Taxon: Opuntia echios J. T. Howell **Family:** Cactaceae

Common Name(s): cacto gigante
tree prickly-pear
tuna gigante

Synonym(s): Opuntia myriacantha F. A. C. Weber

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 30 Mar 2016

WRA Score: 5.0 **Designation:** EVALUATE **Rating:** Evaluate

Keywords: Spiny Cactus, Thicket-Forming, Fleshy-fruit, Bird-Dispersed, Spreads Vegetatively

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	n
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	n
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	n
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
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)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	y
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
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	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		

Qsn #	Question	Answer Option	Answer
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	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		
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)	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	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)		
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)		
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
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**
	Wiggins, I.L., Porter, D.M., & Anderson, E.F. (1971). Flora of the Galápagos Islands. Stanford University Press, Stanford, CA	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"**	**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 28 Mar 2016]	"Native: Southern America Western South America: Ecuador - Galapagos Islands"

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 28 Mar 2016]	

203	**Broad climate suitability (environmental versatility)**	**n**
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	"According to Itow (1965), the distribution range is ca 5 to 130 m, with dominance occurring at elevations of 5 to 40 m." ... "They found that O. echios peaked in abundance at 5 m elevation"
	Dave's Garden. 2016. Tree Prickly Pear - Opuntia echios var. gigantean. http://davesgarden.com/guides/pf/go/84088/. [Accessed 28 Mar 2016]	"Hardiness: USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F) USDA Zone 11: above 4.5 °C (40 °F)"

Qsn #	Question	Answer
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	"The Galapagos Islands, which are extremely arid compared to most tropical archipelagos, experience two fairly distinct seasons each year. The warm season, typically January through May, is caused by warm ocean currents sweeping southward from the direction of Panama. These currents cause both sea and air temperatures around the islands to rise. During this time the skies are normally clear, with occasional heavy showers"

204	Native or naturalized in regions with tropical or subtropical climates	y
	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 28 Mar 2016]	"Native: Southern America Western South America: Ecuador - Galapagos Islands"

205	Does the species have a history of repeated introductions outside its natural range?	n
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	No evidence of widespread cultivation outside native range
	Imada, C.T., Staples, G.W. & Herbst, D.R. 2005. Annotated Checklist of Cultivated Plants of Hawai'i. http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/. [Accessed 28 Mar 2016]	No records from Hawaiian Islands

301	Naturalized beyond native range	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2016. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm. [Accessed 28 Mar 2016]	No evidence

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

Qsn #	Question	Answer
303	**Agricultural/forestry/horticultural weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

Qsn #	Question	Answer
304	**Environmental weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

Qsn #	Question	Answer
305	**Congeneric weed**	**y**
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Opuntia ficus-indica" ... "It spreads by seeds and vegetatively by dislodged stem segments that easily root and regenerate new plants. A single stem segment is capable of building up a dense thicket. Seeds are dispersed by animals"
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	Numerous Opuntia species have become naturalized and invasive outside their native ranges

Qsn #	Question	Answer
401	**Produces spines, thorns or burrs**	**y**
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	"Description: Shrubby to treelike perennial to 12 m tall, branches of ten hanging downward. Trunk, when present, somewhat woody. to 1.25 In across, covered with spines when young, these persisting or later replaced \\'ith reddish orange "bark." Stem pads fleshy, to 50cm long and 32 cm wide. Leaves 2-6 mm long, nonpersistent, usually not obvious. Spines 1-50 per cluster, yellow, brownish, or white. 1-12 cm long; glochids present to absent."

Qsn #	Question	Answer
402	**Allelopathic**	
	Source(s)	**Notes**
	Clark, D. A., & Clark, D. B. (1981). Effects of seed dispersal by animals on the regeneration of Bursera graveolens (Burseraceae) on Santa Fe Island, Galapagos. Oecologia, 49(1), 73-75	[Bursera seedling establish under Opuntia, suggesting that there is little or no allelopathic inhibition] "The association between Bursera juveniles and Opuntia trees could be due either to attraction of Bursera dispersers to the Opuntia or to favorable conditions for establishment at the base of the cactus trees."

Qsn #	Question	Answer
	Rsaissi, N., Bouhache, M., & Bencharki, B. (2013). Allelopathic potential of Barbary fig Opuntia ficus-indica (L.) Mill on the germination and growth of wild jujube Ziziphus lotus (L.) Desf. International Journal of Innovation and Applied Studies, 3(1), 205-214	[Unknown. Allelopathy documented in genus] "Phytoecological observations made in agro ecosystems in the Chaouia region revealed that the tufts of wild jujube "Ziziphus lotus (L.) Desf." enclaved in the hedges of Barbary fig "Opuntia ficus-indica (L.) Mill. " slow their biological activity and their growth and ends by being eliminated completely. The hypothesis that put into play the phenomenon of allelopathy as a mechanism of interference between the two species has been verified in this study. Thus, bioassays were conducted in vitro in the laboratory in order to test the effects of aqueous and hydro-ethanolic extracts of aerial and belowground parts of Barbary fig on seed germination and seedling growth of wild jujube. A dosage of total phenols by Folin-Ciocalteu reagent and a subsequent identification of these phenols compounds have been made. The results showed that these phenols are present in both stems and roots of Barbary fig, with varying concentrations (6.91 to 42.75 mg EAG/g of dry weight) according organ of the plant and the solvent used in the extraction. Very significant inhibitory effects up to 100% were observed on the kinetics and the final rate of jujube seed germination as well as its growth. These results allowed us to infer the existence of a strong correlation between allelopathic effects of Barbary fig on jujube and the concentration of total phenols content in different parts of this species of cactus."

403	Parasitic	n
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	"Shrubby to treelike perennial to 12 m tall, branches of ten hanging downward." [Cactaceae. No evidence of parasitism]

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	Schofield, E. K. (1989). Effects of introduced plants and animals on island vegetation: examples from Galápagos Archipelago. Conservation Biology, 3(3), 227-239	"Although heavily coated with spines, seedlings of the endemic cactus, Opuntia echios, are favorites of goats."
	Tye, A. (2006). Restoration of the vegetation of the Dry Zone in Galapagos. Lyonia 9(2): 29-50	[Suggests palatability to goats. Seedlings may be more vulnerable than adults, which are protected by spines that may deter browsing] "On Santa Fe, the species-focused studies of Hamann showed that Scalesia helleri (Fig. 7) and Opuntia echios, which had been badly affected by the goats, regenerated more or less rapidly following eradication of the animals." ... "Observations indicate that native animals on Española damage Opuntia seedlings in various ways, either eating them or physically damaging them. Further experiments are being carried out to determine which animals cause important damage, and from which the seedlings require protection."

405	Toxic to animals	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Schofield, E. K. (1989). Effects of introduced plants and animals on island vegetation: examples from Galápagos Archipelago. Conservation Biology, 3(3), 227-239	[No evidence] "Although heavily coated with spines, seedlings of the endemic cactus, Opuntia echios, are favorites of goats."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	Unknown

407	Causes allergies or is otherwise toxic to humans	n
	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	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	
	Source(s)	**Notes**
	Stafford, K. 2011. Firewise Plant List - Texas. http://txmg.wpengine.netdna-cdn.com/ellis/files/2012/03/Texas-Plant-Flammability-List.pdf. [Accessed 28 Mar 2016]	"Opuntia spp. - Flammability - Firewise rating = Low"
	Racine, C. H., & Downhower, J. F. (1974). Vegetative and Reproductive Strategies of Opuntia (Cactaceae) in the Galapagos Islands. Biotropica, 6(3), 175–186	[Fire ecology & flammability unknown. Succulent habit may reduce flammability, but formation of thickets in dry habitats may increase fuel loads in fire prone regions] "In the Santa Cruz stand, Opuntia echios var. gigantea dominates but is mixed with other tree species including another cactus, Jasminocereus thouarsii, and several deciduous tree species (nomenclature follows that of Wiggins and Porter 1971)." ... "Here Opuntia trees reach the highest density in any of the three island stands (table 1 b)." [Opuntia tree density = 4135 stems/ha]

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

Qsn #	Question	Answer
	Dave's Garden. 2016. Tree Prickly Pear - Opuntia echios var. gigantean. http://davesgarden.com/guides/pf/go/84088/. [Accessed 28 Mar 2016]	"Sun Exposure: Full Sun Sun to Partial Shade"
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	[Possibly limited by light availability] "Light limitation of growth has been documented for cacti in tropical dry forests. Nobel (1981), in a study of O. echios var. echios on northern Isla Santa Cruz, found that light intensity dropped sharply with canopy height and elevation. The ability of the cactus to fix carbon, measured as the nocturnal increase in acidity, was reduced strongly by lower light availability." ... "The greater density of O. echios in low-elevation habitats with low-canopy cover is consistent with our hypothesis that competition for light limits their population density in closed forest. These results must be interpreted with some caution, however, since it is likely that a number of other environmental factors change along the gradient."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	
	Source(s)	**Notes**
	Arkive. 2016. Prickly pear (Opuntia echios). http://www.arkive.org/prickly-pear/opuntia-echios/. [Accessed 28 Mar 2016]	"Opuntia echios is commonly found in the arid zone, often growing in thin soil, sand or even bare lava, but also occurs at higher elevations in tropical dry forest"
	Dave's Garden. 2016. Tree Prickly Pear - Opuntia echios var. gigantean. http://davesgarden.com/guides/pf/go/84088/. [Accessed 28 Mar 2016]	"Soil pH requirements: 6.1 to 6.5 (mildly acidic) 6.6 to 7.5 (neutral) 7.6 to 7.8 (mildly alkaline)"

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	"Shrubby to treelike perennial to 12 m tall, branches of ten hanging downward. Trunk, when present, somewhat woody. to 1.25 In across, covered with spines when young, these persisting or later replaced \\'ith reddish orange "bark."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	[Opuntia echios var. gigantea forms thickets] "In the Santa Cruz stand, Opuntia echios var. gigantea dominates but is mixed with other tree species including another cactus, Jasminocereus thouarsii, and several deciduous tree species (nomenclature follows that of Wiggins and Porter 1971)." ... "Here Opuntia trees reach the highest density in any of the three island stands (table 1 b)." [Opuntia tree density = 4135 stems/ha]

501	Aquatic	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Arkive. 2016. Prickly pear (Opuntia echios). http://www.arkive.org/prickly-pear/opuntia-echios/. [Accessed 28 Mar 2016]	[Terrestrial] "Opuntia echios is commonly found in the arid zone, often growing in thin soil, sand or even bare lava, but also occurs at higher elevations in tropical dry forest"

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 28 Mar 2016]	Family: Cactaceae Subfamily: Opuntioideae Tribe: Opuntieae

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 28 Mar 2016]	Family: Cactaceae Subfamily: Opuntioideae Tribe: Opuntieae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	"Shrubby to treelike perennial to 12 m tall, branches of ten hanging downward."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	Godínez-Álvarez, H., Valverde, T., & Ortega-Baes, P. (2003) Demographic Trends in the Cactaceae. Botanical Review, 69(2), 173–203	No evidence pf substantial reproductive failure

602	Produces viable seed	y
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	"Like most other cacti, O. echios has several modes of reproduction. It produces large amounts of viable seed (pers. obs.)."

Qsn #	Question	Answer
603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Mondragon-Jacobo, C. & Perez-Gonzalez, S. (eds.). 2001. Cactus (Opuntia Spp.) as Forage. FAO, Rome, Italy	"Natural hybridization of opuntia is common. It is related to polyploidy and appears to be one of the major causes of diversity." [Unknown for O. echios]

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Grant, B. R., & Grant, P. R. (1981). Exploitation of Opuntia cactus by birds on the Galápagos. Oecologia, 49(2), 179-187	"Pollination. In a pollination experiment on Santa Cruz, Rick (1966) found two O. echios flowers to be self-incompatible."
	McMullen, C. K. (1987). Breeding systems of selected Galapagos Islands angiosperms. American Journal of Botany, 74(11): 1694-1705	[Inconclusive] "The present study also provided inconclusive results for Opuntia echios var. gigantea. Grant and Grant (1981) studied another member of this genus, O. helleri, on Isla Genovesa and determined it to be self-incompatible. Percentage fruit set of O. helleri would place it in the self-compatible category of the present study. The great increase in seed set produced by the outcrossed flowers of Grant and Grant, however, seems convincing evidence that this species might indeed be self-incompatible. The results for O. echios var. gigantea leave this possibility open since crosspollinations were not performed."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Grant, B. R., & Grant, P. R. (1981). Exploitation of Opuntia cactus by birds on the Galápagos. Oecologia, 49(2), 179-187	"Birds and insects are potential pollinators. On Daphne Opuntia echios flowers are visited by the carpenter bee Xylocopa darwini, four Geospiza species (Table 1) and a beetle (Ammophorus sp)."
	McMullen, C. K. (1987). Breeding systems of selected Galapagos Islands angiosperms. American Journal of Botany, 74(11): 1694-1705	[Bird & insect-pollinated] "Rick (1966) mentioned one other possible pollinator. This was the cactus finch, Geospiza scandens, which, he stated, visited the flowers of Opuntia echios (Cactaceae). He did mention, however, that the flowers are often damaged in the process of pollinating. Grant and Grant (1981) also reported that plants of Opuntia are visited by finches, as well as by mockingbirds and doves, and that these may be potential pollinators. They suggested that Opuntia may depend on birds for pollination on islands where the carpenter bee is absent." ... "The cactus finch, Geospiza scandens, was often observed visiting flowers of Opuntia echios var. gigantean on Isla Santa Cruz." ... "Finches may also act as pollen vectors for some of the plants tested. These birds were observed at the flowers of Opuntia echios var. gigantea, Sida rhombifolia (Malvaceae), Prosopis juliflora (Mimosaceae), Passiflora foetida var. galapagensis (Passifloraceae), and Tribulus cistoides (Zygophyllaceae). Although the flowers appeared to be damaged during the visits, the possibility of successful pollination and subsequent fertilization does exist. Each of these species, however, was also visited by insects indicating that they do not rely solely on bird pollination on Isla Santa Cruz."

Qsn #	Question	Answer
606	**Reproduction by vegetative fragmentation**	**y**
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	"Like most other cacti, O. echios has several modes of reproduction. It produces large amounts of viable seed (pers. obs.). New plants also can be produced by asexual propagation through growth of fallen cladodes and trunks. A more unusual mechanism is through the areoles (or suppressed lateral buds) of fallen fruits, which can form both roots and shoots directly from maternal tissue."

607	Minimum generative time (years)	
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	[Time to reproductive maturity unknown, but ability to spread vegetatively may precede first flowering] "Like most other cacti, O. echios has several modes of reproduction. It produces large amounts of viable seed (pers. obs.). New plants also can be produced by asexual propagation through growth of fallen cladodes and trunks."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**
	Racine, C. H., & Downhower, J. F. (1974). Vegetative and Reproductive Strategies of Opuntia (Cactaceae) in the Galapagos Islands. Biotropica, 6(3), 175–186	[Dispersed by birds, iguanas & tortoises] "Seed dispersal is accomplished in a variety of ways: the tortoises and iguanas that browse on the pads of Opuntia may also disperse Opuntia seeds by consuming the entire fleshy fruit and then passing the viable and unharmed seeds in their dung (d. Rick and Bowman 1961). Mockingbirds also eat the seeds and the adhering fleshy aril. They do not crack the seeds which are presumably passed unharmed. The cactus ground finch (Geospiza scandens), however, pecks a hole in the fruit, extracts the seeds, and cracks most of them to extract the endosperm. Only whole seeds that stick to the bill of G. scandens are dispersed by bill-wiping."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Living Stones Nursery & Plants for the Southwest. 2016. Opuntia. http://www.lithops.net/Opuntia.htm. [Accessed 30 Mar 2016]	[Plants sold online] "Opuntia echios v. gigantea A huge tree species from the Galapagos Islands. Frost tender. $15.00"

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	[Fleshy-fruited & adapted for dispersal by birds & other frugivorous animals. No evidence of produce contamination & unlikely that this cactus would be grown with commercial crops or produce] "Fruit a berry, green to yellowish green or brownish. ovate. roundish. or top-shaped, 4-11.7 cm lo ng, 2.8-4.7 cm across, fleshy, spines and glochids present to few; seeds numerous. whitish brown. 2- 5 mm long."

704	Propagules adapted to wind dispersal	n
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	[Fleshy-fruited] "Fruit a berry, green to yellowish green or brownish. ovate. roundish. or top-shaped, 4-11.7 cm lo ng, 2.8-4.7 cm across, fleshy, spines and glochids present to few; seeds numerous. whitish brown. 2- 5 mm long."

705	Propagules water dispersed	n
	Source(s)	**Notes**
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	[Unlikely. Fleshy-fruited cactus of arid habitats. Some secondary dispersal by water may occur, but this would probably be an infrequent dispersal vector] "Habitat: Arid lowlands and moist uplands" ... "Fruit a berry, green to yellowish green or brownish. ovate. roundish. or top-shaped, 4-11.7 cm lo ng, 2.8-4.7 cm across, fleshy, spines and glochids present to few; seeds numerous. whitish brown. 2- 5 mm long."

706	Propagules bird dispersed	y
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	"Cladodes and trunks are more likely to remain near the parent plant, while fruits may disperse longer distances. Greater dispersal of fruits is more likely in the arid zone, where the substrate is primarily bare lava, than in the transition zone, where litter and soil are more common substrates (Itow 1965, Reeder & Riechert 1975) and would tend to impede the movement of fallen fruits."
	Grant, B. R., & Grant, P. R. (1981). Exploitation of Opuntia cactus by birds on the Galápagos. Oecologia, 49(2), 179-187	"The aril surrounding the seed was tested with Tes-Tape Lilly | and found to contain glucose, as did the nectar. The aril is fleshy in O. echios, O. helleri and O. galapageia, but it is fibrous in O. megasperma. It is consumed by some bird species on four of the islands we visited (Table 1), and possibly on the other two islands which we visited briefly." ... "Mockingbirds generally swallow the seeds and the aril is removed internally; then the seeds are either voided in feces or regurgitated whole. The finches remove the aril from the seed with the beak and discard the seed, although G. magnirostris on Genovesa occasionally crack them."

707	Propagules dispersed by other animals (externally)	

Qsn #	Question	Answer
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	[Able to reproduce by fallen cladodes. It may be possible that these could attach to passing animals, as they do in other Opuntia species] "Like most other cacti, O. echios has several modes of reproduction. It produces large amounts of viable seed (pers. obs.). New plants also can be produced by asexual propagation through growth of fallen cladodes and trunks. A more unusual mechanism is through the areoles (or suppressed lateral buds) of fallen fruits, which can form both roots and shoots directly from maternal tissue."
	Racine, C. H., & Downhower, J. F. (1974). Vegetative and Reproductive Strategies of Opuntia (Cactaceae) in the Galapagos Islands. Biotropica, 6(3), 175–186	[Seeds may adhere externally to frugivores] "The cactus ground finch (Geospiza scandens), however, pecks a hole in the fruit, extracts the seeds, and cracks most of them to extract the endosperm. Only whole seeds that stick to the bill of G. scandens are dispersed by bill-wiping."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Blake, S., Wikelski, M., Cabrera, F., Guezou, A., Silva, M., Sadeghayobi, E., Yackulic, C. & Jaramillo, P. (2012). Seed dispersal by Galápagos tortoises. Journal of Biogeography, 39(11): 1961-1972	"Does tortoise ingestion and processing influence the success of seed germination? We found no consistent pattern in treatment effects on seed germination success when species data were analysed individually (Table 4). For three species (Psidium guajava, O. echios and P. galapageium) treatment did not influence germination success."
	Grant, B. R., & Grant, P. R. (1981). Exploitation of Opuntia cactus by birds on the Galápagos. Oecologia, 49(2), 179-187	"Mockingbirds generally swallow the seeds and the aril is removed internally; then the seeds are either voided in feces or regurgitated whole. The finches remove the aril from the seed with the beak and discard the seed, although G. magnirostris on Genovesa occasionally crack them."
	Heleno, R., Blake, S., Jaramillo, P., Traveset, A., Vargas, P., & Nogales, M. (2011). Frugivory and seed dispersal in the Galápagos: what is the state of the art?. Integrative Zoology, 6(2), 110-129	"More recent studies have shown that consumption by giant tortoises and land iguanas increases the germination rate of Opuntia echios (Estupiñán & Mauchamp 1995) and that Galápagos mockingbirds generally pass the seeds of ingested fruits intact, whereas medium (Geospiza fortis) and small (G. fuliginosa) ground finches usually crush the seeds before ingesting them (Buddenhagen & Jewell 2006)."
	Tye, A. (2006). Restoration of the vegetation of the Dry Zone in Galapagos. Lyonia 9(2): 29-50	"Tortoises are natural dispersers of Opuntia seed in Galapagos."

Qsn #	Question	Answer
801	**Prolific seed production (>1000/m2)**	
	Source(s)	**Notes**
	Blake, S., Wikelski, M., Cabrera, F., Guezou, A., Silva, M., Sadeghayobi, E., Yackulic, C. & Jaramillo, P. (2012). Seed dispersal by Galápagos tortoises. Journal of Biogeography, 39(11): 1961-1972	[Large numbers of seeds in tortoise dung] "Dung piles with higher numbers of individual seeds did not necessarily contain the greatest number of species. Twelve dung piles contained more than 1000 seeds from a single species (P. guajava 10 piles, Passiflora edulis 1 pile, and O. echios 1 pile)."
	McMullen, C.K. 1999. Flowering plants of the Galápagos. Cornell University Press, Ithaca, NY	[Seeds numerous. Densities unknown] "Fruit a berry, green to yellowish green or brownish. ovate. roundish. or topshaped, 4-11.7 cm lo ng, 2.8-4.7 cm across, fleshy, spines and glochids present to few; seeds numerous. whitish brown. 2- 5 mm long."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Bowers, J. E. (2005). New evidence for persistent or transient seed banks in three Sonoran Desert cacti. The Southwestern Naturalist, 50(4), 482-487	[Unknown for O. echios] "Seeds of several Opuntia species persist in the soil for 2 or more years"

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Generic entry for Opuntia spp.] "Chemical control of Opuntia species is not always effective. Treatments which are or have been recommended in various parts of Australia include: - 2,4,5-T applied in diesel oil, - amitrole T with a wetting agent, - picloram + 2,4,5-T mixtures applied in diesel oil, - MSMA applied in warm weather, - triclopyr as a thorough overall spreay, - picloram + triclopyr mixture, and - hexaflurate."
	WRA Specialist. 2016. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	Hicks, D. J., & Mauchamp, A. (2000). Population Structure and Growth Patterns of Opuntia echios var. gigantea along an Elevational Gradient in the Galapagos Islands. Biotropica, 32(2), 235-243	[Cladodes cut from parent plant may be able to resprout] "Like most other cacti, O. echios has several modes of reproduction. It produces large amounts of viable seed (pers. obs.). New plants also can be produced by asexual propagation through growth of fallen cladodes and trunks. A more unusual mechanism is through the areoles (or suppressed lateral buds) of fallen fruits, which can form both roots and shoots directly from maternal tissue."

Qsn #	Question	Answer
	Parsons, W.T. & Cuthbertson, E.G. 2001. Noxious Weeds of Australia. Second Edition. CSIRO Publishing, Collingwood, Australia	[Generic description of Opuntia species] "Physical removal and burning of plants is the most effective method of control but care must be taken to collect and destroy all dislodged segments and fruit. Because of their high moisture content, plants are not easily burnt and combustible material such as wood or old tyres must form the base of the fire. As much of the root system as possible should be removed by grubbing or cultivation."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Winston, R.L., Schwarzländer, M., Hinz, H.L., Day, M.D.,Cock, M.J.W., Julien, M.H. (eds.). 2014. Biological Control of Weeds: A World Catalogue of Agents and Their Target Weeds, 5th edition. USDA Forest Service, Forest Health Technology Enterprise Team, Morgantown, West Virginia	[Species in the genus are regular subjects of bioncontrol efforts. There are currently no known biocontrol programs for Opuntia echios] "The 2,042 entries in this Fifth Edition span 130 countries and 551 biocontrol agents targeting 224 weeds (when groups such as Opuntia spp. are counted as a single target weed). The most active countries continue to be the USA, Australia, Canada, South Africa and New Zealand."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Grows in tropical climates
• Other Opuntia species are invasive
• Forms dense thickets in native range
• Reproduces by seeds & vegetatively by fallen trunks & cladodes
• Seeds dispersed by birds & other frugivorous animals
• Limited ecological information may reduce accuracy of risk prediction

Low Risk Traits
• No reports of invasiveness or naturalization, but no evidence of widespread introduction outside native range
• Spiny
• Seedlings palatable
• Non-toxic
• Reportedly self-incompatible

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Yes. Forms dense stands in native range
(B) Bird-dispersed?> Dispersed by birds
(C) Life cycle <4 years? Unknown
Outcome = Evaluate