ALASKA NON-NATIVE PLANT INVASIVENESS RANKING FORM

Botanical name: *Euphrasia nemorosa* (Pers.) Wallr.
Common name: common eyebright
Assessors:

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Date: 10/8/2010
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)	16
Biological characteristics and dispersal ability	25 (25)	10
Ecological amplitude and distribution	25 (25)	12
Feasibility of control	10 (7)	3
Outcome score	100 (97)[b]	41[a]
Relative maximum score[2]		**42**

[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

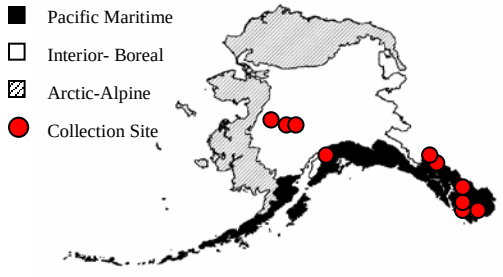
A. CLIMATIC COMPARISON

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: *Euphrasia nemorosa* 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: *Euphrasia nemorosa* has been collected from a site that is within 15 km of Røros, Norway, at a higher elevation than the town (University Museums of Norway 2010). Another specimen was collected from a site that is roughly 32 km south of Dombås, Norway (Vascular Plant Herbarium Trondheim 2010). Using CLIMEX matching program, the climatic similarity between Røros and Nome is 76%, and the similarity between Dombås and Nome is 63% (CLIMEX 1999).

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 **3**

Documentation: *Euphrasia nemorosa* grows in disturbed areas that have exposed mineral soil (Cortés-Burns and Flagstad 2009). It is also a primary colonizer of disturbed areas in its native range in northwest England (Ash et al. 1994). In southeast Alaska, however, it has been observed growing in native vegetation through the moss and in wetland margins in undisturbed areas (Feierabend and Schirokauer 2008). *Euphrasia nemorosa* will compete with native species for space and nutrients as it is hemiparasitic (Yeo 1964).

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 **5**

Documentation: In Europe, where it is native, *Euphrasia nemorosa* grows well in clearings and forest edges of previously disturbed sites, dry meadows, pastures, and chalk grasslands (Kelly 1989, Ash et al. 1994, Lid & Lid 1998). In Southeast Alaska, *Euphrasia nemorosa* grows in undisturbed, mossy areas (Feierabend and Schirokauer 2008), significantly increasing the density of the low forb layer. It also grows in sparsely vegetated areas that have been disturbed by trampling (Cortés-Burns and Flagstad 2009). This species is often associated with herbaceous-roadside plant communities on imported fill in Alaska (AKEPIC 2010), where it probably causes minor changes in the forb density.

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 **3**

Documentation: *Euphrasia nemorosa* is hemiparasitic; it forms haustoria on the roots of other plants and may therefore weaken native plants establishing in disturbed sites. While it is able to grow without a host, it grows best with a host, especially if that host has the ability to fix nitrogen (Yeo 1964). Although *Euphrasia nemorosa* has been found growing on tidal flats and in mossy, undisturbed areas in Southeast Alaska, it does not seem to be detrimental to native vegetation (Feierabend and Schirokauer 2008).

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	**5**

Documentation: *Euphrasia nemorosa* is hemiparasitic (Yeo 1964). The genus is notorious for weak interspecific crossing barriers (French et al. 2003), and *E. nemorosa* may hybridize with native species.

Total Possible	40
Total	**16**

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	**1**

Documentation: *Euphrasia nemorosa* reproduces by seed (Yeo 1964). Areas that were cleared of all vegetation at Nelson Slough in Southeast Alaska were rapidly reinfested by *Euphrasia nemorosa* (Feierabend and Schirokauer 2008). This species quickly spread after being introduced onto industrial waste heaps in Northwest England (Ash et al. 1994), indicating that it is at least somewhat aggressive in its reproduction.

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	**0**

Documentation: *Euphrasia nemorosa* has no specialized mechanisms for long distance dispersal (Horwood 1919). *Euphrasia* species do not generally disperse long distances (Murphy and Downe 2006).

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	**3**

Documentation: *Euphrasia nemorosa* has been documented around the Haines Airport and is commonly associated with areas that have been disturbed by fill importation in Southeast Alaska (Feierabend and Schirokauer 2008, AKEPIC 2010). Infestations occur primarily near areas associated with human activities, such as Kincaid Park in Southcentral Alaska (Cortés-Burns and Flagstad 2009) and a variety of roads, trails, campgrounds, and townsites in Southeast Alaska (Feierabend and Schirokauer 2008).

2.4. Allelopathic

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

Documentation: *Euphrasia nemorosa* 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	**1**

Documentation: *Euphrasia nemorosa* has the ability to parasitize nutrients from surrounding grasses, *Trifolium* species, and *Plantago* species (Yeo 1964, Plants for a Future 2010). It has been shown to be moderately competitive in northwestern England where it spread rapidly after being introduced on industrial waste heaps (Ash et al. 1994).

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: *Euphrasia nemorosa* primarily grows in sparsely vegetated disturbed sites (Cortés-Burns and Flagstad 2009) and has shown no detrimental effects on surrounding vegetation when growing in undisturbed areas in Southeast Alaska (Feierabend and Schirokauer 2008).

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 **2**

Documentation: This species primarily germinates in disturbed areas that have some exposed mineral soil (Cortés-Burns and Flagstad 2009). It has been observed in Southeast Alaska spreading from disturbed areas to undisturbed mossy areas, where it grows amongst native vegetation. Seedlings germinated even under thick mats of grasses and lupines (Feierabend and Schirokauer 2008).

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

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

Score **0**

Documentation: *Euphrasia nemorosa* is the only tracked non-native *Euphrasia* species in Alaska (AKEPIC 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 **3**

Documentation: *Euphrasia nemorosa* primarily grows in sparsely vegetated disturbed sites (Cortés-Burns and Flagstad 2009); however this species is well established in wetland and pond areas in the Dyea flats (AKEPIC 2010).

Total Possible 25

Total **10**

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 **0**

Documentation: *Euphrasia nemorosa* is not documented as an agricultural pest nor has it been deliberately grown on a wide scale (Yeo 1964, Ash et al. 1994).

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 **2**

Documentation: *Euphrasia nemorosa* is known to be hemiparasitic in similar climates (Yeo 1964). Records of any other ecological impacts outside of Alaska were not found.

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 **3**

Documentation: *Euphrasia nemorosa* primarily grows in anthropogenically disturbed sites with sparse vegetation (Cortés-Burns and Flagstad 2009). In Southeast Alaska, infestations have been observed growing in undisturbed areas and at least one infestation is expanding into tidal flats (Feierabend and Schirokauer 2008).

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: *Euphrasia nemorosa* is native to Europe but is also listed as native to Michigan and Quebec (NatureServe 2009, USDA 2010). Additionally, *Euphrasia nemorosa* has been collected from Asia (Harvard University Herbaria 2007), Africa (Botanic Garden and Botanical Museum Berlin-Dahlem 2010), and New Zealand (GBIF New Zealand 2010). Populations are present in subarctic and arctic regions in Norway (Vascular Plant Herbarium Trondheim 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	**2**

Documentation: *Euphrasia nemorosa* is a legally protected rare species in Michigan (Michigan Natural Features Inventory 2007). It has been documented in 9 states total: Alaska, Connecticut, Massachusetts, Michigan, Minnesota, Maine, New Hampshire, Vermont, and Washington (NatureServe 2009, USDA 2010). It is treated as exotic in British Colombia and Alberta, but it is not formally identified as a problem weed (NatureServe 2009).

Total Possible	25
Total	**12**

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	**U**

Documentation: No information is available on seed longevity in this species.

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	**0**

Documentation: *Euphraisia nemorosa* is an annual plant (Klinkenberg 2010).

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 **3**

Documentation: Repeated hand-pulling was marginally to moderately effective in Klondike Gold Rush National Historic Park. Hoeing is more effective than hand-pulling in small infestations, but it requires the removal of native flora in addition to *Euphrasia nemorosa*. Neither hand-pulling, nor hoeing are efficient control methods for large infestations (Feierabend and Schirokauer 2008).

Total Possible	7
Total	**3**

Total for four sections possible	97
Total for four sections	**41**

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