobs, 2008).

Biocontrol: Preliminary studies began on possible insect herbivores on tansy (Schmitz, G. 1998); but currently, no biological control agents are available for management of common tansy. There are numerous insects and diseases that attack common tansy in its native range and several biological control insects have been identified: Isophrictis striatella is a moth that mines the flowerhead, stem, and rhizome; Microplonus millefolii is a stem-mining weevil; moths in the Dichrorampha genus feed on rhizomes; Cassida stigmatica beetles feed on leaves; and the gall midge Rhopalomyia tanaceticola attacks the rosette, stem, and flowerhead. A joint United States and Canadian consortium is currently funding a program of insect biological control of common tansy (Jacobs, 2008).
Sources of information:
Ferrell & Whitson, 1987; Schmitz, G. 1998; Lu, 2004; Jacobs, J. 2008.

Total Possible	7
Section Four Total	2
Total for 4 sections Possible	84
Total for 4 sections	44

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: 'Crispum', 'Fernleaf', 'Isla Gold', 'Silver Lace'

References for species assessment:

Bocher, T. W. 1954. Studies on European calcareous fixed dune communities. Vegetatio. 5/6(1):562-570.

Bostanian, N. J., H. Goulet, J. O'Hara, L. Masner, & G. Racette. 2004. Towards insecticide free apple orchards: Flowering plants to attract beneficial arthropods. Biocontrol Science & Technology. 14(1):25-37.

Brooklyn Botanic Garden. 2009. AILANTHUS database. [Accessed on 23 April 2004].

Bryson, C. T. 1996. The role of United States Department of Agriculture, Agricultural Research Service in the control of introduced weeds. Castanea. 61(3):261-270.

Ferrell, M. A. & T. D. Whitson. 1987. Evaluation of herbicide treatments on common tansy (Tanacetum vulgare L.). West. Soc. Weed Sci. Res. Prog. Rep.. p. 54-55.

Flora of North America Editorial Committee. 2006. Flora of North America. Vol. 19. Oxford Univ. Press, New York, NY. 579 pp.

Gabel, B. & D. Thiery. 1994. Non-host plant odor (Tanacetum vulgare; Asteraceae) affects the reproductive behavior of Lobesia botrana Den. et Schiff (Lepidoptera: Tortricidae). Journal of Insect Behavior. 7(2):149-157.

Jacobs, J. 2008. Ecology and management of common tansy (Tanacetum vulgare L.). United States Department of Agriculture, Natural Resources Conservation Service. Invasive Species Technical Note No. MT-18.

Keskitalo, M., A. Linden, & J. P. T. Valkonen. 1998. Genetic and morphological diversity of Finnish tansy (Tanacetum vulgare L., Asteraceae). Theoretical & Applied Genetics. 96(8):1141-1150.

Kleijn, D. & G. I. J. Snoeijing. 1997. Field boundary vegetation and the effects of agrochemical drift: botanical change caused by low levels of herbicide and fertilizer. J. Applied Ecology. 34(6):1413-1425.

Kopecky, K. 1978. Notes on the development of the present distribution of Tanacetum vulgare in the Orlickehory Mountains and foothills Czechoslovakia. Preslia (Prague). 50(3):253-257.

Lu, S. 2004. Tanacetum vulgare. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer. <www.natureserve.org>. [Accessed on 23 April 2004].

Mack, R. N. 1991. The commercial seed trade: an early disperser of weeds in the United States. Economic Botany. 45(2):257-273.

McVaugh, R. 1957. Establishment of vegetation on sand-flats along the Hudson River, New York--II. The period 1945-1955. Ecology. 38(1):23-29.

Mitchell, E. 1926. Germination of seeds of plants native to Dutchess County, New York. Botanical Gazette. 81(1):108-112.

Nilsson, C., G. Gunnel, J. Mats & U. Sperens. 1989. Patterns of plant species richness along riverbanks. Ecology. 70(1):77-84.

Prach, K. & P. Pysek. 1994. Clonal plants - What is their role in succession? Folia Geobotanica & Phytotaxonomica. 29(2): 307-320. (Plant Clonality: Biology and Diversity. Proceedings of the 3rd Workshop on Clonal Growth in Plants).

Rebele, F. 2000. Competition and coexistence of rhizomatous perennial plants along a nutrient gradient. Plant Ecology. 147(1):77-94.

Schmitz, G. 1998. The phytophagous insect fauna of Tanacetum vulgare L. (Asteraceae) in Central Europe. Beitraege zur Entomologie. 48(1):219-235.

Sengonca, C., J. Kranz, & P. Blaeser. 2002. Attractiveness of three weed species to polyphagous predators and their influence on aphid populations in adjacent lettuce cultivations. Anzeiger fuer Schaedlingskunde. 75(6):161-165.

Sievers, A. F. 1947. The production of minor essential oils in the United States. Economic Botany. 1(2):148-160.

Turner, J. A. 1928. Relation of the distribution of certain Compositae to the hydrogen-ion concentration of the soil. Bull. Torrey Bot. Club. 55(4):199-213.

United States Department of Agriculture, National Resources Conservation Service. 2009. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana [Accessed on 23 April 2004].

Weldy, T. & D. Werier. 2009. New York Flora Atlas. [S. M. Landry and K. N. Campbell (original application development), Florida Center for Community Design and Research. University of South Florida]. New York Flora Association, Albany, New York. [Accessed on 23 April 2004].

Williams, M. C. 1980. Purposefully introduced plants that have become noxious or poisonous weeds. Weed Science. 28(3):300-305.

Woodcock, E. F. 1925. Observations on the poisonous plants of Michigan. Amer. J. Botany. 12(2):116-131.

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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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.