NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Digitalis purpurea L	USDA Plants Code: DIPU
Common names:	Purple foxglove	
Native distribution:	Europe	
Date assessed:	February 4, 2010	
Assessors:	Steve Glenn, Gerry Moore	
Reviewers:	LIISMA SRC	
Date Approved:	March 10, 2010	Form version date: 10 July 2009

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

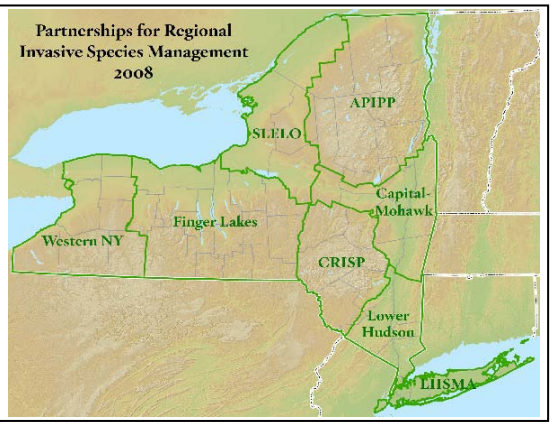
Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form*)			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Common	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 (30)	9
2	Biological characteristic and dispersal ability	25 (25)	17
3	Ecological amplitude and distribution	25 (25)	19
4	Difficulty of control	10 (10)	3
	Outcome score	100 (90)[b]	48[a]
	Relative maximum score †		53.33
	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
Not Assessable: not persistent in NY, or not found outside of cultivation.

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:
Brooklyn Botanic Garden, 2010; Weldy & Werier, 2010.

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: Widely cultivated as an ornamental (Grime et al., 1988; Fellows, 2004).
Sources of information (e.g.: distribution models, literature, expert opinions):
Grime et al., 1988; Fellows, 2004.

If the species does not occur and is not likely to occur in any of the PRISMs, then stop here as there is no need to assess the species. Rank is "Not Assessable."

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

Documentation:
Sources of information:
Brooklyn Botanic Garden, 2010.

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: riverbanks, wet ground at spring, cliffs, Shaded mire, hedgerows, soil heaps, quarry spoil, cinder tips, wasteland, (dwarf alpine ecotypes occur, Grime et al., 1988)

Documentation:
Sources of information:
Hopkins & Wilson, 1974; Stalter et al., 1986; Grime et al., 1988; Planty-Tabacchi et al., 1996; Fellows, 2004; Brooklyn Botanic Garden, 2010.

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)
No studies on the impact to natural ecosystem processes located.
Sources of information:
Authors' pers. comm.

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:
Reportedly forms dense patches affecting the ground layer in coastal and northern California. Author's observations locally indicate that it can occasionally increase the density of the herb layer
Sources of information:
Fellows, 2004; Cal-IPC; authors' pers. comm.

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:
Reportedly displaces native vegetation in northern and coastal California. Locally it occasionally can reduce native vegetation
Sources of information:
Fellows, 2004; CAL-IPC, XXXX; 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 3

Documentation:
Identify type of impact or alteration:
Possible toxicity to herbivores- red deer in Scotland reportedly poisoned by D. purpurea (Corrigall et al., 1978); another study found foxglove highly toxic and was associated with acute death of birds (Arai et al., 1992); and one investigation found mountain beavers reduced their intake of food treated with foxglove extract (Nolte et al., 1995). Although one study found that rabbits did graze on young leaves without mortality (Fenton, 1940).
Sources of information:
Fenton, 1940; Corrigall et al., 1978; Arai et al., 1992; Nolte et al., 1995.

Total Possible 30
Section One Total 9

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction

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):
Reportedly having 20-80 flowers with fruit capsules containing "<1000 seeds" (Grime et al., 1988); up to 250,000 (Salisbury, 1975) to 500,000 (van Baalen, 1982) seeds per plant.

The reproductive life cycle of D. purpurea is complicated vis a vis successional habitats (van Baalen & Prins, 1983) and intra-specific interactions (Sletvold, 2005; Sletvold & Rydgren, 2007).
Sources of information:
Salisbury, 1975; van Baalen, 1982; van Baalen & Prins, 1983; Grime et al., 1988; Sletvold, 2005; Sletvold & Rydgren, 2007 .

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:
Possible adhesion to animals (epizoochory). Numerous sources state that D. purpurea seeds average 0.1 to 0.07 mg.; studies have found seed weight highly significant to predict attachment potential to animal coats; light seeds were best retained, plant species with a diaspore mass <2 mg had a fair chance to be dispersed over long distances, once they get attached to the animal coats (Tackenberg et al., 2006; de Pablos & Peco, 2007).

Possible short-range wind and water dispersal (Fellows, 2004).

Sources of information:
Hutchinson, 1967; van Baalen, 1982; Grime et al., 1988; Thompson et al., 1993; Fellows, 2004; Tackenberg et al., 2006; de Pablos & Peco, 2007.

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:
Cultivated for medicinal (digoxin, gytoxine, and digitoxine; glycosides used in heart diseases) and purposes (Crooks, 1948; Grime et al., 1988; Bucay, 1999; Goldman, 2001). Cultivated as an ornamental and widely naturalized (Grime, 1988; Fellows, 2004). Cultivated on Long Island since at least 1929 (Grier & Grier, 1929).

Sources of information:

Grier & Grier, 1929; Crooks, 1948; Bucay, 1999; Grime et al., 1988; Goldman, 2001; 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:
Evergreen (semi-evergreen?) perennial (facultative biennial?) (van Baalen & Prins, 1983; Grime et al, 1988). Reported to be extremely variable in several morphological characters (Grime et al., 1988), which may enhance ecological amplitude.Relatively fast growing (Rorison, 1967; Grime et al., 1988). Also shade tolerant.
Sources of information:
Rorison, 1967; van Baalen & Prins, 1983; Grime et al., 1988.

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 or observations of foxglove forming thickets or having a climbing or smothering habit.
Sources of information:
Authors' pers comm and 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 2

Documentation:
Describe germination requirements:
Some light required, germination inhibited by shade (van Baalen, 1982; Bliss & Smith, 1985; Grime et al., 1988). Studies indicate frequent fungal attack on seedlings in low light conditions, especially in calcareous soils (Hutchinson, 1967; van Baalen, 1982).
Studies found germination rates as high as 70%-99%, in well drained soils containing some sand (Rorison, 1967; Evans & Etherington, 1990) with intermediate pH providing the best substrate for germination (Rorison, 1967).
Sources of information:
Hutchinson, 1967; Rorison, 1967; van Baalen, 1982; Bliss & Smith, 1985; Grime et al., 1988;Evans & Etherington, 1990.

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:
Digitalis grandiflora, D. lanata, and D. lutea reported from NY and the Northeast; but none invasive.

Brooklyn Botanic Garden, 2010; Weldy & Werier, 2010; U.S.D.A. NRCS, 2010.

Total Possible 25
Section Two Total 17

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 reported from northeastern North America located in the literature or observed.
Sources of information:
Authors' pers comm and obs.

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 one natural habitat given at A2.3 1
C. Known to occur in two natural habitats given at A2.3 2
D. Known to occur in three natural habitat given at A2.3 4
E. Known to occur in four or more natural habitats given at A2.3 6
U. Unknown

Score 6

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3.
Sources of information:
Hopkins & Wilson, 1974; Stalter et al., 1986; Grime et al., 1988; Planty-Tabacchi et al., 1996; Fellows, 2004; Brooklyn Botanic Garden, 2010.

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:
Reportedly "mainly restricted to disturbed shaded habitats..frequently observed on disturbed wasteland..burned areas in woods" (Grime et al., 1988). Soil disturbance greatly increases establishment (Fellows, 2004). One study in Spain found D. purpurea comprised 47% of the seed bank in a secondary forest (Olano et al., 2003). The reproductive life cycle of D. purpurea is complicated vis a vis successional habitats (van Baalen & Prins, 1983).
One study suggests D. purpurea does not always compete as well as other pioneer species as succession progresses (van Andel & Nelissen, 1981). Not know to require anthropogenic disturbance to become established.

Sources of information:
van Andel & Nelissen, 1981; van Baalen & Prins, 1983; Grime et al., 1988; Olano et al., 2003; Fellows, 2004; 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:
Central Europe- while this species manifests some cold-hardiness due to its native range and the evidence of naturalization in Canada (USDA, 2010); reliable snow cover might be the essential requirement for its survival in northern climes. Studies indicate climates with long periods of heavy frost without snow cover result in high kill rates of D. purpurea rosettes and seedlings (van Andel & Nelissen, 1981; Bruelheide & Heinemeyer, 2002).
Sources of information:
Grime et al., 1988; van Andel & Nelissen, 1981; Bruelheide & Heinemeyer, 2002; USDA, 2010.

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, MA, MD, ME, MI, NH, NJ, NY, OH, PA, VT, WI, WV; New Brunswick, Noca Scotia,

Ontario, Quebec
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
U.S.D.A. NRCS, 2010.

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, 2010; Weldy & Werier, 2010.

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 2

Documentation:
Identify longevity of seed bank:
A persistent seed bank is formed. One study in Spain found D. purpurea comprised 47% of the seed bank (Olano et al., 2003). Seed bank is viable at least 5 years (Fellows, 2004). One study suggests that the seed bank is the most important life cycle stage with respect to population growth and persistence in most scenarios (Sletvold & Rydgren, 2007). No evidence for seedbank persisting longer than 10 years.
Sources of information:
van Baalen, 1982; Grime et al., 1988; Thompson et al., 1993; Olano et al., 2003; Fellows, 2004; Sletvold & Rydgren, 2007.

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:
Evergreen (semi-evergreen?) perennial (facultative biennial?), could resprout from roots.
Sources of information:
Grime et al., 1988.

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	0

Documentation:
Identify types of control methods and time-term required:
Management not currently know to be required in New York or elsewhere. Hand pulling (or just removal of the flowers) is effective if flower stalks are destroyed. Mowing will have to be repeated before resprouts set seed. Extended contact with leaves could cause adverse reactions in workers; control efforts required for at least 5 years (Fellows, 2004).
Biocontrol- downy mildew caused by Peronospora digitalidis reported on D. purpurea (Tjosvold & Koike), but further research for its use as dedicated biocontrol is lacking.
Sources of information:
Tjosvold & Koike, 2002; Fellows, 2004.

Total Possible	10
Section Four Total	3
Total for 4 sections Possible	90
Total for 4 sections	48

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: Numerous- over 20 cultivars located on web sites

References for species assessment:

Arai, M., E. Stauber & C. M. Shropshire. 1992. Evaluation of selected plants for their toxic effects on canaries. J. American Veterinary Medical Assoc. 200(9):1329-1331.

Bliss D, & H. Smith. 1985. Penetration of light into soil and its role in the control of seed germination. Plant Cell & Environment. 8(7):475-484.

Brooklyn Botanic Garden. 2010. AILANTHUS database. [Accessed February 2, 2010].

Bruelheide, H. & A. Heinemeyer. 2002. Climatic factors controlling the eastern and altitudinal distribution boundary of Digitalis purpurea L. in Germany. Flora (Jena). 197(6):475-490.

Bucay, J. W. 1999. Digital. Plant with relevance in medicine. Revista Medica Instit. Mexicano Seguro Social. 37(2):147-153.

Cal-IPC. California Invasive Plant Council. [accessed March 10, 2010] http://www.cal-ipc.org/ip/management/ipcw/pages/detailreport.cfm@usernumber=42&surveynumber=182.php

Corrigall, W., R. R. Moody & J. C. Forbes. 1978. Foxglove (Digitalis purpurea) poisoning in farmed red deer (Cervus elaphus). Vet. Rec. 102:119-122.

Crooks, D. M. 1948. Plants for special uses. Economic Botany. 2(1):58-72.

de Pablos, I & B. Peco. 2007. Diaspore morphology and the potential for attachment to animal coats in Mediterranean species: an experiment with sheep and cattle coats. Seed Science Research. 17:109-114.

Evans, C. E. & J. R. Etherington. 1990. The effect of soil water potential on seed germination of some British plants. New Phytologist. 115(3):539-548.

Fellows, M. 2004. Digitalis purpurea. U.S. Invasive Species Impact Rank (I-Rank). NatureServe Explorer <www.natureserve.org> [Accessed February 2, 2010].

Fenton, E. W. 1940. The influence of rabbits on the vegetation of certain hill-grazing districts of Scotland. J. Ecology. 28(2):438-449.

Goldman, P. 2001. Herbal medicines today and the roots of modern pharmacology. Ann. Internal Medicine. 135:594-600.

Grier, N. M. & C. R. Grier. 1929. A list of plants growing under cultivation in the vicinity of Cold Spring Harbor, N.Y. Amer. Midland Naturalist. 11(8):389-434.

Grime, J. P., J. G. Hodgson & R. Hunt. 1988. Comparative plant ecology. a functional approach to common British species. Unwin Hyman, London, UK. 742 pp.

Hopkins, W. E. & R. E. Wilson. 1974. Early oldfield succession on bottomlands of southeastern Indiana. Castanea. 39(1):57-71.

Hutchinson, T. C. 1967. Comparative studies of the ability of species to withstand prolonged periods of darkness. J. Ecology. 55(2):291-299.

Nolte, D. L., B. A. Kimball, K. L. Kelly, Z. Zhang & D. L. Campbell. 1995. Herbivore avoidance of a simple digitalis extract. J. Agricultural & Food Chem. 43(3):830-832.

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