

WEED RISK ASSESSMENT FORM

Botanical name: *Anthemis cotula* L.
 Common name: stinking chamomile, dog fennel, mayweed
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Outcome score:

A. Climatic Comparison		
This species is present or may potentially establish in the following eco-geographic regions:		
1	South Coastal	Yes
2	Interior-Boreal	Yes
3	Arctic-Alpine	No

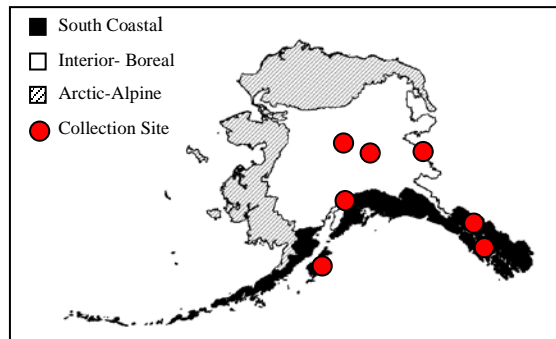
B.	Invasiveness Ranking	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	8
2	Biological characteristic and dispersal ability	25 (25)	12
3	Ecological amplitude and distribution	25 (25)	14
4	Feasibility of control	10 (10)	7
	Outcome score	100 (100) ^b	41 ^a
	Relative maximum score†		0.41

* For questions answered “unknown” do not include point value for the question in parentheses for “Total Answered Points Possible.”

† Calculated as ^a/_b.

A. CLIMATIC COMPARISON:

1.1. Has this species ever been collected or documented in Alaska?	
Yes	Yes – continue to 1.2
	No – continue to 2.1
1.2. Which eco-geographic region has it been collected or documented (see inset map)? <i>Proceed to Section B. Invasiveness Ranking.</i>	
Yes	South Coastal
Yes	Interior-Boreal
	Arctic-Alpine



Documentation: *Anthemis cotula* has been collected in South Coastal and Interior-Boreal ecogeographic regions of Alaska (AK Weed Database 2004, Hultén 1968, UAM 2004, Welsh 1974).

Sources of information:

AK Weeds Database. 2004. Database of exotic vegetation collected in Alaska. University of Alaska, Alaska Natural Heritage Program – US Forest Service – National Park Service Database. Available: <http://akweeds.uaa.alaska.edu/>

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

University of Alaska Museum. University of Alaska Fairbanks. 2004.

<http://hispidamuseum.uaf.edu:8080/home.cfm>

Welsh, S.L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

2.1. Is there a 40% or higher similarity (based on CLIMEX climate matching) between climates anywhere where the species currently occurs and

a. Juneau (South Coastal Region)?

Yes – record locations and similarity; proceed to Section B.

Invasiveness Ranking

No

b. Fairbanks (Interior-Boreal)?

Yes – record locations and similarity; proceed to Section B.

Invasiveness Ranking

No

c. Nome (Arctic-Alpine)?

Yes – record locations and similarity; proceed to Section B.

Invasiveness Ranking

No

No

– If “No” is answered for all regions, reject species from consideration

Documentation: Using the CLIMEX matching program, climatic similarity between Nome and areas where the species is documented is high. Species range includes Røros, Norway (Lid and Lid 1994), which has a 76% climatic match with Nome. However, mayweed chamomile is known mostly from areas with July mean temperatures above 60° F (Kay 1971). These conditions are unlikely to occur in Arctic-Alpine ecogeographic region (WRCC 2005). Thus establishment of *Anthemis cotula* in Arctic-Alpine Alaska may not be possible.

Sources of information: CLIMEX for Windows, Version 1.1a. 1999. CISRO Publishing, Australia.

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

Lid, J. and D. T. Lid. 1994. Flora of Norway. The Norske Samlaget, Oslo. Pp. 1014.

WRCC - Western Regional Climate Center 2001. Desert Research Institute. <http://www.wrcc.dri.edu> [March 9, 2005].

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes

- | | | |
|----|---|----|
| A. | No perceivable impact on ecosystem processes | 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; hydrology; or affects fire frequency, 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 |
| U. | Unknown | |

Score

1

Documentation:

Identify ecosystem processes impacted:

Though mayweed chamomile has not been reported from undisturbed areas (Kay 1971, Roberts and Neilson 1981, UAM 2004, Whitson et al. 2000), it may retard succession after sites have been invaded.

Rational:

Sources of information:

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

Roberts, H.A. and J.E. Neilson. 1981. Seed survival and periodicity of seedling emergence in twelve weedy species of Compositae. Annals of Applied Biology 97: 325-334.

University of Alaska Museum. University of Alaska Fairbanks. 2004.

<http://hispidamuseum.uaf.edu:8080/home.cfm>

Whitson, T. D., L. C. Burrill, S. A. Dewey, D. W. Cudney, B. E. Nelson, R. D. Lee, R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

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

1

Documentation:

Identify type of impact or alteration:

Mayweed chamomile typically grows in large numbers and can change the density of the layer on cultivated fields or ruderal sites. It is not known from undisturbed plant communities (Kay 1971).

Rational:

Sources of information:

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

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

1

Documentation:

Identify type of impact or alteration:

Mayweed chamomile has not been observed in undisturbed areas in Alaska (Hultén 1968, Kay 1971, Roberts and Neilson 1981, Whitson et al. 2000) and no impact on native populations has been documented.

Rational:

Sources of information:

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University

Press, Stanford, CA. 1008 p.

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

Roberts, H.A. and J.E. Neilson. 1981. Seed survival and periodicity of seedling emergence in twelve weedy species of Compositae. Annals of Applied Biology 97: 325-334.

Whitson, T. D., L. C. Burrill, S. A. Dewey, D. W. Cudney, B. E. Nelson, R. D. Lee, R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

1.4. Impact on higher 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. Minor alteration 3
- C. Moderate alteration (minor reduction in nesting/foraging sites, reduction in habitat connectivity, interference with native pollinators, injurious components such as spines, toxins) 7
- D. Severe alteration of higher trophic populations (extirpation or endangerment of an existing native species/population, or significant reduction in nesting or foraging sites) 10
- U. Unknown

Score

5

Documentation:
 Identify type of impact or alteration:
 Mayweed chamomile is unpalatable to grazing animals. The flowers are visited and pollinated mainly by syrphid flies and other Diptera. Hybrids with *Tripleurospermum perforata* and *Anthemis tinctoria* have been recorded. Weevils, aphids, spittlebugs, bugs, moths, slugs, and snails have been reported to feed on mayweeds, causing serious damage to achenes and vegetative parts of plants (Erneberg 1999). This plant can be seriously infected by fungi (Kay 1971). Mayweed chamomile is potentially allelopathic to certain forage species (Smith 1990).

Rational:

Sources of information:
 Erneberg, M. 1999. Effects of herbivory and competition on an introduced plant in decline. Oecologia 118: 203-209.
 Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.
 Smith, A.E. 1990. Potential allelopathic influence of certain pasture weeds. Crop protection 9(6): 410-414.

Total Possible

40

 Total

8

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode of reproduction

- A. Not aggressive reproduction (few [0-10] seeds per plant and no vegetative reproduction) 0
- B. Somewhat aggressive (reproduces only by seeds (11-1,000/m²)) 1
- C. Moderately aggressive (reproduces vegetatively and/or by a moderate amount of seed, <1,000/m²) 2
- D. Highly aggressive reproduction (extensive vegetative spread and/or many seeded, >1,000/m²) 3
- U. Unknown

Score

3

Documentation:
 Describe key reproductive characteristics (including seeds per plant):
 The number of seeds produced by a plant varies widely depending on the soil fertility

and the intensity of competition. Plants of average size are capable of producing from 550 to 12,000 achenes. The largest plant observed at the experimental site in Britain had a reproductive capacity of 27,000 achenes (Kay 1971).

Rational:

Sources of information:

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

2.2. Innate potential for long-distance dispersal (bird dispersal, sticks to animal hair, buoyant fruits, 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) | 2 |
| C. | Numerous opportunities for long-distance dispersal (species has adaptations such as pappus, hooked fruit-coats, etc.) | 3 |
| U. | Unknown | |

Score

Documentation:

Identify dispersal mechanisms:

The achenes of mayweed chamomile lack any structural adaptations for dispersal (Kay 1971).

Rational:

Sources of information:

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

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, contamination, etc.)

- | | | |
|----|--|---|
| A. | Does not occur | 0 |
| B. | Low (human dispersal is infrequent or inefficient) | 1 |
| C. | Moderate (human dispersal occurs) | 2 |
| D. | High (there are numerous opportunities for dispersal to new areas) | 3 |
| U. | Unknown | |

Score

Documentation:

Identify dispersal mechanisms:

Mayweed chamomile seed can easily contaminate grass seeds. Achenes remaining on the plant may be dispersed for some distance with hay. They may also be dispersed on footwear and clothes, in mud and soil adhering to agricultural equipment, and the feet of farm animals (Kay 1958, USDA, ARS 2005).

Rational:

Sources of information:

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <http://www.ars-grin.gov/var/apache/cgi-bin/npgs/html/taxon.pl?300618> [March 8, 2005].

2.4. Allelopathic

- | | | |
|----|---------|---|
| A. | No | 0 |
| B. | Yes | 2 |
| U. | Unknown | |

Score

Documentation:

Describe effect on adjacent plants:
 Mayweed chamomile is potentially allelopathic to certain forage species (Smith 1990).
 Rational:
 Mayweed chamomile leaf-tissue extract resulted in 50% reduction in Italian ryegrass and alfalfa seed germination. Tissue extracts also influenced Italian ryegrass and alfalfa seedlings growth (Smith 1999).
 Sources of information:
 Smith, A.E. 1990. Potential allelopathic influence of certain pasture weeds. Crop protection 9(6): 410-414.

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 nitrogen fixing ability 3
- U. Unknown

Score 1

Documentation:
 Evidence of competitive ability:
 Mayweed chamomile is able to compete with crop species.
 Rational:
 Sources of information:

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

- A. No 0
- B. Forms dense thickets 1
- C. Has climbing or smothering growth habit, or otherwise taller than the surrounding vegetation 2
- U. Unknown

Score 0

Documentation:
 Describe grow form:
 Mayweed chamomile typically grows in large numbers and can change the density of the layer on cultivated fields or ruderal sites. It does not form thickets and does not have a climbing growth habit (Douglas et al. 1998, Whitson 2000).
 Rational:
 Sources of information:
 Douglas, G. W., G. B. Straley, D. Meidinger, J. Pojar. 1998. Illustrated flora of British Columbia. V. 2. Ministry of Environment, Lands and Parks Ministry of Forests. British Columbia. 401 pp.
 Whitson, T. D., L. C. Burrill, S. A. Dewey, D. W. Cudney, B. E. Nelson, R. D. Lee, R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

2.7. Germination requirements

- A. Requires open soil and disturbance to germinate 0
- B. Can germinate in vegetated areas but in a narrow range or in special conditions 2
- C. Can germinate in existing vegetation in a wide range of conditions 3
- U. Unknown

Score 0

Documentation:
 Describe germination requirements:
 Mayweed chamomile is a weed of cultivated fields and is known only germinating on disturbed soils (Gealy et al. 1985, Gealy et al. 1994, Kay 1971, Roberts and Neilson

1981).
 Rational:

Sources of information:
 Gealy, D.R., F.L. Young, and L.A. Morrow. 1985. Germination of mayweed (*Anthemis cotula*) achenes and seed. *Weed Science* 33: 69-73.
 Gealy, D.R., S.A. Squier, and A.G. Ogg Jr. 1994. Soil environment and temperature affect germination and seedling growth of mayweed chamomile (*Anthemis cotula*). *Weed Technology* 8: 668-672.
 Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. *The Journal of Ecology* 59(2): 623-636.
 Roberts, H.A. and J.E. Neilson. 1981. Seed survival and periodicity of seedling emergence in twelve weedy species of Compositae. *Annals of Applied Biology* 97: 325-334.

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

- A. No 0
- B. Yes 3
- U. Unknown

Score

3

Documentation:
 Species:
Anthemis arvensis L. considered a weed in Colorado (USDA 2002)
 Sources of information:
 USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

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
- U. Unknown

Score

0

Documentation:
 Describe type of habitat:
 Mayweed chamomile is commonly found in cereal crops, waste areas, farmyards, overgrazed pastures, and along roadsides (Kay 1971, Roberts and Neilson 1981, Whitson et al. 2000)
 Rational:

Sources of information:
 Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. *The Journal of Ecology* 59(2): 623-636.
 Roberts, H.A. and J.E. Neilson. 1981. Seed survival and periodicity of seedling emergence in twelve weedy species of Compositae. *Annals of Applied Biology* 97: 325-334.
 Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, Wyoming. 630 pp.

Total Possible

25

 Total

12

3. DISTRIBUTION

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

- A. No 0

- B. Is occasionally an agricultural pest 2
- C. Has been grown deliberately, bred, or is known as a significant agricultural pest 4
- U. Unknown

Score 4

Documentation:

Identify reason for selection, or evidence of weedy history:

Mayweed chamomile is a long-established weed of arable land in Britain. Its achenes have been found in archaeological material dated to medieval times. The fact that Anglo-Saxon farmers were the first to cultivate the heavy soils favoring mayweed chamomile, suggest that it may have become an important agricultural weed in Britain during Anglo-Saxon times (Kay 1958). Mayweed chamomile has become the most important weed in agriculture (Ivens 1979).

Rational:

Sources of information:

Ivens, G.W. 1979. Stinking mayweed. *New Zealand Journal of Agriculture* 138: 21-23.
 Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. *The Journal of Ecology* 59(2): 623-636.

3.2. Known level of impact in natural areas

- A. Not known to cause impact in any other natural area 0
- B. Known to cause impacts in natural areas, but in dissimilar habitats and climate zones than exist in regions of Alaska 1
- C. Known to cause low impact in natural areas in similar habitats and climate zones to those present in Alaska 3
- D. Known to cause moderate impact in natural areas in similar habitat and climate zones 4
- E. Known to cause high impact in natural areas in similar habitat and climate zones 6
- U. Unknown

Score 0

Documentation:

Identify type of habitat and states or provinces where it occurs:

Mayweed chamomile is not known to cause an impact on any natural areas.

Sources of information:

3.3. Role of anthropogenic and natural 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 disturbances 3
- C. Can establish independent of any known natural or anthropogenic disturbances 5
- U. Unknown

Score 0

Documentation:

Identify type of disturbance:

Kay (1971) suggested that stinking chamomile does not grow in undisturbed habitats. Seedling establishment is slow and readily crowded out by competing plants on vegetated sites. Mayweed chamomile grows best in open conditions (Ivens 1979). This species has been encountered only on disturbed sites in Alaska (AK Weeds Database 2004, Hultén 1968, Kay 1971, Welsh 1974).

Rational:

Sources of information:

AK Weeds Database. 2004. Database of exotic vegetation collected in Alaska. University of Alaska, Alaska Natural Heritage Program – US Forest Service – National Park Service Database. Available: <http://akweeds.uaa.alaska.edu/>
 Hultén, E. 1968. *Flora of Alaska and Neighboring Territories*. Stanford University Press, Stanford, CA. 1008 p.
 Ivens, G.W. 1979. Stinking mayweed. *New Zealand Journal of Agriculture* 138: 21-23.
 Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. *The Journal*

of Ecology 59(2): 623-636.
 Welsh, S. L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.

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
- U. Unknown

Score

5

Documentation:

Describe distribution:

Mayweed chamomile is native to the Mediterranean region, but has been widely introduced as a weed in the temperate zone. Its European distribution extends to southern Norway, central Sweden and southern Finland. Its southern extent includes the Canary Islands, Egypt and western Asia. This species has been introduced to the United States and Canada, Argentina, Australia and New Zealand (Hultén 1968, Ivens 1979, Kay 1957, USDA, ARS 2005).

Rational:

Sources of information:

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.

Ivens, G.W. 1979. Stinking mayweed. New Zealand Journal of Agriculture 138: 21-23.

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. The Journal of Ecology 59(2): 623-636.

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <http://www.ars-grin.gov/var/apache/cgi-bin/npgs/html/taxon.pl?300618> [March 8, 2005].

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

- A. 0-5% of the states 0
- B. 6-20% of the states 2
- C. 21-50%, and/or state listed as a problem weed (e.g., "Noxious," or "Invasive") in 1 state or Canadian province 4
- D. Greater than 50%, and/or identified as "Noxious" in 2 or more states or Canadian provinces 5
- U. Unknown

Score

5

Documentation:

Identify states invaded:

Mayweed chamomile occurs in nearly all states of the United States. It is declared a noxious weed in Colorado and Nevada (USDA 2002).

Rational:

Sources of information:

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Total Possible

25

Total

14

4. FEASIBILITY OF CONTROL

4.1. Seed banks

- A. Seeds remain viable in the soil for less than 3 years 0

- B. Seeds remain viable in the soil for between 3 and 5 years 2
- C. Seeds remain viable in the soil for 5 years and more 3
- U. Unknown

Score 3

Documentation:

Identify longevity of seed bank:

Up to 6.7% of seeds remained viable in the soil after 5 year of sown in study by Roberts and Neilson (1981). Chippindale and Nilton (1934) suggested 6 years seed viability for mayweed chamomile. Salzmann (1954, cited in Kay 1971) obtained 63% germination after 1 year of burial in the soil, 68% germination after 3 years and only 6% after 11 years. Viability of seeds was recorded up to 30 years after burial (Darlington and Steinbauer 1961).

Rational:

Sources of information:

Chippindale, H.G. and W.E.J. Milton. 1934. On the viable seeds present in the soil beneath pasture. *The Journal of Ecology* 22(2): 508-531.
 Darlington, H.T. and G.P. Steinbauer. 1961. The eighty-year period for Dr. Beal's seed viability experiment. *American Journal of Botany* 48(4): 321-325.
 Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. *The Journal of Ecology* 59(2): 623-636.
 Roberts, H.A. and J.E. Neilson. 1981. Seed survival and periodicity of seedling emergence in twelve weedy species of Compositae. *Annals of Applied Biology* 97: 325-334.

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
- U. Unknown

Score 2

Documentation:

Describe vegetative response:

Mayweed chamomile can produce vigorous new shoots from the undamaged lower parts of the plant after cutting (Kay 1971).

Rational:

Sources of information:

Kay, Q.O.N. 1971. Biological flora of the British Isles. *Anthemis cotula* L. *The Journal of Ecology* 59(2): 623-636.

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; requires a minor investment in human and financial resources 2
- C. Management requires a major short-term investment of human and financial resources, or a moderate long-term investment 3
- D. Management requires a major, long-term investment of human and financial resources 4
- U. Unknown

Score 2

Documentation:

Identify types of control methods and time-term required:

Combinations of rotation grazing and herbicides treatment the best methods of successful control of mayweed chamomile (Ivens 1979). This weed is known to be resistant to a number of herbicides.

Rational:

Sources of information:

Ivens, G.W. 1979. Stinking mayweed. *New Zealand Journal of Agriculture* 138: 21-23.

Total Possible	10
Total	7

Total for 4 sections Possible	100
Total for 4 sections	41

References:

- AK Weeds Database. 2004. Database of exotic vegetation collected in Alaska. University of Alaska, Alaska Natural Heritage Program – US Forest Service – National Park Service Database. Available: <http://akweeds.uaa.alaska.edu/>
- Chippindale, H.G. and W.E.J. Milton. 1934. On the viable seeds present in the soil beneath pasture. *The Journal of Ecology* 22(2): 508-531.
- CLIMEX for Windows, Version 1.1a. 1999. CISRO Publishing, Australia.
- Darlington, H.T. and G.P. Steinbauer. 1961. The eighty-year period for Dr. Beal's seed viability experiment. *American Journal of Botany* 48(4): 321-325.
- Douglas, G. W., G. B. Straley, D. Meidinger, J. Pojar. 1998. Illustrated flora of British Columbia. V. 2. Ministry of Environment, Lands and Parks Ministry of Forests. British Columbia. 401 pp.
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