ALASKA NON-NATIVE PLANT INVASIVENESS RANKING FORM

Botanical name: *Viola tricolor* L.
Common name: johnny jumpup
Assessors:

Timm Nawrocki Research Technician Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2798	Lindsey A. Flagstad Research Technician Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2786
Matthew L. Carlson, Ph.D. Associate Professor Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska 99501 (907) 257-2790	

Reviewers:

Ashley Grant Invasive Plant Program Instructor Cooperative Extension Service, University of Alaska Fairbanks 1675 C Street, Anchorage, Alaska 99501 (907) 786-6315	Bonnie M. Million. Alaska Exotic Plant Management Team Liaison Alaska Regional Office, National Park Service, U.S. Department of the Interior 240 West 5th Avenue Anchorage, Alaska, 99501 (907) 644-3452
Gino Graziano Natural Resource Specialist Plant Materials Center, Division of Agriculture, Department of Natural Resources, State of Alaska 5310 S. Bodenburg Spur, Palmer, Alaska, 99645 (907) 745-4469	Jeff Conn, Ph. D. Research Agronomist Agricultural Research Service, U.S. Department of Agriculture 319 O'Neil Building, 905 Koyukuk St. – UAF Campus, Fairbanks, Alaska 99775 (907) 474-7652
Robert L. DeVelice, Ph. D. Vegetation Ecologist Chugach National Forest, Forest Service, U.S. Department of Agriculture 3301 C Street, Suite 300 Anchorage, Alaska 99503 (907) 743-9437	Whitney Rapp Katmai, Lake Clark, Alagnak, and Aniakchak Planning, Research Permitting, GIS/GPS, and Invasive Species National Park Service, U.S. Department of the Interior P.O. Box 7 King Salmon, Alaska, 99613 (907) 246-2145

Date: 10/19/2010
Date of previous ranking, if any: 5T

OUTCOME SCORE:

CLIMATIC COMPARISON

This species is present or may potentially establish in the following eco-geographic regions:

Pacific Maritime	Yes
Interior-Boreal	Yes
Arctic-Alpine	Yes

INVASIVENESS RANKING	**Total** (total answered points possible[1])	**Total**
Ecological impact	40 (40)	6
Biological characteristics and dispersal ability	25 (25)	8

Ecological amplitude and distribution	25 (25)	14
Feasibility of control	10 (7)	5
Outcome score	100 (97)[b]	33[a]
Relative maximum score[2]		**34**

[1] For questions answered "unknown" do not include point value for the question in parentheses for "total answered points possible."
[2] Calculated as a/b × 100

A. CLIMATIC COMPARISON

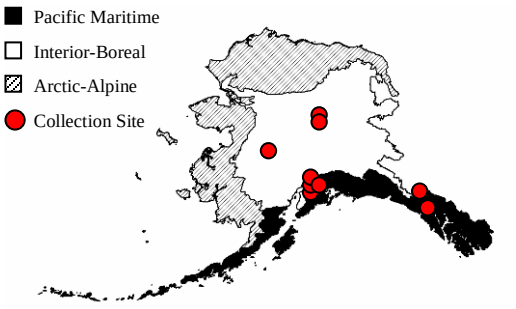
1.1. Has this species ever been collected or documented in Alaska?

☒ Yes - continue to 1.2
☐ No - continue to 2.1

1.2. From which eco-geographic region has it been collected or documented (see inset map)?

Proceed to Section B. INVASIVNESS RANKING

☒ Pacific Maritime
☒ Interior-Boreal
☐ Arctic-Alpine



Documentation: *Viola tricolor* has been documented from the Pacific Maritime and Interior-Boreal ecogeographic regions of Alaska (AKEPIC 2010, UAM 2010).

2.1. Is there a 40 percent or higher similarity (based on CLIMEX climate matching, see references) between climates where this species currently occurs and:

a. Juneau (Pacific Maritime region)?
☐ Yes – record locations and percent similarity; proceed to Section B.
☐ No

b. Fairbanks (Interior-Boreal region)?
☐ Yes – record locations and percent similarity; proceed to Section B.
☐ No

c. Nome (Arctic-Alpine region)?
☒ Yes – record locations and percent similarity; proceed to Section B.
☐ No

If "No" is answered for all regions; reject species from consideration

Documentation: *Viola tricolor* has been observed at a site approximately 1.5 km from Røros, Norway, and a site approximately 2.5 km from Dombås, Norway. It has been documented from a location close to Arkhangel'sk, Russia. According to CLIMEX, Røros, Dombås, and Arkhangel'sk have 76%, 63%, and 76% climatic similarities with Nome, respectively (CLIMEX 1999, Nadtochij and Budrevskaya 2003, Vascular Plant Field Notes Oslo 2010, Vascular Plant Field Notes Trondheim 2010).

B. INVASIVENESS RANKING

1. Ecological Impact

1.1. Impact on Natural Ecosystem Processes

a. No perceivable impact on ecosystem processes 0

b.	Has the potential to influence ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
c.	Has the potential to cause significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, degrades habitat important to waterfowl)	7
d.	Has the potential to cause major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology, hydrology, or affects fire frequency thereby altering community composition; species 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
e.	Unknown	U

Score **1**

Documentation: *Viola tricolor* grows in roadsides and disturbed areas at low densities (AKEPIC 2010, Klinkenberg 2010), where it may cause modest reductions in moisture and nutrients available to native species.

1.2. Impact on Natural Community Structure

a.	No perceived impact; establishes in an existing layer without influencing its structure	0
b.	Has the potential to influence structure in one layer (e.g., changes the density of one layer)	3
c.	Has the potential to cause significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
d.	Likely to cause major alteration of structure (e.g., covers canopy, eliminating most or all lower layers)	10
e.	Unknown	U

Score **1**

Documentation: *Viola tricolor* may increase the density of plants growing in disturbed areas, but infestations do not appear to persist in Alaska (Carlson pers. obs.).

1.3. Impact on Natural Community Composition

a.	No perceived impact; causes no apparent change in native populations	0
b.	Has the potential to influence community composition (e.g., reduces the population size of one or more native species in the community)	3
c.	Has the potential to significantly alter community composition (e.g., significantly reduces the population size of one or more native species in the community)	7
d.	Likely to cause major alteration in community composition (e.g., results in the extirpation of one or more native species, thereby reducing local biodiversity and/or shifting the community composition towards exotic species)	10
e.	Unknown	U

Score **1**

Documentation: *Viola tricolor* may reduce the amount of resources available in disturbed areas, impacting the populations of native colonizers to a minor degree, but it does not generally compete well with other species (Nadtochij 2009).

1.4. Impact on associated trophic levels (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades)

a.	Negligible perceived impact	0
b.	Has the potential to cause minor alteration (e.g., causes a minor reduction in nesting or foraging sites)	3
c.	Has the potential to cause moderate alteration (e.g., causes a moderate reduction in habitat connectivity, interferes with native pollinators, or introduces injurious components such as spines, toxins)	7
d.	Likely to cause severe alteration of associated trophic populations (e.g., extirpation or endangerment of an existing native species or population, or significant reduction in nesting or foraging sites)	10
e.	Unknown	U

Score **3**

Documentation: *Viola tricolor* is insect pollinated (Lankinen 2000), and its presence may alter native plant-pollinator interactions.

Total Possible 40
Total **6**

2. Biological Characteristics and Dispersal Ability

2.1. Mode of reproduction

a.	Not aggressive (produces few seeds per plant [0-10/m^2] and not able to reproduce vegetatively).	0
b.	Somewhat aggressive (reproduces by seed only [11-1,000/m^2])	1
c.	Moderately aggressive (reproduces vegetatively and/or by a moderate amount of seed [<1,000/m^2])	2
d.	Highly aggressive (extensive vegetative spread and/or many seeded [>1,000/m^2])	3
e.	Unknown	U

Score **2**

Documentation: Plants reproduce by seeds, and each plant is capable of producing up to 3,020 seeds (Nadtochij 2009).

2.2. Innate potential for long-distance dispersal (wind-, water- or animal-dispersal)

a.	Does not occur (no long-distance dispersal mechanisms)	0
b.	Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)	2
c.	Numerous opportunities for long-distance dispersal (species has adaptations such as pappus, hooked fruit coats, etc.)	3
d.	Unknown	U

Score **1**

Documentation: Seeds are ejected explosively from the fruits and are further dispersed by ants (Beattie and Lyons 1975). They have elaiosomes, fleshy-oily protuberances that attract ants (Kiviniemi 2008).

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sale of species, use as forage or for revegetation, dispersal along highways, transport on boats, common contaminant of landscape materials, etc.).

a.	Does not occur	0
b.	Low (human dispersal is infrequent or inefficient)	1
c.	Moderate (human dispersal occurs regularly)	2
d.	High (there are numerous opportunities for dispersal to new areas)	3
e.	Unknown	U

Score **2**

Documentation: *Viola tricolor* is commonly cultivated in gardens, and in Alaska it may escape from cultivation into disturbed areas (DiTomaso and Healy 2007, eFloras 2008). It is recommended in Alaska as a fire resistant plant for use in landscaping around homes (Alaska Community Forestry Program 2005).

2.4. Allelopathic

a.	No	0
b.	Yes	2
c.	Unknown	U

Score **0**

Documentation: *Viola tricolor* is not allelopathic.

2.5. Competitive ability

a.	Poor competitor for limiting factors	0
b.	Moderately competitive for limiting factors	1
c.	Highly competitive for limiting factors and/or able to fix nitrogen	3
d.	Unknown	U

Score **0**

Documentation: *Viola tricolor* is a poor competitor with other plant species (Nadtochij 2009).

2.6. Forms dense thickets, has a climbing or smothering growth habit, or is otherwise taller than the surrounding vegetation.

a.	Does not grow densely or above surrounding vegetation	0
b.	Forms dense thickets	1
c.	Has a climbing or smothering growth habit, or is otherwise taller than the surrounding vegetation	2
d.	Unknown	U

Score **0**

Documentation: *Viola tricolor* grows in patches (Kiviniemi 2008), but has not been documented growing at densities high enough to exclude other species.

2.7. Germination requirements

a.	Requires sparsely vegetated soil and disturbance to germinate	0
b.	Can germinate in vegetated areas, but in a narrow range of or in special conditions	2
c.	Can germinate in existing vegetation in a wide range of conditions	3

d. Unknown U

Score **0**

Documentation: In its native range, *Viola tricolor* grows on semi-natural grasslands, dry hillsides, flat rocks, rocky outcrops, sand dunes, and cultivated soils (Lankinen 2000, Kiviniemi 2008, NatureGate 2010). Infestations in Alaska occur only on anthropogenically disturbed substrates (AKEPIC 2010).

2.8. Other species in the genus invasive in Alaska or elsewhere

a. No 0
b. Yes 3
c. Unknown U

Score **3**

Documentation: No *Viola* species are considered noxious in the U.S. or Canada (Invaders 2010, USDA 2010). *V. arvensis* can be a problematic weed in agricultural crops, and heavy infestations can reduce crop yields (Crop Compendium 2010). *V. arvensis*, *V. nephrophylla*, and *V. sororia* are considered weeds in some parts of the U.S. (USDA 2010).

2.9. Aquatic, wetland, or riparian species

a. Not invasive in wetland communities 0
b. Invasive in riparian communities 1
c. Invasive in wetland communities 3
d. Unknown U

Score **0**

Documentation: No evidence has been documented to suggest that *Viola tricolor* invades riparian or wetland habitats.

Total Possible 25
Total **8**

3. Ecological Amplitude and Distribution

3.1. Is the species highly domesticated or a weed of agriculture?

a. Is not associated with agriculture 0
b. Is occasionally an agricultural pest 2
c. Has been grown deliberately, bred, or is known as a significant agricultural pest 4
d. Unknown U

Score **4**

Documentation: *Viola tricolor* is a commonly cultivated garden ornamental, and it has been grown as an herbal medicine (DiTomaso and Healy 2007, eFloras 2008, Plants for a Future 2010). It is recommended in Alaska as a fire resistant plant for use in landscaping around homes (Alaska Community Forestry Program 2005). In the western U.S., northern Finland, and Russia, this species is a weed of agricultural fields (DiTomaso and Healy 2007, Nadtochij 2009, NatureGate 2010).

3.2. Known level of ecological impact in natural areas

a. Not known to impact other natural areas 0

b.	Known to impact other natural areas, but in habitats and climate zones dissimilar to those in Alaska	1
c.	Known to cause low impact in natural areas in habitats and climate zones similar to those in Alaska	3
d.	Known to cause moderate impact in natural areas in habitat and climate zones similar to those in Alaska	4
e.	Known to cause high impact in natural areas in habitat and climate zones similar to those in Alaska	6
f.	Unknown	U

Score **0**

Documentation: *Viola tricolor* grows in disturbed areas and cultivated lands in the western U.S. (DiTomaso and Healy 2007). In northern Finland and Russia, it is a weed of cultivated land (Nadtochij 2009, NatureGate 2010). However, no ecological impacts have been documented in natural areas.

3.3. Role of anthropogenic and natural disturbance in establishment

a.	Requires anthropogenic disturbance to establish	0
b.	May occasionally establish in undisturbed areas, readily establishes in naturally disturbed areas	3
c.	Can establish independently of natural or anthropogenic disturbances	5
e.	Unknown	U

Score **0**

Documentation: *Viola tricolor* grows in disturbed areas and roadsides (Klinkenberg 2010). It is intolerant of shade and establishes in open areas (Nadtochij 2009). All infestations in Alaska are associated with either fill importation or material extraction (AKEPIC 2010).

3.4. Current global distribution

a.	Occurs in one or two continents or regions (e.g., Mediterranean region)	0
b.	Extends over three or more continents	3
c.	Extends over three or more continents, including successful introductions in arctic or subarctic regions	5
e.	Unknown	U

Score **5**

Documentation: *Viola tricolor* is native to Europe. It has been introduced to China, Japan, Australia, New Zealand, South America, and North America (Mito and Uesugi 2004, eFloras 2008, GBIF New Zealand 2010, Tropicos 2010, USDA 2010). It has been collected from arctic regions in Norway and western Russia (Nadtochij and Budrevskaya 2003, Vascular Plant Herbarium Oslo 2010).

3.5. Extent of the species' U.S. range and/or occurrence of formal state or provincial listing

a.	Occurs in 0-5 percent of the states	0
b.	Occurs in 6-20 percent of the states	2
c.	Occurs in 21-50 percent of the states and/or listed as a problem weed (e.g., "Noxious," or "Invasive") in one state or Canadian province	4
d.	Occurs in more than 50 percent of the states and/or listed as a problem weed in two or more states or Canadian provinces	5

e.	Unknown	U

Score **5**

Documentation: *Viola tricolor* grows in 40 states of the U.S. (USDA 2010).

Total Possible 25
Total **14**

4. Feasibility of Control

4.1. Seed banks

a.	Seeds remain viable in the soil for less than three years	0
b.	Seeds remain viable in the soil for three to five years	2
c.	Seeds remain viable in the soil for five years or longer	3
e.	Unknown	U

Score **3**

Documentation: Seeds can remain viable in the soil for up to six years (Nadtochij 2009).

4.2. Vegetative regeneration

a.	No resprouting following removal of aboveground growth	0
b.	Resprouting from ground-level meristems	1
c.	Resprouting from extensive underground system	2
d.	Any plant part is a viable propagule	3
e.	Unknown	U

Score **U**

Documentation: Information on the resprouting ability of *Viola tricolor* has not been documented.

4.3. Level of effort required

a.	Management is not required (e.g., species does not persist in the absence of repeated anthropogenic disturbance)	0
b.	Management is relatively easy and inexpensive; requires a minor investment of human and financial resources	2
c.	Management requires a major short-term or moderate long-term investment of human and financial resources	3
d.	Management requires a major, long-term investment of human and financial resources	4
e.	Unknown	U

Score **2**

Documentation: Mechanical methods and herbicide applications have been successful at controlling *Viola tricolor* in cultivated fields in Russia (Nadtochij 2009). Annually-repeated, mechanical removal of plants has been successful in controlling *Viola tricolor* in Glacier Bay National Park and Preserve (Rapp 2009).

Total Possible 7
Total **5**

Total for four sections possible	97
Total for four sections	**33**

References:

AKEPIC database. Alaska Exotic Plant Information Clearinghouse Database. 2010. Available: http://akweeds.uaa.alaska.edu/

Alaska Community Forestry Program. 2005. Protect Your Home from Wildfire, Fire Resistant Vegetation and Landscaping. Community Forestry Program, Division of Forestry, Alaska Department of Natural Resources. [27 October 2010] http://forestry.alaska.gov/pdfs/05FireResistVeg.pdf

Beattie, A., and N. Lyons. 1975. Seed Dispersal in Viola (Violaceae): Adaptations and Strategies. American Journal of Botany. 62(7). 714-722 p.

Carlson, M., Associate Research Professor – Botany, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2790 – Pers. obs.

CLIMEX. 1999. CLIMEX for Windows, Predicting the effects of climate on plants and animals. Version 1.1a. CISRO Publishing. Collingwood, Australia.

Crop Compendium. 2010. Bayer CropScience AG, Bayer. Available at http://compendium.bayercropscience.com

DiTomaso, J., and E. Healy. 2007. Weeds of California and Other Western States. Vol. 2. University of California Agriculture and Natural Resources Communication Services, Oakland, CA. 974 p.

eFloras. 2008. Published on the Internet http://www.efloras.org [accessed 19 October 2010]. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, Cambridge, MA.

GBIF New Zealand, New Zealand National Plant Herbarium (CHR). 2010. Accessed through GBIF (Global Biodiversity Information Facility) data portal (http://data.gbif.org/datasets/resource/474, 2010-10-26).

Invaders Database System. 2010. University of Montana. Missoula, MT. http://invader.dbs.umt.edu/

Kiviniemi, K. 2008. Effects of fragment size and isolation on the occurrence of four short-lived plants in semi-natural grasslands. Acta Oecologica. 33(1). 56-65 p.

Klinkenberg, B. (Editor) 2010. *Viola tricolor* L. In: E-Flora BC: Electronic Atlas of the Plants of British Columbia**.** Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia. Vancouver, BC. [27 October 2010] Available: http://www.geog.ubc.ca/biodiversity/eflora/index.shtml

Lankinen, Å. 2000. Effects of soil pH and phosphorous on in vitro pollen competitive ability and sporophytic traits in clones of *Viola tricolor*. International Journal of Plant Sciences. 161(6). 885-893 p.

Mito, T., and T. Uesugi. 2004. Invasive Alien Species in Japan: The Status Quo and the New Regulation for Prevention of their Adverse Effects. Global Environmental Research. 8(2). 171-191 p.

Nadtochij, I. 2009. Weeds, *Viola tricolor* L. – Garden violet. AgroAtlas. Interactive agricultural ecological atlas of Russia and neighboring countries: Economic plants and their diseases, pests, and weeds. [27 October 2010] http://www.agroatlas.ru/en/content/weeds/Viola_tricolor/

Nadtochij, I., and I. Budrevskaya. 2003. Weeds, Area of distribution and harmfulness of *Viola tricolor*. AgroAtlas. Interactive agricultural ecological atlas of Russia and neighboring countries: Economic plants and their diseases, pests, and weeds. [27 October 2010] http://www.agroatlas.ru/en/content/weeds/Viola_tricolor/map/

NatureGate. 2010. Finland Nature and Species. Helsinki, Finland. [27 October 2010] Available: http://www.luontoportti.com/suomi/en/

Plants for a Future. 2010. [27 October 2004] Available: http://www.pfaf.org/user/default.aspx

Rapp, W. 2009. Invasive Plant Management in Glacier Bay National Park and Preserve, Summer 2009 Field Season Report. Report on file with Glacier Bay National Park and Preserve, National Park Service. Gustavus, AK. 164 p.

Tropicos. 2010. *Viola tricolor* L. Missouri Botanical Garden. St. Louis, MO. [27 October 2010] http://www.tropicos.org/Name/33800045

UAM. 2010. University of Alaska Museum, University of Alaska Fairbanks. Available: http://arctos.database.museum/home.cfm

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2010. The PLANTS Database http://plants.usda.gov [19 October 2010]. National Plant Data Center, Baton Rouge, LA 70874-4490 USA

Vascular Plant Herbarium, Oslo. 2010. Accessed through GBIF (Global Biodiversity Information Facility) data portal (http://data.gbif.org/datasets/resource/1078, 2010-10-20). Natural History Museum, University of Oslo. Oslo, Norway.

Vascular Plants Field Notes, Oslo. 2010. Accessed through GBIF (Global Biodiversity Information Facility) data portal (http://data.gbif.org/datasets/resource/1079, 2010-10-20). Natural History Museum, University of Oslo. Oslo, Norway.

Vascular Plant Field Notes, Trondheim. 2010. Accessed through GBIF (Global Biodiversity Information Facility) data portal (http://data.gbif.org/datasets/resource/8064, 2010-10-20). Natural History Museum, University of Oslo. Trondheim, Norway.