Taxon: Glycyrrhiza glabra L.

Family: Fabaceae

Common Name(s): licorice
licorice root
liquorice

Synonym(s): Glycyrrhiza glandulifera Waldst. & Kit.
Glycyrrhiza hirsuta Pall.
Glycyrrhiza pallida Boiss. & Noe
Glycyrrhiza violacea Boiss. & Noe

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 30 Mar 2017

WRA Score: 11.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Perennial Herb, Weedy, Edible Roots, N-Fixing, Rhizomatous

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)	High
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		
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	y=1, n=0	n
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals		
406	Host for recognized pests and pathogens	y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
409	Is a shade tolerant plant at some stage of its life cycle		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	y
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	y=1, n=-1	y
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut		
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	y=-1, n=1	y
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**
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	[Different types grow in different climates, but no evidence that plant is highly domesticated] "Native to Eurasia, northern Africa, and western Asia. Widely naturalized in temperate regions. The Oriental type of licorice root is grown in the Near East, Syria, Iraq, Caucasus of Russia, Iran, and northern China; the Spanish type in Spain, Italy, and Greece. Modern plantations have been successful in California and Yorkshire."

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

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	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 28 Mar 2017]	"Native: Africa Northern Africa: Libya Asia-Temperate Caucasus: Armenia; Azerbaijan; Georgia; Russian Federation - Dagestan; Russian Federation-Ciscaucasia - Ciscaucasia China: China - Xinjiang Middle Asia: Kazakhstan; Kyrgyzstan; Tajikistan; Turkmenistan; Uzbekistan Mongolia: Mongolia Siberia: Russian Federation - Kurgan Western Asia: Afghanistan; Cyprus; Iran; Iraq; Israel; Jordan; Lebanon; Syria; Turkey Asia-Tropical Indian Subcontinent: India; Pakistan Europe Eastern Europe: Moldova; Russian Federation-European part - European part; Ukraine Southeastern Europe: Albania; Bulgaria; Former Yugoslavia; Greece; Italy; Romania Southwestern Europe: France"

202	Quality of climate match data	High

Qsn #	Question	Answer
	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 28 Mar 2017]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Liquorice can adapt to a wide range of climates. In its wild form, it can be found in regions with an annual rainfall between 400 and 1160 mm, mean air temperature ranging from 5 to 25 °C and soil pH of 5.7–8.2." ... "It is native to the Mediterranean basin and the central and southwest regions of Asia,(7,11) and can be found at low or high altitudes, nearly up to 1200 m above sea level."
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Ranging from Boreal Moist through SUbtopical Dry Forest Life Zone, this species has been reported to tolerate annual precipitation of 4.0 -11.6 dm (mean of 13 cases = 6.5), annual temperature of 5]-25.0°C (mean of 13 cases = 13.9), and pH of 5.5-8.2 (mean of 10 cases = 7.1)."

204	Native or naturalized in regions with tropical or subtropical climates	y
	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 30 Mar 2017]	[With temperate and tropical distribution] "Native: Africa Northern Africa: Libya Asia-Temperate Caucasus: Armenia; Azerbaijan; Georgia; Russian Federation - Dagestan; Russian Federation-Ciscaucasia - Ciscaucasia China: China - Xinjiang Middle Asia: Kazakhstan; Kyrgyzstan; Tajikistan; Turkmenistan; Uzbekistan Mongolia: Mongolia Siberia: Russian Federation - Kurgan Western Asia: Afghanistan; Cyprus; Iran; Iraq; Israel; Jordan; Lebanon; Syria; Turkey Asia-Tropical Indian Subcontinent: India; Pakistan Europe Eastern Europe: Moldova; Russian Federation-European part - European part; Ukraine Southeastern Europe: Albania; Bulgaria; Former Yugoslavia; Greece; Italy; Romania Southwestern Europe: France"

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

Qsn #	Question	Answer
	Source(s)	**Notes**
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Liquorice is widely cultivated as a medicinal plant, but it can also be a troublesome weed in its wild form at warm temperature climates. (11) It is native to the Mediterranean basin and the central and southwest regions of Asia,(7,11) and can be found at low or high altitudes, nearly up to 1200 m above sea level."

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Native to Eurasia, northern Africa, and western Asia. Widely naturalized in temperate regions."
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	"The plant is naturalized in the oases. However, it is not well used for its therapeutic value. Waste land and slightly saline areas could be used to cultivate this plant and avoid importation."

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	KewScience. 2017. Plants of the World Online - Glycyrrhiza glabra. http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:496941-1. [Accessed 29 Mar 2017]	"It has also been introduced to many countries, for example the USA where it is a weed of moist roadside sites." [Possibly disturbance weed that may impact agriculture. See 3.03]

303	Agricultural/forestry/horticultural weed	y
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Glycyrrhiza glabra ... Weed of: Cereals, Pastures"
	Abdulahi, A., & Haghparast, R. (2006). Control of liqorice (Glycyrrhiza glabra) through split doses of glyphosate.http://agris.fao.org/agris-search/search.do?recordID=IR2008001109. [Accessed]	"Liqurice is one of the most dominant perenial weeds of dry lands farming in Kermanshah, and annually caused significant damage to field crops."
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Often becomes a weed. Attempts are made to eradicate it so the soil may be used for more productive crops."

304	Environmental weed	
	Source(s)	**Notes**
	Tan, D. T., Thu, P. Q., & Dell, B. (2012). Invasive plant species in the national parks of Vietnam. Forests, 3(4), 997-1016	"Appendix 1. List of alien plant species in 10 national parks in Vietnam" [Includes Glycyrrhiza glabra. Impacts unspecified]

Qsn #	Question	Answer
305	**Congeneric weed**	**y**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Glycyrrhiza aspera ... Weed of: Cereals" ... "Glycyrrhiza echinata ... Weed of: Pastures" ... "Glycyrrhiza gontscharovii ... Weed of: Cereals" ... "Glycyrrhiza lepidota ... Weed of: Pastures, Vegetables"

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2010. Flora of China. Vol. 10 (Fabaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Herbs, perennial. Stem 50–150 cm tall, woody at base, densely scaly glandular punctate, white hairy. Leaves 5–14 cm, 11–17-foliolate; stipules caducous, linear, 1–2 mm; petiole densely yellow-brown glandular hairy and villous; leaflets ovate-oblong, oblong-lanceolate, or elliptic, 1.7–4 × 0.8–2 cm, abaxially densely yellow scaly glandular punctate and pubescent on veins, adaxially glabrescent or pilose, base rounded, apex rounded or retuse and with mucro."

402	Allelopathic	n
	Source(s)	**Notes**
	Mudbrick Cottage Herbfarm. 2017. Licorice. http://www.herbcottage.com.au/licorice.html. [Accessed 30 Mar 2017]	"The flowering plant, zinnia is popular as a companion to licorice due to its insect attracting qualities. It helps attract pollinators and deters predators. Since it is very hardy, it can grow in the same location as licorice."
	Kadioglu, I., Yanar, Y., & Asav, U. (2005). Allelopathic effects of weeds extracts against seed germination of some plants. Journal of environmental biology/Academy of Environmental Biology, India, 2 (2), 169-173	[No evidence. Stimulates chick"This study investigated the allelopathic effects of various weeds extracts on seed germination of 11 crop species. Most of the weed extracts tested had inhibitory effects on seed germination of common bean, tomato, pepper, squash, onion, barley, wheat, and corn at different application rates as compared with the 10% acetone control. Chickpea seed germination was inhibited by extracts of Solanum nigrum L., Chenopodium album L., and Matricaria chamomilla L. (10%, 20% and 22.5%, respectively) at the end of 21 day incubation period. However, Glycyrrhiza glabra L., Sorghum halepense (L.) Pers., and Reseda lutea L. extracts stimulated chickpea seed germination at the rates of 95%, 94%, and 93%, respectively, compared to control. It was concluded that some of the weed extracts tested in this study could be used as inhibitor while others could be used as stimulator for the crops. "

Qsn #	Question	Answer
	Mohammadi, G., Javanshir, A., Rahimzadeh, K. F., Mohammadi, A., & Zehtab, S. (2004). The study of allelopathic effect of some weed species on germination and seedling growth of chickpea. Desert (Biaban): 9(2) 267-278	[No evidence] "The allelopathic effect of Sorghum halepense L. Chenopodium album L. Glycyrrhiza glabra L. Convolvulus arvensis L. and Polygonum aviculare L. on germination and seedling growth of chickpea was evaluated on a completely randomized design with four replicates in laboratorial studies. In these experiments, shoots, soil of root zone (rhizosphere) and extracted water from rhizosphere of weeds were used. Results indicated that, shoots, soil of root zone and extracted water from rizospher of Sorghum halepense, Chenopodium album and convolvulus arvensis significantly decreased germination and seedling growth of chickpea as compared to control. While, Glycyrrhiza glabra and Polygonum aviculare did not affect these traits. In most cases, Sorghum halepense had more inhibitory effect on the traits under study. Plumule growth was influenced more severely than radical growth."

403	Parasitic	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2010. Flora of China. Vol. 10 (Fabaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs, perennial. Stem 50–150 cm tall, woody at base" [Fabaceae (alt.Leguminosae). No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Glantz, M. (editor). 2004. Creeping Environmental Problems and Sustainable Development in the Aral Sea Basin. Cambridge University Press, Cambridge, UK	"Basic meadow communities of value as fodder for livestock are those of reed (Phragmites australis), thistle (Alhagi pseudalhagi), licorice (Glycyrrhiza glabra), and Aeluropus littoralis. These make up the bulk of the fodder crops grazed by cattle."
	Dagar, J. C., Yadav, R. K., Dar, S. R., & Ahamad, S. (2015). Liquorice (Glycyrrhiza glabra): a potential salt-tolerant, highly remunerative medicinal crop for remediation of alkali soils. Current Science 108, 1683-1687	"During October–November, plants were harvested (about 10 cm over the ground) and biomass was observed. This may be used as fodder or green manure."
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Spent licorice is used in fire-extinguishing agents, to insulate fiberboards, and as a compost for growing mushrooms; also in feed for cattle, horses, and chickens."

405	Toxic to animals	
	Source(s)	**Notes**
	KewScience. 2017. Plants of the World Online - Glycyrrhiza glabra. http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:496941-1. [Accessed 29 Mar 2017]	"Hazards: It has been reported that excessive liquorice consumption can lead to cardiac dysfunction and severe hypertension." [Unknown if animals could be poisoned by excessive consumption of liquorice]

406	Host for recognized pests and pathogens	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Liquorice is little susceptible to pests (such as insects) and diseases with scarce reports for crop infestation so far. For example, in Italy, Casulli and Ippolito(146) identified liquorice rust [Uromyces glycyrrhizae (Rab.) Magn.] as a pathogen of G. glabra. The infected plants presented pustules on their leaves, stem elongation, early resetting, browning of pith and the formation of many buds in the crown region.(146) Foliar sprays with fungicides (i.e., kresoxim-methyl) have been very effective against liquorice rust.(147) Furthermore, liquorice is also susceptible to aphids. In Iran, aphids (Aphis craccivora Koch) have been identified as liquorice pests.(148) In Italy, Casulli and Ippolito(146) have also observed aphid infections in liquorice plants. Nowadays, there are no registered insecticides to use on liquorice crop, and only aphid's parasitoids may be used as biological control agents. According to Rakhshani et al.,(148) Aphis craccivora is parasitized by Lysiphlebus fabarum (Marshall) (Hymenoptera: Braconidae: Aphidiinae)."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	**Notes**
	KewScience. 2017. Plants of the World Online - Glycyrrhiza glabra. http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:496941-1. [Accessed 29 Mar 2017]	[No evidence] "Hazards: It has been reported that excessive liquorice consumption can lead to cardiac dysfunction and severe hypertension."
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	[Potentially toxic if consumed in excess] "Despite the beneficial effects of liquorice, toxicity symptoms have also been reported from frequent and excessive intake.(4) After consumption, glycyrrhizin is metabolized by gut bacteria (Eubacterium L-8 and Streptococcus LJ-22) to 18β-glycyrrhetinic acid, as the main product, and to 18β-glycyrrhetinic acid-3-O-β-D-glucuronide, as the by-product.(115) Glycyrrhetinic acid is highly involved in the metabolism of corticosteroids, since it inhibits 11-β-hydroxysteroid dehydrogenase and consequently the conversion of cortisol to cortisone.(116,117) Therefore, the inhibition of this enzyme due to a high level of exposure to glycyrrhetinic acid leads to hypertension and hypokalaemia.(118)"

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Spent licorice is used in fire-extinguishing agents"
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	[No evidence] "Leaves, stem and root: The plant is a herbaceous perennial." ... "Liquorice enjoys fertile, sandy or clay soil near a river or stream where enough water is available for the plant to flourish in the wild, or under cultivation where it can be irrigated."

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Plants for a Future. 2017. Glycyrrhiza glabra. http://www.pfaf.org/user/Plant.aspx?LatinName=Glycyrrhiza+glabra. [Accessed 28 Mar 2017]	"It can grow in semi-shade (light woodland) or no shade."
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Licorice grows best in dry, sunny, hot climate, faring best in deep, rich, heavy river-bottom soils."
	Dave's Garden. 2017. Licorice Glycyrrhiza glabra. http://davesgarden.com/guides/pf/go/286/. [Accessed 28 Mar 2017]	"Sun Exposure: Full Sun"

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	**Notes**
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Licorice grows best in dry, sunny, hot climate, faring best in deep, rich, heavy river-bottom soils. Requires annual rainfall of 50-65 cm, and adequate soil moisture; overflow does not harm crop. A definite dry season seems beneficial."
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Liquorice can adapt to a wide range of climates. In its wild form, it can be found in regions with an annual rainfall between 400 and 1160 mm, mean air temperature ranging from 5 to 25 °C and soil pH of 5.7–8.2." ... "The best growth of liquorice occurs in sandy soils, and clay soils should be avoided since they hinder plant establishment and cultivation practices.(11,17) Plants prefer deep and well-drained soils,(26) but according to Dagar et al.(125) and Kushiev et al.(126) liquorice may be also cultivated in sodic soils as a means of phytoremediation and soil properties improvement, since most of the conventional crops are sensitive under such conditions. The deep root system allows for more efficient use of water; therefore, liquorice plants could be considered as tolerant in water stress conditions and ideal for dry climates and semi-arid areas with relative lower abundance of irrigation water."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2010. Flora of China. Vol. 10 (Fabaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs, perennial. Stem 50–150 cm tall, woody at base, densely scaly glandular punctate, white hairy. Leaves 5–14 cm, 11–17 -foliolate; stipules caducous, linear, 1–2 mm; petiole densely yellow-brown glandular hairy and villous; leaflets ovate-oblong, oblong-lanceolate, or elliptic, 1.7–4 × 0.8–2 cm, abaxially densely yellow scaly glandular punctate and pubescent on veins, adaxially glabrescent or pilose, base rounded, apex rounded or retuse and with mucro."

412	Forms dense thickets	n
	Source(s)	**Notes**
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	[No evidence] "Liquorice enjoys fertile, sandy or clay soil near a river or stream where enough water is available for the plant to flourish in the wild, or under cultivation where it can be irrigated."

Qsn #	Question	Answer
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2010. Flora of China. Vol. 10 (Fabaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Margins of farms, roadsides, saline areas; 500–1300 m. Xinjiang [Afghanistan, India, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; N Africa, SW Asia, E and S Europe, Indian Ocean islands (Maldives); introduced in Australia, C Europe, and North America]."
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	No evidence

501	Aquatic	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2010. Flora of China. Vol. 10 (Fabaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Terrestrial herb] "Herbs, perennial ... Margins of farms, roadsides, saline areas; 500–1300 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 28 Mar 2017]	Family: Fabaceae (alt.Leguminosae) Subfamily: Papilionoideae Tribe: Galegeae

503	Nitrogen fixing woody plant	y
	Source(s)	**Notes**
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"G. glabra is able to fix N2 from the atmosphere in symbiosis with nitrogen-fixing bacteria. Mesorhizobium strains have been reported to induce effective nodules on G. glabra and G. uralensis species. However, apart from Mesorhizobium bacteria, which are true symbionts, other sporadic bacteria belonging to the Rhizobium, Sinorhizobium, Agrobacterium and Paenibacillus genera have also been identified and classified as having weak, infrequent or no N2 fixation capacity."

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Liquorice (Glycyrrhiza glabra L.) is a perennial plant with a height of 0.7–2.0 m and erect growth.(5,18) The plant develops a deep root system with a depth of more than 1 m.(11) The root system consists of well-developed horizontal stolons and rhizomes, while the buds on the underground stolons can expand to form new stems."

601	Evidence of substantial reproductive failure in native habitat	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	KewScience. 2017. Plants of the World Online - Glycyrrhiza glabra. http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:496941-1. [Accessed 29 Mar 2017]	"Widely distributed in Eurasia, Glycyrrhiza glabra is not considered to be threatened. Where it is cultivated as a crop, it is normally harvested in a sustainable manner, although there are some concerns that the commercial harvest of rhizomes can be destructive to naturally occurring populations and their habitats."

602	Produces viable seed	y
	Source(s)	**Notes**
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Licorice may be grown from seed, but usually from cuttings, suckers or crown divisions. In spring, crown divisions are set ca. 45 cm apart in rows wide enough to permit cultivation. New plantings must be watered adequately. The crop is ready to harvest in 3-5 yr when rhizomes and roots have developed an extensive system 2-3.5 m deep and several m wide. Attempts to propagate by seed in Kashmir were unsuccessful. Cuttings take fairly well."
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Plant is propagated either asexually by using vegetative cuttings (stolons) or sexually with the use of seeds."

603	Hybridizes naturally	y
	Source(s)	**Notes**
	Tian, R. W., Lu, J. H., Xie, L. B., Qin, Z. L., & LI, X. Y. (2012). Effect of Flowering Mode and Pollination on Reproductive Success and the Relationship between Glycyrrhiza glabra L. and Glycyrrhiza uralensis Fisch. Acta Botanica Boreali-Occidentalia Sinica, 10, 012	"This means that hybridization between G.glabra L. and G.uralensis Fisch. are compatible and no reproductive obstacles. Studies have shown that overlapping time of the florescence, common floral visitors and compatible of hybridization may be important conditions to successfully make interspecific pollination and speciation for natural hybrid species of two Glycyrrhiza L. species."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	"Flower and fruit: The axillary inflorescences are upright, spike-like and 10 to 15 cm long. The individual flowers are 1 to 1.5 cm long, bluish to pale violet and short-pedicled. The calyx is short, bellshaped and glandular-haired. The tips of the calyx are longer than the tube, and are pointed lanceolate. Petals are narrow, the carina petals are not fused, and they are pointed but not beaked."
	Temperate Climate Permaculture. 2017. Permaculture Plants: Licorice (Liquorice). http://tcpermaculture.com/. [Accessed 30 Mar 2017]	"Pollination: Not self-fertile. Pollinated by insects."

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

Qsn #	Question	Answer
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	"Flower and fruit: The axillary inflorescences are upright, spike-like and 10 to 15 cm long. The individual flowers are 1 to 1.5 cm long, bluish to pale violet and short-pedicled. The calyx is short, bellshaped and glandular-haired. The tips of the calyx are longer than the tube, and are pointed lanceolate. Petals are narrow, the carina petals are not fused, and they are pointed but not beaked."
	Temperate Climate Permaculture. 2017. Permaculture Plants: Licorice (Liquorice). http://tcpermaculture.com/. [Accessed 30 Mar 2017]	"Pollination: Not self-fertile. Pollinated by insects."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York	"Erect, branching, perennial herb, to 1 m tall, with a branching rhizome"
	Foulkes, J. N. and Heard, L. M. B. (Eds.). 2003. A Biological Survey of the South East, South Australia. 1991 and 1997. Department for Environment and Heritage, South Australia	"Near both these sites are farm residences where the plant species may have dispersed from, transferred either by birds (as seed) or possibly by earth moving equipment (as root material) during road construction."
	Mudbrick Cottage Herbfarm. 2017. Licorice. http://www.herbcottage.com.au/licorice.html. [Accessed 30 Mar 2017]	"The licorice plant is stoloniferous, which means it spreads by growing new plants, similar to the strawberry plant."

607	Minimum generative time (years)	
	Source(s)	**Notes**
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	[Unknown, but probably within 2 years. May be able to spread by rhizomes prior to first flowering] "Leaves, stem and root: The plant is a herbaceous perennial. It is 1 to 2 m high and has a long sturdy primary taproot. The taproot is 15 cm long and subdivides into 3 to 5 subsidary roots, 1.25 m in length. There are several horizontal woody stolons which may reach 8 m. New stems are produced every year. They are sturdy, erect, branched either from the base or from further up, and are generally rough at the top."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	
	Source(s)	**Notes**
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"The flowers are small (1 cm long) and have purple to whitish blue color, and the pods (2–3 cm) are flat, with an oblong to linear shape, (5,19) have a smooth surface,(11) turn brown at maturity and contain 1–7 seeds.(5,19) The seeds have dark color, a reniform shape and small size, with a diameter of about 2.5 mm and a thousand seeds weight of 6.2 g." [No means of external attachment, although small size may allow external attachment]

Qsn #	Question	Answer
	Foulkes, J. N. and Heard, L. M. B. (Eds.). 2003. A Biological Survey of the South East, South Australia. 1991 and 1997. Department for Environment and Heritage, South Australia	[Potentially moved in soil] "Glycyrrhiza glabra (Liquorice) is an erect perennial with a woody rootstock and long thick rhizomes. This species possibly originates from North Africa and south-east Asia. (Weber 1986). In South Australia it has been recorded in the Northern Lofty and Southern Lofty Herbarium regions. During the survey, this species was collected at a site in the West Avenue Range east of Greenways and recorded at another site nearby to the south. Near both these sites are farm residences where the plant species may have dispersed from, transferred either by birds (as seed) or possibly by earth moving equipment (as root material) during road construction. The same unmade road links these two site locations and these farm residences."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	KewScience. 2017. Plants of the World Online - Glycyrrhiza glabra. http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:496941-1. [Accessed 29 Mar 2017]	"Glycyrrhiza glabra is native to Eurasia, northern Africa and western Asia, where it grows up to 1,200 m above sea level. It has also been introduced to many countries, for example the USA where it is a weed of moist roadside sites. Liquorice is also cultivated as a crop plant, particularly in Russia, Spain and the Middle East."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Crop, Herbal, Ornamental" [Possibly. Unable to confirm]

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	[No evidence] "The fruit is a pod, 1.5 to 2.5 cm long, and 4 to 6 mm wide. It is erect and splayed, flat with thick sutures, glabrous, somewhat reticulate-pitted, and usually has 3 to 5 brown, reniform seeds."
	Liu, H., Zhang, D., Yang, X., Huang, Z., Duan, S., & Wang, X. (2014). Seed dispersal and germination traits of 70 plant species inhabiting the gurbantunggut desert in northwest China. The Scientific World Journal, 2014. dx.doi.org/10.1155/2014/346405	[Related taxon with autochorous dispersal] "Table 1: Family, species, vegetative period, month of seed collection, seed traits (seed mass, seed size, seed shape), seed germination percentage, dispersal syndromes and dispersal strategies recorded for each of the 70 study species." [Glycyrrhiza inflata - Dispersal syndromes = Autochory]

705	Propagules water dispersed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Escapee"

706	Propagules bird dispersed	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Foulkes, J. N. and Heard, L. M. B. (Eds.). 2003. A Biological Survey of the South East, South Australia. 1991 and 1997. Department for Environment and Heritage, South Australia	[Bird dispersal speculated. No conclusive evidence] "Near both these sites are farm residences where the plant species may have dispersed from, transferred either by birds (as seed) or possibly by earth moving equipment (as root material) during road construction. The same unmade road links these two site locations and these farm residences."
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	[No evidence] "The fruit is a pod, 1.5 to 2.5 cm long, and 4 to 6 mm wide. It is erect and splayed, flat with thick sutures, glabrous, somewhat reticulate-pitted, and usually has 3 to 5 brown, reniform seeds."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Escapee"
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	"The fruit is a pod, 1.5 to 2.5 cm long, and 4 to 6 mm wide. It is erect and splayed, flat with thick sutures, glabrous, somewhat reticulate-pitted, and usually has 3 to 5 brown, reniform seeds." [No evidence. No means of external attachment]

708	Propagules survive passage through the gut	
	Source(s)	**Notes**
	Foulkes, J. N. and Heard, L. M. B. (Eds.). 2003. A Biological Survey of the South East, South Australia. 1991 and 1997. Department for Environment and Heritage, South Australia	[Bird dispersal speculated. No conclusive evidence] "Near both these sites are farm residences where the plant species may have dispersed from, transferred either by birds (as seed) or possibly by earth moving equipment (as root material) during road construction. The same unmade road links these two site locations and these farm residences."

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	IUCN Centre for Mediterranean Cooperation. 2005. A Guide to Medicinal Plants in North Africa. IUCN, Malaga, Spain	"The fruit is a pod, 1.5 to 2.5 cm long, and 4 to 6 mm wide. It is erect and splayed, flat with thick sutures, glabrous, somewhat reticulate-pitted, and usually has 3 to 5 brown, reniform seeds."
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	[Densities unknown] "the pods (2–3 cm) are flat, with an oblong to linear shape,(5,19) have a smooth surface,(11) turn brown at maturity and contain 1–7 seeds.(5,19) The seeds have dark color, a reniform shape and small size, with a diameter of about 2.5 mm and a thousand seeds weight of 6.2 g."

802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Ghadiri, H., & Bagherani Torshiz, N. (2010). Effects of scarification and temperature on germination of licorice (Glycyrrhiza glabra L.) seeds. Journal of Agricultural Science and Technology, 2, 257-262	"Licorice reproduces by rhizome and seed. The seed is round, flat (lens shaped) which has shining chestnut-brown color. In natural stands, seed germination is very low, due to dormancy caused by hard seed coat (Boe and Wynia, 1985)."
	Karkanis, A., Martins, N., Petropoulos, S. A., & Ferreira, I. C. F. R. (2016). Phytochemical composition, health effects, and crop management of liquorice (Glycyrrhiza glabra L.): A medicinal plant. Food Reviews International. dx.doi.org/10.1080/87559129.2016.1261300	"Various scarification treatments and temperatures have been studied in order to increase germination rate and render sexual propagation applicable for commercial cultivation, since the occurrence of hard seeds is very frequent."

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Abdulahi, A., & Haghparast, R. (2006). Control of liqorice (Glycyrrhiza glabra) through split doses of glyphosate.http://agris.fao.org/agris-search/search.do?recordID=IR2008001109. [Accessed]	"Liqurice is one of the most dominant perenial weeds of dry lands farming in Kermanshah, and annually caused significant damage to field crops. In this research to control the growth and regrowth of liqurice splited doses (SD) of Glyphosate , a systemic herbicide, were applied. The experiment was conducted based on randomized complete block design in 3 replications with 9 treatments : (2 lit/ha at once), (1 + 1 lit/ha), (0.5 + 0.5 + 0.5 + 0.5 lit/ha), (4 lit/ha at once), (2 + 2 lit/ha), (1 + 1 + 1 + 1 lit/ha), (6 lit /ha at once), (3 + 3 lit/ ha), (1.5 + 1.5 + 1.5 + 1.5 lit /ha) and splited doses applied in 3 days interval. First herbicide application was conducted in fallow on a unique density of liqurice and before that the number of liqurice plants per plot were counted .In autumn, the plots cultivated with wheat , and in spring number of emerged liqurice plants counted to determine the effect of treatments in controlling the weed. Results indicated that applying 6 lit/ha , 4 lit/ha and 3+3 lit/ha of Glyphosate had respectively the best effect in controlling of liqurice. A significant linear relation was found between herbicide dose and regrowth density of liqurice, so the herbicide dose increases the the regrowth of liqorice decreases. "

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Temperate Climate Permaculture. 2017. Permaculture Plants: Licorice (Liquorice). http://tcpermaculture.com/. [Accessed 30 Mar 2017]	[Resprouts from roots/rhizomes] "Life Span: No good information available as we typically harvest the roots, and new plants grow from the remnants or from the rhizomes left over, so an individual's life span is likely irrelevant."

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
• Broad climate suitability
• Certain varieties can grow in tropical climates
• Widely naturalized
• Regarded as an agricultural weed in a number of locations
• Related species have also become invasive
• Excessive liquorice consumption can lead to cardiac dysfunction and severe hypertension
• N- fixing (beneficial, but may also alter soil chemistry & facilitate other invasive weeds)
• Reproduces by seeds and vegetatively by rhizomes
• Hybridizes with other Glycyrrhiza species
• Seeds & rhizome fragments intentionally dispersed, & potentially accidentally dispersed as a soil contaminant
• Seeds may form a persistent seed bank
• Able to resprout from rhizomes and root fragments

Low Risk Traits
• Unarmed (no spines, thorns, or burrs)
• Provides fodder for livestock
• Important commercial uses
• Reported to be self-incompatible
• Herbicides may provide effective control