Taxon: Sorbus aucuparia L. **Family:** Rosaceae

Common Name(s): quickbeam
rowan
rowan berry

Synonym(s): Sorbus kamtschatcensis Kom.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 16 Jun 2017

WRA Score: 8.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Temperate Tree, Ornamental, Pure Stands, Self-Incompatible, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation		
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence of domestication] "Native to Europe, the distribution of the rowan tree stretches from the UK and Ireland south to the mountains of Morocco (North Africa) and east to the Caucasus and Turkey (Asia Minor). It was introduced to the USA in colonial times and has also naturalized in Canada. "

102	Has the species become naturalized where grown?	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

Qsn #	Question	Answer
201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**Low**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Jun 2017]	"Distributional Range: Native: Africa Macaronesia: Portugal - Madeira Islands Asia-Temperate Caucasus: Armenia; Azerbaijan; Russian Federation - Dagestan; Russian Federation-Ciscaucasia - Ciscaucasia China: China - Heilongjiang, - Hebei, - Gansu, - Jilin, - Liaoning, - Shanxi, - Shandong, - Shaanxi, - Nei Monggol Eastern Asia: Korea Mongolia: Mongolia Russian Far East: Russian Federation - Khabarovsk, - Primorye, - Amur, - Kamchatka Siberia: Russian Federation - Buryatia, - Gorno-Altay, - Tuva, - Yakutia-Sakha, - Altay, - Krasnoyarsk, - Chita, - Irkutsk, - Kemerovo, - Kurgan, - Novosibirsk, - Omsk, - Tomsk, - Tyumen Western Asia: Turkey Europe Eastern Europe: Belarus; Russian Federation - Komi, - Perm; Russian Federation-European part - European part; Ukraine Middle Europe: Austria; Belgium; Czech Republic; Germany; Hungary; Netherlands; Poland; Slovakia; Switzerland Northern Europe: Denmark; Finland; Iceland; Ireland; Norway; Sweden; United Kingdom Southeastern Europe: Albania; Bosnia and Herzegovina; Bulgaria; Croatia; Greece; Italy; Macedonia; Montenegro; Romania; Serbia; Slovenia Southwestern Europe: France; Portugal; Spain"

202	Quality of climate match data	High
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Jun 2017]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Climatic amplitude (estimates) - Altitude range: 600 - 2100 m - Mean annual rainfall: 500 - 1350 mm - Rainfall regime: summer; bimodal - Dry season duration: 2 - 4 months - Mean annual temperature: -6 - 21ºC - Mean maximum temperature of hottest month: 23 - 31ºC - Mean minimum temperature of coldest month: -20 - 2ºC - Absolute minimum temperature: > -25ºC"
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	[Elevation range exceeds 1000 m] "Thickets, roadsides, woods, other habitats near towns, scattered in remote natural settings; –2100 m"

204	**Native or naturalized in regions with tropical or subtropical climates**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Jun 2017]	"Native: Africa Macaronesia: Portugal - Madeira Islands Asia-Temperate Caucasus: Armenia; Azerbaijan; Russian Federation - Dagestan; Russian Federation-Ciscaucasia - Ciscaucasia China: China - Heilongjiang, - Hebei, - Gansu, - Jilin, - Liaoning, - Shanxi, - Shandong, - Shaanxi, - Nei Monggol Eastern Asia: Korea Mongolia: Mongolia Russian Far East: Russian Federation - Khabarovsk, - Primorye, - Amur, - Kamchatka Siberia: Russian Federation - Buryatia, - Gorno-Altay, - Tuva, - Yakutia-Sakha, - Altay, - Krasnoyarsk, - Chita, - Irkutsk, - Kemerovo, - Kurgan, - Novosibirsk, - Omsk, - Tomsk, - Tyumen Western Asia: Turkey Europe Eastern Europe: Belarus; Russian Federation - Komi, - Perm; Russian Federation-European part - European part; Ukraine Middle Europe: Austria; Belgium; Czech Republic; Germany; Hungary; Netherlands; Poland; Slovakia; Switzerland Northern Europe: Denmark; Finland; Iceland; Ireland; Norway; Sweden; United Kingdom Southeastern Europe: Albania; Bosnia and Herzegovina; Bulgaria; Croatia; Greece; Italy; Macedonia; Montenegro; Romania; Serbia; Slovenia Southwestern Europe: France; Portugal; Spain Naturalized: Australasia New Zealand: New Zealand Northern America : Canada; United States"

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	"Thickets, roadsides, woods, other habitats near towns, scattered in remote natural settings; –2100 m; introduced; St. Pierre and Miquelon; Alta., B.C., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que., Sask.; Alaska, Calif., Colo., Conn., D.C., Idaho, Ill., Ind., Iowa, Maine, Md., Mass., Mich., Minn., Mont., Nebr., N.H., N.J., N.Y., N.Dak., Ohio, Oreg., Pa., R.I., S.C., S.Dak., Utah, Vt., Wash., W.Va., Wis., Wyo.; Eurasia; n Africa; Atlantic Islands (Iceland, Madeira); introduced also in Pacific Islands (New Zealand)" ... "Sorbus aucuparia is a commonly planted ornamental tree that is widely bird-disseminated.
	Skolmen, R.G. 1980. Plantings on the forest reserves of Hawaii: 1910–1960. Institute of Pacific Islands Forestry, Pacific Southwest Forest & Range Experiment Station, US Forest Service, Honolulu, HI	No records of plantings in Hawaiian Islands

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"It was introduced to the USA in colonial times and has also naturalized in Canada."
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Jun 2017]	"Naturalized: Australasia New Zealand: New Zealand Northern America : Canada; United States"
	Lediuk, K. D., Damascos, M. A., Puntieri, J. G., & de Torres Curth, M. I. (2016). Population dynamics of an invasive tree, Sorbus. Plant Ecology, 217(7), 899-911	"Sorbus aucuparia is a fleshy fruited tree recently established in temperate forests of northwestern Patagonia."
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2017. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/. [Accessed 15 Jun 2017]	No evidence in Hawaiian Islands to date

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"S. aucuparia is a pioneer species, which thrives in poor soils and colonizes disturbed areas." [A disturbance-adapted tree with negative environmental impacts]

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Alaska Exotic Plant Management Team. 2017. Invasive Plant Species in Alaska. http://www.nps.gov/akso/natres/epmt/. [Accessed 15 Jun 2017]	"Ecological Impact European mountain ash is able to integrate into coastal rainforest communities in southeast Alaska and dominate (e.g., Sitka National Historical Park). It has also been reported to invade forest communities in Wisconsin (WDNR 2003). Fruits are highly desirable to birds, suggesting the potential for alterations in abundance and composition of avian fauna (Gilman and Watson 1994). European mountain ash hybridizes with the native S. scopulina and S. sitchensis where their ranges overlap (Pojar and MacKinnon 1994)."

305	Congeneric weed	y
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Sorbus domestica. http://keyserver.lucidcentral.org. [Accessed 15 Jun 2017]	"Service tree (Sorbus domestica) is regarded as an environmental weed in the ACT."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	A number of Sorbus species are listed as naturalized and/or invasive

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	[No evidence] "Trees, 60–150 dm. Stems 1–3(or 4); bark gray to bronze; winter buds purple, ovoid to ovoid conic, 5–15 mm, dull, not glutinous, usually densely villous, hairs whitish, rarely rufous, <outer scales sometimes merely ciliate>. Leaves pinnately compound; stipules deciduous or persistent, whitish-villous or glabrate; blade paler or often whitish abaxially, dull green to bluish green adaxially, leaflets 11–17(–19), opposite, oblong to oblong-lanceolate or oblanceolate, (2. –)3–6(–7.5) × 1.5–2 cm, l/w ratio 2.4–3.7, margins serrate at least in distal 1/2, often almost to base, apex acute to obtuse, abaxial surface white-tomentose to villous at flowering, indument often persisting, at least along midveins, leaflet axils, and petiole bases, hairs usually whitish, sometimes rufous."

402	Allelopathic	
	Source(s)	**Notes**
	Bhattarai, T. (2005). Allelopathy: The Interaction Between Plants. Nepal Journal of Science and Technology, 6(1): 81-89	[Effects in field conditions unknown] "Parascorlnc acid extracted from the fruit of Sorbus aucuparia is inhibitory to seed germination and seedling growth."

403	Parasitic	n
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Slender tree up to 15(−20) m with narrow crown and usually erecto-patent branches; bark greyish and smooth" [Rosaceae. No evidence]

Qsn #	Question	Answer
404	**Unpalatable to grazing animals**	**n**
	Source(s)	**Notes**
	Hanelt, P. (ed.). 2001. Mansfeld's encyclopedia of agricultural & horticultural crops: (except ornamentals). Algae, Fungi, Pteridophyta, Gymnospermae, Angiospermae - Dicotyledones: Magnoliaceae - Chrysobalanaceae Vol. 1. Springer-Verlag, Berlin, Heidelberg, New York	"Widespread plantings along streets and roads, as wind protection, for recultivation of polluted forests and as fodder for game and birds."
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	[Browsed by several species] "Sorbus aucuparia is a stress-tolerant competitor (Grime et al. 1988). Nevertheless, its establishment in woodland, and presumably also in skeletal soils, appears to be adversely affected by the presence of grazing stock or game (McVear & Ratcliffe 1962; Pigott 1983; Hester et al. 1996; Linder et al. 1997). In Swedish boreal forest reserves, Linder et al. (1997) observed that S. aucuparia was the most numerous species in the seedling cohort, but was almost totally missing in the tree layer, because of high browsing pressure. After excluding sheep from hill pastures in North Wales, Hill et al. (1992) observed colonization by S. aucuparia along fences in some sites. Birds used fence posts as perches and must have introduced the seeds. Kinnaird et al. (1979) reported that, in a woodland in Aberdeenshire, as much as 99% of rowan trees was barked by beef cattle. On average 78% of the bark was removed. However, rowan is very tolerant to damage (Miller et al. 1982). "

405	Toxic to animals	n
	Source(s)	**Notes**
	Hanelt, P. (ed.). 2001. Mansfeld's encyclopedia of agricultural & horticultural crops: (except ornamentals). Algae, Fungi, Pteridophyta, Gymnospermae, Angiospermae - Dicotyledones: Magnoliaceae - Chrysobalanaceae Vol. 1. Springer-Verlag, Berlin, Heidelberg, New York	[No evidence] "Widespread plantings along streets and roads, as wind protection, for recultivation of polluted forests and as fodder for game and birds."

Qsn #	Question	Answer
406	**Host for recognized pests and pathogens**	**y**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"S. aucuparia is sensitive to most of the pests and diseases that plague the Rosaceae and is, therefore, not recommended for monoculture avenue plantings where a uniform effect is desired. Maintenance is needed to control insect and disease problems. It is susceptible to many pests including fireblight, sunscald, borers and frost cracking."
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Sorbus aucuparia is the primary host of Argyresthia conjugella Zell. This fruit moth is also known to infest apple fruits, but if a moth has the opportunity to choose between fruits of S. aucuparia and Malus spp., it will consistently choose the former (Ahlberg 1927). Sperens (1997b) has shown that in Sweden the number of fruits produced in a population determined the number of A. conjugella individuals in the same population. A. sorbiella (Treitschke) is strictly linked to S.aucuparia (Alford 1991). A race of Yponomeuta padellus (L.) infesting S. aucuparia has a local distribution (Alford 1991; Kooi et al. 1991)."

407	**Causes allergies or is otherwise toxic to humans**	
	Source(s)	**Notes**
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"(Leaves infusion taken as an emetic, for pneumonia, diphtheria, croup.)"
	Hanelt, P. (ed.). 2001. Mansfeld's encyclopedia of agricultural & horticultural crops: (except ornamentals). Algae, Fungi, Pteridophyta, Gymnospermae, Angiospermae - Dicotyledones: Magnoliaceae - Chrysobalanaceae Vol. 1. Springer-Verlag, Berlin, Heidelberg, New York	"Different non-bitter mutants had been selected for human consumption:"
	Plants for a Future. 2017. Sorbus aucuparia. http://www.pfaf.org/user/Plant.aspx?LatinName=sorbus+aucuparia. [Accessed 15 Jun 2017]	[Seeds potentially toxic] "Large quantities of the raw fruit can cause vomiting, especially if people are not used to the fruit. Seeds probably contain hydrogen cyanide. this is the ingredient that gives almonds their characteristic flavour. Unless the seed is very bitter it should be perfectly safe in reasonable quantities. In small quantities, hydrogen cyanide has been shown to stimulate respiration and improve digestion, it is also claimed to be of benefit in the treatment of cancer. In excess, however, it can cause respiratory failure and even death."

408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	Fitzgerald, S. and Waldo, A. J. 2001. Fire-Resistant Plants for Oregon Home Landscapes. Forest Resource Note No. 6. Oregon State University Extension Service, Redmond, OR	"Fire-Resistant Plant Materials for Oregon" [Sorbus aucuparia included in list of fire resistant plants]

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Not in fire prone habitats] "It is a typical tree of mountain areas from altitudes of 600 to 2100 m. Best adapted to cooler climates, it thrives in wet fields, near streams and swamps. Studies in Germany have shown that it occurs in the tree layer in a wide range of forest types at all altitudinal zones (to about 1600 m). In forests in north-western Germany it achieves its greatest height in submontane to montane sites, but the preference for high altitudes usually ascribed to S. aucuparia is probably attributable to reduced competition."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Lediuk, K. D., Damascos, M. A., Puntieri, J. G., & de Torres Curth, M. I. (2016). Population dynamics of an invasive tree, Sorbus. Plant Ecology, 217(7), 899-911	"Within its native distribution, S. aucuparia is very tolerant to shade at seedling and sapling stages but demands sunny conditions for flowering and fruiting (Raspe´ et al. 2000). This last also appears to be the case in the invaded areas of Argentina, where seedlings and saplings of S. aucuparia develop under lower light availability than reproductive individuals"
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	[Able to establish n shaded sites] "Sorbus aucuparia is considered as a heliophilous or semiheliophilous species (Rameau et al. 1989). Seedlings and saplings are very tolerant to shade, but light is required for flowering and fruiting"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"A range of diverse soil types and substrata are tolerated: sandy, loam or clay, but well-drained, acid soils are preferred. The tree prefers acid soils on hills and occurs more frequently on mountains. It requires adequate moisture and water during dry periods. It is not recommended for wet soils and is sensitive to pollution."

Qsn #	Question	Answer
411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Slender tree up to 15(−20) m with narrow crown and usually erecto-patent branches; bark greyish and smooth (Hedlund 1901; Hegi Fl. 4, ed. 2; Fl. Eur. 2; Fl. Br. Isl.; Rameau et al. 1989; Guendels 1990). Twigs pubescent when young, then glabrous and greyish-brown. Buds 10–15 mm, ovoid or ovoid-conic, dark brown, somewhat pubescent (Fl. Br. Isl.; Rameau et al. 1989). Leaves 10–25 cm, pinnate, with (4–)5–7(−9) pairs of leaflets (Hedlund 1901; Hegi Fl. 4, ed. 2; Fl. Eur. 2; Fl. Br. Isl.). Leaflets 2.5–6(−9) cm, oblong, acute or subacute, more or less rounded at the often somewhat unequal base, serrate, sometimes doubly so, dark green and glabrous above; subglaucous beneath and pubescent at first, especially on the midrib, usually becoming subglabrous (Hegi Fl. 4, ed. 2; Fl. Br. Isl.). Terminal leaflet more or less equalling the lateral (never larger) (Fl. Br. Isl.). Petiole 2–4 mm (Fl. Br. Isl.). Adaxial glands present on rachis (Robertson et al. 1992)."

412	**Forms dense thickets**	**y**
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Sorbus aucuparia has a maximum life span of 150 years (Grime et al. 1988). It is mostly disseminated, but can also occur in pure stands (McVean & Ratcliffe 1962; Kullman 1986)."

501	**Aquatic**	**n**
	Source(s)	**Notes**
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	[Terrestrial] "Thickets, roadsides, woods, other habitats near towns, scattered in remote natural settings; –2100 m"

502	**Grass**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Jun 2017]	Family: Rosaceae Subfamily: Amygdaloideae Tribe: Maleae Subtribe: Malinae

503	**Nitrogen fixing woody plant**	**n**
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	No evidence [Family: Rosaceae]

504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	"Trees, 60–150 dm."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "Native to Europe, the distribution of the rowan tree stretches from the UK and Ireland south to the mountains of Morocco (North Africa) and east to the Caucasus and Turkey (Asia Minor). It was introduced to the USA in colonial times and has also naturalized in Canada."
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 15 Jun 2017]	No evidence. Widely distributed

602	Produces viable seed	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"For propagation, it is advisable to harvest the berries a little before full ripening (September), because dormancy is strengthened in fruits that are too ripe. Seed can be sown in autumn in containers protected against rodents and birds, or in spring, but 2 months of pre-chilling at 2-4°C are needed."
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Sorbus aucuparia seeds are characterized by a deep and absolute dormancy, which has two components, an embryo dormancy and a dormancy imposed by the seed coat (Flemion 1931; Devillez 1979a,b,c; Devillez et al. 1980). Indeed, no germination of freshly collected seeds or excised embryos was observed after 1 month of incubation at 20 °C (Devillez 1979a,c; Barclay & Crawford 1984; Grime et al. 1988; Table 3). Dormancy breakdown involves complex processes concerning water intake and circulation, growth regulators and trophic relations (Devillez et al. 1980). The embryo dormancy could be related to an insufficient digestion of the perisperm by the cotyledons, and varies from year to year (Anonymous 1963; Devillez 1979c)."

603	Hybridizes naturally	y
	Source(s)	**Notes**
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	"Natural hybrids with S. decora have been reported by G. N. Jones (1939) (one fruiting specimen found near Opeongo Lake, Algonquin Park, Ontario), with Aronia arbutifolia [×Sorbaronia hybrida (Moench) C. K. Schneider; synonyms A. hybrida (Moench) Zabel, Sorbus spuria Persoon] in Truro, Nova Scotia, and also in Maine, New Hampshire, and Vermont (D. W. Magee and H. A. Ahles 1999), and with A. melanocarpa (×Sorbaronia fallax C. K. Schneider) in Maine and Massachusetts."

Qsn #	Question	Answer
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Sorbus aucuparia as well as S. torminalis (L.) Crantz, S. chamaemespilus (L.) Crantz and S. aria (L.) Crantz and their products form a hybrid complex (Proctor et al. 1989; Proctor & Groenhof 1992; Mikoláš 1995; see below)." ... "The hybrid S. aria × aucuparia=S. × thuringiaca (Ilse) Fritsch occurs very rarely as a single tree with the parents but is sometimes planted (Hedlund 1901; Fl. Br. Isl.; Mikoláš 1995). Leaves 7–11 cm, more or less oblong, 1.6–2.3 times as long as broad, mostly with 1–3 pairs of free leaflets at the base but on some trees many of the leaves are lobed nearly to the base but without free leaflets, upper part with more or less oblong lobes, serrate, obtuse, dull green and glabrous above, greenish-grey-tomentose beneath. Veins (including free leaflets) 10–12 pairs; petiole 1.5–3 cm. Inflorescence woolly pubescent. Petals 4–6 mm. Anthers cream, more rarely pink. Styles 2–3. Fruit 8–10 mm, subglobose, scarlet, with few inconspicuous lenticels. This fertile hybrid shows marked segregation from seed but F2 plants have not been found wild in England (Fl. Br. Isl.)."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	[Largely self-incompatible] "Proctor & Yeo (1973) the convergence of stamens causes self-pollination. However, it is doubtful whether this phenomenon represents an adaptation to pollination in the absence of active pollinators, since Raspé (1998) has shown the species to be self-incompatible" ... "Cross pollination significantly increased the fruit set as well as extra pollen vs. open pollinations (Table 2). Since virtually no fruit set (and very low fruit initiation) occurred after self-pollination, Raspé (1998) concluded that this species is self-incompatible. Self-incompatibility in S. aucuparia is probably of the gametophytic type, as in Pyrus serotina (Sassa et al. 1992) or Malus × domestica (Sassa et al. 1994; Broothaerts et al. 1995). Indeed, the self-incompatibility system is often conserved within a family (de Nettancourt 1977) and the Maloideae are generally considered to form a homogenous phylogenetic group. Sperens (1996) reported that S. aucuparia was only partly self-incompatible in his study sites, near Umeå (Sweden). However, he observed a fruit : flower ratio five times larger and a seed : ovule ratio two times larger in cross-pollinated inflorescences compared to self-pollinated inflorescences. This might indicate that the self-incompatibility mechanism is functional but weakened (Bixby & Levin 1996)."

605	Requires specialist pollinators	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Percival (1965) considered the species as a short-tongued fly flower because it is shallow, with accessible nectar and massed flattish inflorescences. Indeed, Raspé (1998) reported that in the upper Ardenne (Belgium), the flowers are visited principally by Diptera (87–89%); and particularly by Syrphidae (24–40% of the Diptera) and Empididae (16–42% of the Diptera). Some Apidae (bumblebees and honeybees, 6–7%) were also observed. Faegri & van der Pijl (1979) noted Coleopterans as the principal pollinators. Proctor & Yeo (1973) recorded various insect visitors. The flowers have been noted in the English Lake District attracting exclusively large numbers of blow-flies (Calliphora spp.). However, the recorded visitors are of many species and include beetles (several families), flies (several families), bees (social and solitary) and other Hymenoptera, Lepidoptera, etc. Both nectar and pollen are taken and some of the beetles eat parts of the flowers as well (Proctor & Yeo 1973; Raspé 1998). Proctor et al. (1996) also noted Dilophus febrilis (Diptera, Bibionidae) on the flowers."
	Janick, J.& Paull, R.E. 2008. The Encyclopedia of Fruit & Nuts. CABI Publishing, Wallingford, UK	"The flowers attract many pollinating insects such as bees and beetles."

606	Reproduction by vegetative fragmentation	
	Source(s)	**Notes**
	Alaska Exotic Plant Management Team. 2017. Invasive Plant Species in Alaska. http://www.nps.gov/akso/natres/epmt/. [Accessed 15 Jun 2017]	"European mountain ash is a perennial tree that grows rapidly and establishes by seeds, cuttings, or bare root propagation, but it does not spread vegetatively (GRIN 2004)."
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Lateral clonal spread of up to 5 m from root suckering has occasionally been recorded (Kullman 1986)."
	WRA Specialist. 2017. Personal Communication	Possible, but limited. See Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Seed bearing begins at about 15 years of age. The tree bears a good seed crop almost annually, with light crops in intervening years (Anonymous 1963). Wallenius (1999) reported that, in Finland, annual fruit yield correlated negatively with the previous year yield (data from 1956 to 1996)."
	Lediuk, K. D., Damascos, M. A., Puntieri, J. G., & de Torres Curth, M. I. (2016). Population dynamics of an invasive tree, Sorbus. Plant Ecology, 217(7), 899-911	"The minimum reproductive age was 10 years, and all reproductive individuals were located in high light conditions."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	[No means of external attachment] "Birds are the main seed dispersers (see IX), but mammals play also a role (Snow & Snow 1988). A mean diameter of about 9 mm allows the fruits to be swallowed whole by all except the smallest frugivores. Warblers may be able to swallow the smaller fruits whole but cannot swallow full-sized ones (Snow & Snow 1988). Where suitable habitats are adjacent to mountain streams, the seeds are also dispersed by water (Disp. Pl.)."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Animals, Flyers, Goat, Livestock, Water, Escapee"
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	"Sorbus aucuparia is a commonly planted ornamental tree that is widely bird-disseminated."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Seed bearing begins at about 15 years of age." [No evidence. Unlikely given long time to maturity & bird-dispersed seeds]

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Birds are the main seed dispersers (see IX), but mammals play also a role (Snow & Snow 1988). A mean diameter of about 9 mm allows the fruits to be swallowed whole by all except the smallest frugivores. Warblers may be able to swallow the smaller fruits whole but cannot swallow full-sized ones (Snow & Snow 1988). Where suitable habitats are adjacent to mountain streams, the seeds are also dispersed by water (Disp. Pl.)."

705	Propagules water dispersed	y
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Where suitable habitats are adjacent to mountain streams, the seeds are also dis- persed by water (Disp. Pl.)."

706	Propagules bird dispersed	y
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Birds are the main seed dispersers (see IX), but mammals play also a role (Snow & Snow 1988). A mean diameter of about 9mm allows the fruits to be swallowed whole by all except the smallest frugivores. Warblers may be able to swallow the smaller fruits whole but cannot swallow full-sized ones (Snow & Snow 1988)."

Qsn #	Question	Answer
	Paulsen, T., & Högstedt, G. (2002). Passage through Bird Guts Increases Germination Rate and Seedling Growth in Sorbus aucuparia. Functional Ecology, 16(5), 608-616	"On the west coast of Norway, Turdus spp. (Thrushes) are important dispersal agents of Sorbus aucuparia L. (Rowan) seeds, and avian and mammalian gut treatment often alters seed germination characteristics."
	Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford	"Pomes yellow or orange-red to red, globose to subglobose, 8–12 mm diam., shiny or dull, <slightly glaucous or not>; sepals inconspicuous, incurved. Seeds brown, ovoid to ovoid lanceoloid, 3–4.5 × 1.5–2 mm, asymmetric, slightly flattened." ... "Sorbus aucuparia is a commonly planted ornamental tree that is widely bird-disseminated." ...
	Janick, J.& Paull, R.E. 2008. The Encyclopedia of Fruit & Nuts. CABI Publishing, Wallingford, UK	"The bright orange to red berries ripen between August and October and attract birds such as thrushes."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Birds are the main seed dispersers (see IX), but mammals play also a role (Snow & Snow 1988). A mean diameter of about 9 mm allows the fruits to be swallowed whole by all except the smallest frugivores. Warblers may be able to swallow the smaller fruits whole but cannot swallow full-sized ones (Snow & Snow 1988). Where suitable habitats are adjacent to mountain streams, the seeds are also dispersed by water (Disp. Pl.)."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Paulsen, T., & Högstedt, G. (2002). Passage through Bird Guts Increases Germination Rate and Seedling Growth in Sorbus aucuparia. Functional Ecology, 16(5), 608-616	"The present study shows that, in addition to seed dispersal, at least for S. aucuparia, avian gut treatment is also advantageous to seedling growth for several reasons."

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Alaska Exotic Plant Management Team. 2017. Invasive Plant Species in Alaska. http://www.nps.gov/akso/natres/epmt/. [Accessed 15 Jun 2017]	"Seeds are numerous and tiny, with many thousands of seeds produced per plant each year."
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"The ripe fruit contains a variable number of rather soft, small seeds (Hegi Fl. 4, ed. 2; Iketani & Ohashi 1991). Usually 1–5 full-sized seeds are produced per fruit, but we observed up to 8 seeds in a 4-celled pome (i.e. all ovules gave rise to a seed). Fresh weight of fruit averaged 0.4 –0.49 g (Herrera 1987; Snow & Snow 1988) or 0.20–0.68 g (Kutsko et al. 1982) and dry weight averaged 114 mg (Herrera 1987). Seed dry weight ranged from 1.15 mg to 4.14 mg (Barclay & Crawford 1984; given as 2.58 mg by Grime et al. 1988; 1.4 mg by Herrera 1987); seed fresh weight averaged 8.2 mg (Snow & Snow 1988). The seed 'burden' (seed as a percentage of the total fruit weight) is unusually low, averaging 3.4%."

Qsn #	Question	Answer
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y**
	Source(s)	**Notes**
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"No persistent seed bank has been detected within the Sheffield region (Grime et al. 1988) but Hill (1979) suggested that seeds have considerable longevity in the soil. This observation, if confirmed, would make S. aucuparia the only tree in the British flora characterized by a long persistent seed bank."
	Alaska Exotic Plant Management Team. 2017. Invasive Plant Species in Alaska. http://www.nps.gov/akso/natres/epmt/. [Accessed 15 Jun 2017]	"Seeds have a strong innate dormancy that lifts gradually over a few years, and they remain viable in the soil for 5 years or more (Granström 1987)."
	Granstrom, A. (1987). Seed Viability of Fourteen Species During Five Years of Storage in a Forest Soil. Journal of Ecology, 75(2), 321-331	"Three others had a strong innate dormancy which was gradually lifted within a few years, resulting in a high degree of germination in the soil: Prunus padus was eliminated within three years but a fraction of Sorbus aucuparia and Trientalis europaea remained viable after five years." ... "A proportion of the seeds of Betula pendula, Sorbus aucuparia, Vaccinium myrtillus and V. vitis-idaea had their seed coats partly degraded after five years in the soil, although this had not affected the viability of the seeds."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	Alaska Exotic Plant Management Team. 2017. Invasive Plant Species in Alaska. http://www.nps.gov/akso/natres/epmt/. [Accessed 15 Jun 2017]	"It has the ability to resprout after cutting. Frill methods—application of herbicide to exposed cambium—or felling the tree and applying herbicide to cut stumps to prevent resprouting should be effective. Use herbicides labelled for frill application only."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	Alaska Exotic Plant Management Team. 2017. Invasive Plant Species in Alaska. http://www.nps.gov/akso/natres/epmt/. [Accessed 15 Jun 2017]	"Control measures for European mountain ash are largely untested. It has the ability to resprout after cutting."
	Raspe, O., Findlay, C., & Jacquemart, A. L. (2000). Sorbus aucuparia L. Journal of Ecology, 88(5), 910-930	"Some regeneration occurs by epicormic shoots, particularly at high altitude where viable seeds are seldom produced, or in response to grazing or coppicing (Barclay & Crawford 1984; Kullman 1986). Lateral clonal spread of up to 5 m from root suckering has occasionally been recorded (Kullman 1986). In cuttings taken from 2- to 3-year-old coppice shoots, 38% rooted and rooting was improved by a basal dip in indolebutyric acid (Hansen 1990)."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m, demonstrating environmental versatility
• Naturalized in Canada, New Zealand, Patagonia, Alaska & possibly elsewhere
• Controlled as an environmental weed in Alaska
• Other Sorbus species are invasive
• Host for pests and pathogens of Rosaceae
• Seeds may be toxic
• Tolerates many soil types
• Seedlings and sapling are shade tolerant
• Capable for forming pure stands
• Reproduces by seeds
• Hybridizes with other Sorbus species
• Seeds dispersed by birds, mammals, water & intentionally by people
• Seeds may persist in soil for 5 years
• Able to coppice & resprout after cutting

Low Risk Traits
• From cooler, temperate climates. May only be invasive at higher elevations of tropical environments
• Unarmed (no spines, thorns, or burrs)
• Palatable to browsing animals
• Ornamental
• Self-incompatible
• Vegetative spread may be limited to a few suckers
• Reaches maturity in 10+ years