

WEED RISK ASSESSMENT FORM

Botanical name: Sorbus aucuparia L.

Common name: European mountain ash

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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	No
3	Arctic-Alpine	No
This species is unlikely to establish in any region in Alaska		

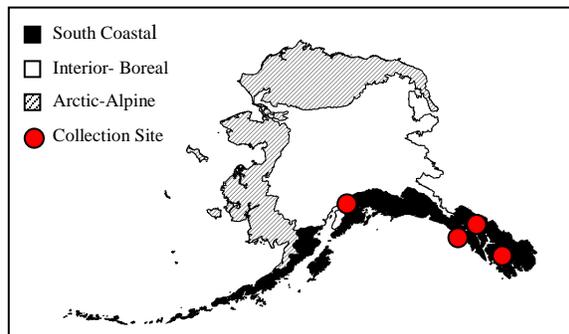
B. Invasiveness Ranking	Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)
2	Biological characteristic and dispersal ability	25 (25)
3	Ecological amplitude and distribution	25 (25)
4	Feasibility of control	10 (10)
	Outcome score	100 (100) ^b
	Relative maximum score [†]	59
		0.59

* 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
	Interior-Boreal
	Arctic-Alpine



Documentation: Has been collected in Juneau, Ketchikan, Craig, Petersburg, and Sitka (Hultén 1968, UAM 2004, Welsh 1974). Widely planted as ornamental in Anchorage and towns in Southeast of Alaska.

Sources of information:

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 any 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

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: Range of the species includes Kirov, and Kazan in Russia, and Anchorage, which have 60%, 59%, and 58% climatic match with Fairbanks, respectively. However, it appears to reach its physiological limit around Anchorage as it withstands winter temperatures to -33°F and requires 110 frost free days (USDA 2002). Fairbanks typically has 140 frost free days, but winter temperatures reach -60°F. It is therefore unlikely to establish in the Interior ecogeographic region.

In the Arctic-Alpine ecoregion, there is a high climatic match between Nome and areas where the species is documented such as Arkhangel'sk (76%) and Kirov (66%), Russia, (Hultén 1968). However, minimum temperatures are far too low and the number of frost free days is at the physiological limit of *Sorbus aucuparia*.

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

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

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.

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

5

Documentation:

Identify ecosystem processes impacted:

Stands of European mountain ash likely alter light and nutrient availability for other species (Conn – pers. com.).

Rational:

Sources of information:

Conn, J. Weed Scientist, USDA Agricultural Research Service PO Box 757200
Fairbanks, Alaska 99775 tel: (907) 474-7652; fax (907) 474-6184 – 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

5

Documentation:

Identify type of impact or alteration:

European mountain ash is able to integrate into largely undisturbed coastal rainforest communities and dominate, creating moderately dense crown canopy. When established at high densities it likely reduces structural complexity below it in Sitka Historical Park (M. Shephard - pers. com.).

Rational:

Sources of information:

Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Shephard, M., Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 202, Anchorage, Alaska 99503 Division. Tel: (907) 743-9454 - Pers. com.

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

5

Documentation:

Identify type of impact or alteration:

European mountain ash appears to outcompete red alder along shorelines (M. Shephard - pers. comm.). Produces significant reduction in the population size of one or more native species in the community (Jeff Conn pers. comm.). Hybridizes with native *Sorbus scopolina* and *S. sitchensis* (Pojar and MacKinnon 1994).

Rational:

Sources of information:

Conn, J., Ph.D., Weed Scientist, USDA Agricultural Research Service, P.O. Box 757200, Fairbanks, Alaska 99775-7200. Tel: (907) 474 2423. – Pers. com.

Pojar, J. and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia, and Alaska. B.C. Ministry of Forests and Lone Pine Publishing. Redmond, Washington. 527 pp.

Shephard, M., Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 202, Anchorage, Alaska 99503 Division. Tel: (907) 743-9454 - Pers. com.

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

7

Documentation:

Identify type of impact or alteration:

Fruits of European mountain ash are highly desirable to birds, so there is a potential for alterations in abundance and composition of avian fauna. There is also the possibility for competition with native plants for fruit dispersal.

Rational:

Sources of information:

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

Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Lapina I., Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2710 – Pers. obs.

Total Possible

40

Total

22

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):

Seeds of European mountain ash are numerous and small (125,000/lbs), with many thousands of seeds produced per plant per year (Granström 1987, USDA, NRCS 2002).

Rational:

Sources of information:

Granström, A. 1987. Seed viability of fourteen species during five years of storage in a forest soil. *Journal of Ecology*, 75, p.321-331.

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.

2.2. 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

3

Documentation:

Identify dispersal mechanisms:

Fruits of European mountain ash spread by birds, especially waxwings and thrushes (Gilman and Watson 1994, Dickinson and Campbell 1991).

Rational:

Sources of information:

Dickinson, T.A. and C.S. Campbell. 1991. Population structure and reproductive ecology in the Maloideae (Rosaceae). *Systematic Botany*, 16 (2): 350-362.

Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

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

3

Documentation:

Identify dispersal mechanisms:

European mountain ash is widely planted as an ornamental in southern and southeastern Alaska, where it has escaped (Hultén 1968, Welsh 1974). It has been reported to be spread as contaminant of horticultural stock (Hodkinson and Thompson 1997).

Rational:

Sources of information:

Hodkinson, D., K. Thompson. 1997. Plant dispersal: the role of man. *Journal of Applied Ecology*, 34: 1484-1496.

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

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

2.4. Allelopathic

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

Score

0

Documentation:

Describe effect on adjacent plants:

This species is not listed as an allelopathic (USDA, NRCS 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.

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

Documentation:

Evidence of competitive ability:

European mountain ash is able to compete with native species in undisturbed forest communities (Wisconsin DNR 2003).

Rational:

Sources of information:

Wisconsin Department of Natural Resources: abstract. Non-native plants. 2003. <http://www.dnr.state.wi.us>

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

Documentation:

Describe grow form:

European mountain ash tree can grow 25 – 40 feet high and form rounded open crown shading out other vegetation (USDA, NRCS 2002, Gilman and Watson 1994, Welsh 1974).

Rational:

Sources of information:

Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

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.

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

Documentation:

Describe germination requirements:
 Seeds of European mountain ash germinated well in experimental conditions of multiple years in moist soil (2 cm in soil, under moss/litter layer) in central Sweden then full light and 20° C (Granström 1987). Cold-stratification is necessary for germination (USDA 2002).
 Rational:

Sources of information:
 Granström, A. 1987. Seed viability of fourteen species during five years of storage in a forest soil. *Journal of Ecology* 75: 321-331.

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

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

Score

0

Documentation:
 Species:
 No other weedy *Sorbus* species are present.
 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 or wetland 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:
 European mountain ash is a species of forests and suburban habitats.
 Rational:

Sources of information:
 Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.
 Wisconsin Department of Natural Resources: abstract. Non-native plants. 2003. <http://www.dnr.state.wi.us>

Total Possible

25

 Total

14

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:
 European mountain ash is planted as an ornamental and tree of residential streets.
 Rational:
 Flowers, fruits, and fall leaves are showy. Successfully grown in urban areas where air

pollution, poor drainage, compacted soil, and drought are common.

Sources of information:

Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

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

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

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

3

Documentation:

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

European mountain ash invades forest communities in Wisconsin (Wisconsin Department of Natural Resources 2003). It has spread from Wrangell Island to Kadin Island and invades undisturbed coastal rainforest in Sitka Natural Historical Park, Alaska (M. Shephard, R. Lipkin - pers com.).

Sources of information:

Lipkin, R., Botanist, Alaska Natural Heritage Program, University of Alaska Anchorage, 707 A Street, Anchorage, Alaska. Tel: (907) 257-2785 – Pers. obs.

Shephard, M., Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 522, Anchorage, Alaska 99503 Division. Tel: (907) 743-9454 - Pers. com.

Wisconsin Department of Natural Resources: abstract. Non-native plants. 2003.

<http://www.dnr.state.wi.us>

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

2

Documentation:

Identify type of disturbance:

European mountain ash may occasionally establish in undisturbed areas. Cutting promotes resprouting and establishment. This species has intermediate shade tolerance (USDA 2002), so it is unlikely it will establish in late successional coastal rainforest communities without disturbance.

Rational:

Sources of information:

Wisconsin Department of Natural Resources: abstract. Non-native plants. 2003.

<http://www.dnr.state.wi.us>

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

3

Documentation:

Describe distribution:

European mountain ash is native of Europe (Spain to Balkans, north to British Isles/Nordic countries, and east to Ural Mountains), northern Africa, and western Asia. It has naturalized in 27 northern states, in many climatic areas, throughout moist cool regions of North America.

Rational:

Sources of information:

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

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.

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

4

Documentation:

Identify states invaded:

European mountain ash has naturalized in 27 northern states, in many climatic areas, throughout moist cool regions of North America. Species is not considered noxious in North America (Invaders Database System 2003, USDA, NRCS 2002).

Rational:

Sources of information:

Invaders Database System. The University of Montana. 2003. Montana Noxious Weed Trust Fund. Department of Agriculture. <http://invader.dbs.umt.edu/>

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

16

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:

The seeds remain viable in the soil for five years or more (Granström 1987).

Rational:

Sources of information:

Granström, A. 1987. Seed viability of fourteen species during five years of storage in a forest soil. *Journal of Ecology* 75: 321-331.

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:

European mountain ash resprouts after cutting (USDA, NRCS 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.

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:

Control measures for European mountain ash are largely untested. Management requires a major short-term investment, or moderate long-term investment (Jeff Conn – pers. com.).

Rational:

Sources of information:

Conn, J., Ph.D., Weed Scientist, USDA Agricultural Research Service, P.O. Box 757200, Fairbanks, Alaska 99775-7200. Tel: (907) 474 2423. – Pers. com.

Total Possible

10

Total

7

Total for 4 sections Possible

100

Total for 4 sections

59

References:

- Dickinson, T.A. and C.S. Campbell. 1991. Population structure and reproductive ecology in the Maloideae (Rosaceae). *Systematic Botany*, 16 (2): 350-362.
- Gilman, E.F. and D.G. Watson. 1994. *Sorbus aucuparia* European Mountain-Ash. Fact Sheet ST-599, Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.
- Granström, A. 1987. Seed viability of fourteen species during five years of storage in a forest soil. *Journal of Ecology*, 75, p.321-331.
- Hodkinson, D., K. Thompson. 1997. Plant dispersal: the role of man. *Journal of Applied Ecology*, 34: 1484-1496.
- Hultén, E. 1968. *Flora of Alaska and Neighboring Territories*. Stanford University Press, Stanford, CA. 1008 pp.
- Pojar, J., and A. MacKinnon. 1994. *Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia, and Alaska*. B.C. Ministry of Forests and Lone Pine Publishing. Redmond, Washington. 527 pp.
- Invaders Database System. The University of Montana. 2003. Montana Noxious Weed Trust Fund. Department of Agriculture. <http://invader.dbs.umt.edu/>
- University of Alaska Museum. University of Alaska Fairbanks. 2003. <http://hispidamuseum.uaf.edu:8080/home.cfm>
- 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.
- Welsh, S.L. 1974. *Anderson's flora of Alaska and adjacent parts of Canada*. Brigham University Press. 724 pp.
- Wisconsin Department of Natural Resources: abstract. Non-native plants. 2003. <http://www.dnr.state.wi.us>