Taxon: Marrubium vulgare **Family:** Lamiaceae

Common Name(s): horehound
white horehound

Synonym(s):

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 8 Jan 2016

WRA Score: 17.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Perennial Herb, Agricultural Weed, Unpalatable, Dense Cover, Animal-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)	Intermediate
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	y
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)	y
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	y
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

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		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
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	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	n
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**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	No evidence

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**Intermediate**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Jan 2016]	"Native: Africa Macaronesia: Portugal - Madeira Islands; Spain - Canary Islands Northern Africa: Algeria; Libya; Morocco; Tunisia Asia-Temperate Caucasus: Armenia; Azerbaijan; Russian Federation-Ciscaucasia - Ciscaucasia China: China - Xinjiang Middle Asia: Kazakhstan; Turkmenistan; Uzbekistan Western Asia: Afghanistan; Cyprus; Iran; Israel; Jordan; Lebanon; Syria; Turkey Asia-Tropical Indian Subcontinent: Pakistan Europe East Europe: Belarus; Estonia; Latvia; Lithuania; Russian Federation-European part - European part; Ukraine Middle Europe: Austria; Belgium; Czechoslovakia; Hungary; Netherlands; Poland; Switzerland Northern Europe: Denmark; Sweden; United Kingdom - England Southeastern Europe: Albania; Bulgaria; Former Yugoslavia; Greece; Italy; Romania Southwestern Europe: France; Portugal; Spain"

Qsn #	Question	Answer
202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Jan 2016]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Horehound is drought-tolerant, occurring in areas that receive a minimum of 200 mm annual rainfall. It is frostresistant, but is susceptible to fire and waterlogging."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Elevation range exceeds 1000 m, demonstrating environmental versatility] "in Hawai'i naturalized and locally common in dry, disturbed sites, 150-1,920 m, on Lana'i and Hawai'i."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized and locally common in dry, disturbed sites, 150-1,920 m, on Lana'i and Hawai'i."
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"It has become a weed in southern USA, including California and Texas, in South America (Argentina, Chile, Peru, Uruguay), New Zealand and Australia."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"M. vulgare is native to North Africa, Europe and parts of Asia, and has been introduced to Japan, southern Africa, the Americas, Australia and New Zealand."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Eurasia, now very widely naturalized"

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Eurasia, now very widely naturalized; in Hawai'i naturalized and locally common in dry, disturbed sites, 150-1,920 m, on Lana'i and Hawai'i. First collected on Lana'i in 1913 [Forbes 289.L (coli. G. Munro), BISH"

302	Garden/amenity/disturbance weed	

Qsn #	Question	Answer
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[A weed of disturbed sites with negative impacts on agriculture and the natural environment] "It tends to invade land that has been disturbed, overgrazed or previously grazed by sheep."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Grazing animals avoid M. vulgare if alternative food is available because of the bitter alkaloid, marrubin, contained in the leaves (Everist 1981). M. vulgare decreases pasture productivity and reduces the value of wool fleece contaminated with the hooked burrs. The cost of horehound in the contamination of wool has been estimated at 1.5–3.4%, thereby reducing the price of the wool by 20.3 cents per kilogram compared to clean wool – an annual loss in SA of up to $52 700 per year (Carter, pers. comm. 1998). The overall cost of M. vulgare to Australian wool producers in 1985–86 was estimated to be $A680 000 per year (Sloan et al. 1988)."

304	Environmental weed	y
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"A native of dry grassland and open places, this drought tolerant plant forms dense and pure stands where invasive that may extend over large areas. These stands reduce native species richness and alter the community structure. Establishment and growth of tree and shrub seedlings is strongly reduced in invaded areas"
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"In Australia, M. vulgare is regarded as an environmental weed in Victoria, South Australia and Tasmania, since it invades native vegetation there (Weeds of Australia, 2013). It can invade open bushland such as red gum, dry coastal vegetation, mallee shrubland, lowland grassy woodlands, black box woodlands, open grasslands and rocky outcrops, especially where areas have been disturbed, overgrazed or previously grazed by sheep (Weiss et al., 2013). M. vulgare does not appear to invade undisturbed native vegetation. Its unpalatability to livestock means that it is ignored in favour of other pasture species, giving it a big competitive advantage (Weiss et al., 2000). In California, M. vulgare is less invasive on the mainland than it is on offshore islands like the Channel Islands and Catalina Island, where it forms small to large dense patches with greater than 75% cover, excluding native vegetation and altering grassland structure (Knapp and DiTomaso, 2005). On the mainland it rarely forms dense patches but can become especially common in overgrazed areas."
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"In certain situations, M. vulgare directly threatens native plants. In Vic, the endangered marble daisy bush, Olearia astroloba Lander & N.G. Walsh (Asteraceae) is at risk from horehound invasion (Carter and Walsh 2006)."

305	Congeneric weed	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	The following taxa are listed as naturalized and/or weeds: Marrubium alternidens, Marrubium alysson, Marrubium anisodon, Marrubium cuneatum, Marrubium globosum, Marrubium incisum, Marrubium x paniculatum, Marrubium parviflorum, Marrubium peregrinum, Marrubium pestalozzae, Marrubium radiatum, Marrubium x remotum, Marrubium supinum

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence] "Perennial herbs from a stout taproot; stems usually several, ascending to nearly erect, 3-10 dm long, conspicuously white woolly pubescent. Leaves elliptic to ovate-orbicular, 3-7 cm long, 1-4 cm wide, white woolly pubescent, especially on lower surface, margins crenate-dentate, apex obtuse to rounded, base very broadly cuneate to truncate or subcordate, petioles 1-2 cm long."

402	Allelopathic	
	Source(s)	**Notes**
	Lovett, J. V., & Weerakoon, W. L. (1983). Weed characteristics of the Labiatae, with special reference to allelopathy. Biological Agriculture & Horticulture, 1(2), 145-158	"Food-tainting weeds Marrubium vulgare (Horehound) produces taints and affects the quality of meat {Whittet, 1968)" [No mention of allelopathy of M. vulgare in this publication]
	Sas-Piotrowska, B., & Piotrowski, W. (2010). Vitality and healthiness of barley (Hordeum vulgare L.) seeds treated with plant extracts. Journal of Plant Protection Research, 50(1), 117-124	[M. vulgare extracts enhanced germination of barley seeds] "The most favourable impact on viability of the seeds of common barley was revealed for infusions from roots of L. officinale, from stigmas of Zea mays, from flowers of C. oxyacantha and macerations from flowers of Lavandula vera, from leaves of Mentha piperita and from roots of L. officinale. A positive effect on the germination capacity was exerted by infusions from the stigmas of Z. mays, from flowers of C. oxyacantha, from rhizomes of Acorus calamus, from bark of Frangula alnus, and macerations from bark of F. alnus, from leaves of M. piperita, from flowers of C. oxyacantha and from herb of Marrubium vulgare."

403	Parasitic	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs from a stout taproot" [Lamiaceae. No evidence]

404	Unpalatable to grazing animals	y
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Grazing animals avoid M. vulgare if alternative food is available because of the bitter alkaloid, marrubin, contained in the leaves (Everist 1981)."

Qsn #	Question	Answer
	Weiss, J., Sagliocco, J. L., & Wills, E. (2000). Horehound (Marrubium vulgare): a comparison between European and Australian populations. Plant Protection Quarterly, 15 (1): 18-20	"Horehound leaves contain marrubin, a bitter alkaloid, which makes it unpalatable for grazing animals."
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"In Australia, M. vulgare has been a declared noxious plant in parts of New South Wales, South Australia, Tasmania, Victoria and Western Australia. Plants are bitter and not preferentially eaten by livestock. Besides the plants taking up space which could be occupied by productive and palatable pasture species, M. vulgare fruits reduce the value of sheep's wool (Weiss et al., 2000)."
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Livestock avoid consuming the bitter-tasting foliage, and the plant thrives in the absence of competition with other vegetation." ... "Sheep will feed on horehound, but it is not preferred forage. Intensive grazing may open up the ground for the plant to spread."

405	Toxic to animals	n
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	[Bitter, but not reported to be toxic] "Grazing animals avoid M. vulgare if alternative food is available because of the bitter alkaloid, marrubin, contained in the leaves (Everist 1981)."
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Non-toxic, but unpalatable & can taint flavor of animals that consume it] "M. vulgare apparently has a bitter taste, caused by the alkaloid marrubin, so that it is not normally palatable to livestock although, if hungry, sheep will graze it. However, the meat of animals forced to eat it is tainted by the strong flavour and odour, and it takes about 7 days' grazing on clean pasture for the taint to be lost (Parsons and Cuthbertson, 1992)."

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	Malcolm, G. M., Kuldau, G. A., Gugino, B. K., & Jiménez-Gasco, M. D. M. (2013). Hidden host plant associations of soilborne fungal pathogens: an ecological perspective. Phytopathology, 103(6), 538-544	"Many soilborne fungal pathogens are known to cause disease on a large number of crop plants, including a variety of important agronomical, horticultural, ornamental, and forest plants species. For instance, the fungus Verticillium dahliae causes disease on >400 host plants." ... "TABLE 1. Agricultural crops and common weed plant species found in endophytic relationships with Verticillium dahlia" [Includes Marrubium vulgare]
	Barton, B. & Drost, D. 2008. Horehound in the Garden. Utah State University Cooperative Extension, Logan, UT. https://extension.usu.edu/. [Accessed 8 Jan 2016]	"Pests and Disease: Horehound is not susceptible to many diseases or insects problems."
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	Not listed among impacts

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	[Numerous medicinal uses listed] "(Plant expectorant, diaphoretic, diuretic, febrifuge, emmenagogue, tonic, used in candies for coughs, colds and sore throat, and as a laxative when taken in large doses. Fresh plant infusion or decoction taken in malaria. Bitter dried herb infusion for debility and cold s, prolonged use can contribute to high blood pressure, a weak tea relieves stomachache and colic. Flowers, leaves and stems infusion pectoral , stomachic, for diabetes, cardiac troubles; powdered leaf a mild disinfectant; paste of leaves applied for boils and rheumatism.)"
	The Herbal Resource. 2016. White Horehound Herb – Side Effects and Health Benefits. http://www.herbal-supplement-resource.com/white-horehound-herb.html. [Accessed 8 Jan 2016]	[Potential problem to susceptible individuals] "The fresh plant has been known to cause skin rash in sensitive people. Dust from the dried herb can irritate the airways, so it might be a good idea to use a face-mask when processing the plant."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Not described as a fire hazard, but dense cover may increase fuel load & carry fires in dry or fire prone habitats] "It can form large dense patches with greater than 75% cover, excluding native vegetation and altering grassland structure." ... "Fire kills all mature plants as well as reducing the soil seed bank by up to 80% (Weiss et al., 2000)."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	**Notes**
	Barton, B. & Drost, D. 2008. Horehound in the Garden. Utah State University Cooperative Extension, Logan, UT. https://extension.usu.edu/. [Accessed 8 Jan 2016]	"Horehound does best in full sun and sandy well drained soil."
	Plants for a Future. 2016. Marrubium vulgare. http://www.pfaf.org/user/Plant.aspx?LatinName=Marrubium+vulgare. [Accessed 8 Jan 2016]	"requires a warm sunny position"
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Areas with high light intensity] "in Hawai'i naturalized and locally common in dry, disturbed sites,"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Texas AgriLife Research and Extension. 2016. Common Horehound. Texas A&M AgriLife Extension Service, Uvalde, TX. http://uvalde.tamu.edu/herbarium/forbs-common-name-index/common-horehound/. [Accessed 8 Jan 2016]	"Common Horehound is a weedy pest that can be seen growing in various soils types of the South Texas Plains and Edwards Plateau."
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"It grows generally on alkaline and very poor soils and is an early coloniser of eroded areas, roadsides, channel banks, sheep camps, rabbit warrens and other disturbed sites, from which it encroaches into bushland and adjoining farmland."

Qsn #	Question	Answer
	Barton, B. & Drost, D. 2008. Horehound in the Garden. Utah State University Cooperative Extension, Logan, UT. https://extension.usu.edu/. [Accessed 8 Jan 2016]	"Soils: Horehound grows in most soils types especially poor, dry and neglected soils."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs from a stout taproot; stems usually several, ascending to nearly erect, 3-10 dm long, conspicuously white woolly pubescent."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"A native of dry grassland and open places, this drought tolerant plant forms dense and pure stands where invasive that may extend over large areas. These stands reduce native species richness and alter the community structure. Establishment and growth of tree and shrub seedlings is strongly reduced in invaded areas"

501	Aquatic	n
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Terrestrial herb] "Dry forests, scrub- and woodland, arid rangelands, disturbed sites."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Jan 2016]	"Family: Lamiaceae (alt.Labiatae) Subfamily: Lamioideae"

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 7 Jan 2016]	Lamiaceae

Qsn #	Question	Answer
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs from a stout taproot" [No bulbs, corms or tubers, but taproot may enable plants to persist]

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence. Widespread native & introduced range] "M. vulgare is native to North Africa, Europe and parts of Asia, and has been introduced to Japan, southern Africa, the Americas, Australia and New Zealand."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Horehound reproduces from seed and, while some germination can occur throughout winter and spring whenever sufficient water is available, most germination occurs in response to autumn rainfall (Lippai et al. 1996)."

603	**Hybridizes naturally**	**y**
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Overseas, M. vulgare can hybridise with M. supinum L., which is sometimes found in herb gardens in Australia."

604	**Self-compatible or apomictic**	
	Source(s)	**Notes**
	Plants for a Future. 2016. Marrubium vulgare. http://www.pfaf.org/user/Plant.aspx?LatinName=Marrubium+vulgare. [Accessed 7 Jan 2016]	"The plant is self-fertile."

605	**Requires specialist pollinators**	**n**
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Horehound, as with most members of the Lamiaceae (mint) family, is primarily bee-pollinated."
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"M. vulgare is primarily pollinated by honey bees (Apis mellifera)."

606	**Reproduction by vegetative fragmentation**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Reproduces by seed."

607	Minimum generative time (years)	1
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Plants may or may not flower in their first year, depending mainly on soil fertility. Established plants flower over several summer months and new growth is produced each year in autumn and spring."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Parsons and Cuthbertson (1992) suggested that many of the present infestations in Australia began in farm gardens, often when the house was abandoned, but also from dumped cuttings and garden refuse." ... "As in Australia, in the USA M. vulgare has been distributed throughout regions where sheep are raised (Stritzke, 1975). There it is found along fencelines from where it spreads into adjacent rangeland."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Its historical use as a medicinal herb in tea, sweets and liqueurs and as a garden herb almost certainly led to its spread to the Americas, Australia and New Zealand in the 1800s."
	Outsidepride.com. 2016. Horehound Seeds. http://www.outsidepride.com/seed/flower-seed/horehound-flower-seed.html. [Accessed 7 Jan 2016]	[This and other websites sell M. vulgare seeds over the internet] "Horehound (Marrubium Vulgare) - You can grow Horehound seeds and use the perennial herb plant in your own soothing teas, or if you are adventurous, in your own homemade candy."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	**y**
	Source(s)	**Notes**
	Queensland Government. 2011. Weeds of Australia - Marrubium vulgare. http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Marrubium_vulgare.htm. [Accessed 8 Jan 2016]	"These fruit readily attach to animals, vehicles, and clothing and are also dispersed in water and contaminated agricultural produce."
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[Wool contaminant] "The fruit or burr readily attaches to fur or wool or clothing and can in this way be spread by sheep (Ovis ovis), rabbits (Oryctolagus cuniculus), kangaroos (Macropus spp.) and emus (Dromaius novaehollandiae) (Weiss et al., 2000) and in North America by bison (Bison bison) (Gastineau, 2012). Shimwell (2006) lists it as a 'wool alien' in Britain."

704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Nutlets ovoid, ca. 2 mm long, smooth."

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Water is an effective dispersing agent for the seeds. Plants can be found along water supply channels (Weiss et al., 2000)."

706	**Propagules bird dispersed**	**n**
	Source(s)	**Notes**
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Fruits disperse with water, soil movement, mud, and human activities and by clinging to animals, the shoes and clothing of humans, and vehicle tires." [No evidence of bird dispersal]
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Potentially externally dispersed. Not fleshy-fruited or adapted for consumption by birds] "Fruits disperse primarily by falling to the ground beneath the parent plants, but long distance dispersal can occur when seeds cling to the fur, feathers, and feet of animals or to the shoes and clothing of people."

707	**Propagules dispersed by other animals (externally)**	**y**
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	"Grazing animals contribute to seed dispersal via the movement of burrs and seeds attached to their fleece."

Qsn #	Question	Answer
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"The fruit or burr readily attaches to fur or wool or clothing and can in this way be spread by sheep (Ovis ovis), rabbits (Oryctolagus cuniculus), kangaroos (Macropus spp.) and emus (Dromaius novaehollandiae) (Weiss et al., 2000) and in North America by bison (Bison bison) (Gastineau, 2012). Shimwell (2006) lists it as a 'wool alien' in Britain."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Horses (Equus ferus caballus) are known to eat M. vulgare and pass viable seeds in their faeces (Weiss et al., 2000)."
	St John-Sweeting, R. S., & Morris, K. A. (1991). Seed transmission through the digestive tract of the horse. In Proceedings of the 9th Australian Weeds Conference. Adelaide, South Australia. Weed Management Society of Australia (pp. 170-172).	"Table 1. Viability of seed before and after transmission though the digestive tract of the horse and mean total seed transmission as a % of ingested seed, over 13 days after ingestion." [mean total seed transmission of horehound seeds = 1.4%]

801	Prolific seed production (>1000/m2)	y
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Mature plants can produce in excess of 20,000 seeds a year, and seeds can survive in the soil for 7-10 years (Weiss et al., 2000)."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Mature plants can produce in excess of 20,000 seeds a year, and seeds can survive in the soil for 7-10 years (Weiss et al., 2000)."
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Populations can develop a large seedbank."
	Royal Botanic Gardens Kew. (2016) Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/. [Accessed 8 Jan 2016]	"Storage Conditions: Viability is halved following 3 years open storage at room temperature (Ewart, 1908); long-term storage under IPGRI preferred conditions at RBG Kew, WP. Oldest collection3 years"

803	Well controlled by herbicides	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Although selective herbicides that can be used in grass/legume pastures are few – according to Parsons and Cuthbertson (1992) MCPA is less damaging than 2,4-D to sown legumes – a number of herbicides are effective for treating individual plants or small patches. These include 2,4-D, MCPA, amitrole T, dicamba (with or without 2,4-D and MCPA), glyphosate, triclopyr and terbutryn. Diuron can be used to control seedlings in cereal crops if applied when the crop is in the 2- to 5-leaf stage. Weiss et al. (2000) added bromacil, bromacil + trichloroacetic acid, diflufenican and metribuzin to this list."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"An effective herbicide is 2,4-D ester"

804	Tolerates, or benefits from, mutilation, cultivation, or fire	n
	Source(s)	**Notes**
	CABI, 2016. Marrubium vulgare. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Isolated plants or very small infestations of M. vulgare should be pulled and burnt before flowering and the area checked for seedlings (Parsons and Cuthbertson, 1992). When the species is more densely established, the area should be burnt to destroy existing plants and stimulate seeds to germinate, and then ploughed, preferably in summer. Further cultivation must be repeated when germination occurs. Cultivation should be followed by the sowing of a crop or pasture appropriate for the local area. Any surviving or newly emerged plants of M. vulgare should be sprayed. Fire kills all mature plants as well as reducing the soil seed bank by up to 80% (Weiss et al., 2000)."
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Manual removal or cultivation can control white horehound. Partially buried plants can survive. Burning can kill mature plants, and it usually stimulates seed germination the following season."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	**Notes**
	Julien, M., McFadyen, R. & Cullen, J. (eds.). (2012). Biological Control of Weeds in Australia. CSIRO Publishing, Melbourne	[Effective biocontrol agents introduced into Australia] "Horehound is a widespread weed in southern Australia. In 1990, a 10-year biocontrol program (six years exploration and host-specificity testing and four years mass-rearing and releasing) was initiated. Two moths were found to be host-specific and released across the south-eastern states. The defoliator horehound plume moth is now widely distributed at over 100 sites and in moderate- to high-rainfall areas is having a suppressing effect on the weed and reducing seed production. The root-boring horehound clearwing moth has been released at fewer sites in Vic, SA and NSW. It appears to be well established and is increasing the mortality of plants at those sites. Two other insects have been identified as potential agents."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m, demonstrating environmental versatility
• Naturalized in areas with tropical climates
• Widely naturalized, including Hawaii and Lanai islands
• Disturbance-adapted weed with negative impacts to agriculture & the natural environment
• Other Marrubium species are weeds
• Generally unpalatable to grazing animals
• Tolerates many soil types
• Forms dense cover that excludes & inhibits other plants
• Reproduces by seeds
• Hybridizes with Marrubium supinum
• May reach maturity in one year
• Fruit attach to animals, vehicles, & clothing & also dispersed by water & contaminated agricultural produce
• Seeds survive passage through guts of horses
• Prolific seed production
• Seeds may persist in the soil for 7-10 years

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Medicinal uses
• Grows primarily in full sun
• Not reported to spread vegetatively
• Cultivation & fire provide effective control
• Herbicides may provide effective control