Taxon: Helianthus tuberosus L. **Family:** Asteraceae

Common Name(s): earth apple
Jerusalem artichoke
sunchoke
topinambur

Synonym(s): Helianthus tomentosus Michx.
Helianthus tuberosus var. albus
Helianthus tuberosus var. purpurellus
Helianthus tuberosus var. tuberosus

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 12 May 2020

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

Keywords: Herbaceous Perennial, Weedy, Edible, Tuberous, Spreads Vegetatively

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	y
102	Has the species become naturalized where grown?	y=1, n=-1	y
103	Does the species have weedy races?	y=1, n=-1	y
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates		
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	n=0, y = 1*multiplier (see Appendix 2)	n
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	y=1, n=0	y
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
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	y=1, n=0	y
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	y
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)	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		
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)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)		
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?**	**y**
	Source(s)	**Notes**
	Anderson, J. E., Campbell, A., & Kantar, M. B. (2019). Crop Wild Relatives of Root Vegetables in North America. Pp. 243-279. In North American Crop Wild Relatives, Volume 2. Springer, Cham, Switzerland	"Jerusalem artichoke, the domesticated form of Helianthus tuberosus L., shows reduced tuber number and increased individual tuber size relative to wild collected individuals. Helianthus tuberosus is native to central North America (Kays and Nottingham 2008; Rogers et al. 1982) and was domesticated in the eastern United States. Helianthus tuberosus is an autoallohexaploid whose progenitors are likely the autotetraploid H. hirsutus Raf. (an autotetraploid of H. divaricatus L.) and the diploid H. grosseserratus Martens (Bock et al. 2014)."

102	Has the species become naturalized where grown?	y
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 11 May 2020]	"Naturalized Africa MACARONESIA: Portugal [Azores] Asia-Temperate WESTERN ASIA: Cyprus CAUCASUS: Russian Federation-Ciscaucasia [Ciscaucasia] CHINA: China EASTERN ASIA: Japan Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Europe NORTHERN EUROPE: Norway, Sweden, United Kingdom MIDDLE EUROPE: Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland EASTERN EUROPE: Belarus, Estonia, Latvia, Lithuania, Moldova, Russian Federation-European part, [European part] Ukraine (incl. Krym) SOUTHEASTERN EUROPE: Albania, Bulgaria, Croatia, Italy (incl. Sardinia, Sicily), Macedonia, Romania, Slovenia SOUTHWESTERN EUROPE: France (incl. Corsica), Spain (incl. Baleares) Southern America SOUTHERN SOUTH AMERICA: Argentina, Uruguay"

Qsn #	Question	Answer
103	**Does the species have weedy races?**	**y**
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The plant has become invasive in parts of Europe, where it forms extensive and dense populations, crowding out native vegetation and preventing natural regeneration by shrubs and trees. Plants compete for space, water and nutrients. The plant establishes well on alluvial plains, displacing plant species adapted to these open habitats by shading and preventing woody species from becoming established (Balogh, 2008). The annual stems of Jerusalem artichoke may accumulate during winter at the upper river edges, preventing establishment of native plants (Hartmann et al., 1995)."

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**Low**
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Jerusalem artichoke is an ancient Amerindian native to eastern North America from Maine west to Dakota and southwards to northern Florida and Texas. It is now widely cultivated in many places around the world, including North America, France, Italy, Germany, East European countries, China and also (in spite of low suitability) in some tropical countries in the cooler highlands (India, Indonesia, Malaysia, Kenya, Zaire and Nigeria)." … "Although a temperate species, H. tuberosus tolerates sub-zero to hot temperatures (Duke 1983)."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 11 May 2020]	"Native Northern America EASTERN CANADA: Canada [Québec (s.), Nova Scotia, Ontario (s.), Prince Edward Island, New Brunswick] WESTERN CANADA: Canada [Saskatchewan (s.), Manitoba (s.)] NORTHEASTERN U.S.A.: United States [Indiana, Maine (s.), Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, Connecticut] NORTH-CENTRAL U.S.A.: United States [Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Illinois, Oklahoma, Wisconsin] NORTHWESTERN U.S.A.: United States [Colorado, Idaho, Washington, Wyoming] SOUTHEASTERN U.S.A.: United States [Alabama (n.), Arkansas, Delaware, District of Columbia, Florida (n.), Georgia, Kentucky, Louisiana (n.), Maryland, North Carolina, South Carolina, Virginia, Mississippi, Tennessee] SOUTH-CENTRAL U.S.A.: United States [Texas]"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**

Qsn #	Question	Answer
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 11 May 2020]	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Although a temperate species, H. tuberosus tolerates sub-zero to hot temperatures (Duke 1983). Most Jerusalem artichoke cultivars require average annual temperatures of between 6 and 26 °C, within a growing season of at least 125 frost-free days (Cosgrove et al. 2000 ; Duke 1983). Jerusalem artichoke grows under different pedoclimatic conditions and shows good tolerance to frost, drought and other adverse conditions, as well as resistance to pests and diseases (Slimestad et al. 2010). H. tuberosus tubers can withstand freezing for months even if the frost kills the stems and leaves (Duke 1983)."
	Anderson, J. E., Campbell, A., & Kantar, M. B. (2019). Crop Wild Relatives of Root Vegetables in North America. Pp. 243-279. In North American Crop Wild Relatives, Volume 2. Springer, Cham, Switzerland	"The native range of Helianthus tuberosus is quite large, ranging from the Mississippi River to the Atlantic Ocean and from the Gulf of Mexico to the Hudson Bay (Kantar et al. 2015). The large range provides many opportunities to find populations that are adapted to diverse climatic and biological stresses."
	Flora of North America Editorial Committee. 2006. Flora of North America North of Mexico. Vol. 21. New York and Oxford	[Broad latitudinal and elevation range] "Flowering late summer–fall. Roadsides, fields, waste areas; 0–1000(–1500) m; Man., N.B., N.S., Ont., P.E.I., Que., Sask.; Ala., Ark., Colo., Conn., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Nebr., N.H., N.J., N.Y., N.C., N.Dak., Ohio, Okla., Pa., R.I., S.C., S.Dak., Tenn., Tex., Utah, Vt., Va., Wash., W.Va., Wis., Wyo.; cultivated and adventive in Europe."

204	Native or naturalized in regions with tropical or subtropical climates	
	Source(s)	**Notes**
	Walker, M. (2020). DOFAW State Protection Forester. Pers Comm.04 May	"I found some plants that are naturalizing that we think is Helianthus tuberosus , most likely from some farm lots a mile or so makai of the location." [Potentially naturalizing on Oahu, Hawaiian Islands]
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Jerusalem artichoke is an ancient Amerindian native to eastern North America from Maine west to Dakota and southwards to northern Florida and Texas. It is now widely cultivated in many places around the world, including North America, France, Italy, Germany, East European countries, China and also (in spite of low suitability) in some tropical countries in the cooler highlands (India, Indonesia, Malaysia, Kenya, Zaire and Nigeria)." … "Although a temperate species, H. tuberosus tolerates sub-zero to hot temperatures (Duke 1983)."

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

Qsn #	Question	Answer
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Jerusalem artichoke is an ancient Amerindian native to eastern North America from Maine west to Dakota and southwards to northern Florida and Texas. It is now widely cultivated in many places around the world, including North America, France, Italy, Germany, East European countries, China and also (in spite of low suitability) in some tropical countries in the cooler highlands (India, Indonesia, Malaysia, Kenya, Zaire and Nigeria)."

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Walker, M. (2020). DOFAW State Protection Forester. Pers Comm.04 May	"I found some plants that are naturalizing that we think is Helianthus tuberosus , most likely from some farm lots a mile or so makai of the location." [Potentially naturalizing on Oahu, Hawaiian Islands]
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 11 May 2020]	"Naturalized Africa MACARONESIA: Portugal [Azores] Asia-Temperate WESTERN ASIA: Cyprus CAUCASUS: Russian Federation-Ciscaucasia [Ciscaucasia] CHINA: China EASTERN ASIA: Japan Australasia AUSTRALIA: Australia NEW ZEALAND: New Zealand Europe NORTHERN EUROPE: Norway, Sweden, United Kingdom MIDDLE EUROPE: Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland EASTERN EUROPE: Belarus, Estonia, Latvia, Lithuania, Moldova, Russian Federation-European part, [European part] Ukraine (incl. Krym) SOUTHEASTERN EUROPE: Albania, Bulgaria, Croatia, Italy (incl. Sardinia, Sicily), Macedonia, Romania, Slovenia SOUTHWESTERN EUROPE: France (incl. Corsica), Spain (incl. Baleares) Southern America SOUTHERN SOUTH AMERICA: Argentina, Uruguay"
	Imada, C. (2019). Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). Bishop Museum Technical Report 69. Bishop Museum, Honolulu, HI	Not recorded by date of publicationb

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Since seed production is low and seeds are not highly dispersive, H. tuberosus is not often seen invading disturbed areas. Thus , it is likely to manifest its weediness more as a volunteer crop (Wall and Friesen 1989)."

Qsn #	Question	Answer
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Environmental and agricultural weed] "The plant has become invasive in parts of Europe, where it forms extensive and dense populations, crowding out native vegetation and preventing natural regeneration by shrubs and trees. Plants compete for space, water and nutrients."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Helianthus tuberosus has been shown to exhibit allelopathic effects by reducing germination of grasses and crop plants (Tesio et al., 2012)."
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Uncontrolled populations of Jerusalem artichoke can be a serious threat to successful crop production. According to Wyse et al. (1986) "Soybean producers in southern Canada and the midwestern United States are reporting that Jerusalem artichoke infestations are increasing in many fields''."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Cereals, Orchards & Plantations, Pome Fruits, Vegetables"
	Anderson, J. E., Campbell, A., & Kantar, M. B. (2019). Crop Wild Relatives of Root Vegetables in North America. Pp. 243-279. In North American Crop Wild Relatives, Volume 2. Springer, Cham, Switzerland	"When cultivated, H. tuberosus is planted using tuber parts and replanted every 3 years (Kays and Nottingham, 2008). A major limitation to production is that the species can become a volunteer weed in subsequent crops."

304	Environmental weed	y
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The plant has become invasive in parts of Europe, where it forms extensive and dense populations, crowding out native vegetation and preventing natural regeneration by shrubs and trees. Plants compete for space, water and nutrients. The plant establishes well on alluvial plains, displacing plant species adapted to these open habitats by shading and preventing woody species from becoming established (Balogh, 2008). The annual stems of Jerusalem artichoke may accumulate during winter at the upper river edges, preventing establishment of native plants (Hartmann et al., 1995)."

305	Congeneric weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Kane, N. C., & Rieseberg, L. H. (2008). Genetics and evolution of weedy Helianthus annuus populations: adaptation of an agricultural weed. Molecular Ecology, 17 (1), 384-394	"The common sunflower Helianthus annuus is an interesting case of a native, disturbance-adapted annual plant in which some populations have evolved many typical traits of agricultural weeds, including resistance to some of the most commonly used herbicides (Zelaya & Owen 2004; Massinga et al. 2005). The species H. annuus contains weedy, wild, and domesticated forms (Heiser et al. 1969). Weed and wild forms are self-incompatible, while domesticated varieties are typically self-compatible. The weed form is listed as a noxious weed in the states of Iowa, Minnesota and Alaska, and is known to be a problematic weed in corn, soybeans, and other species (Irons & Burnside 1982; Mesbah et al. 2004). It has been found to decrease yields of corn by up to 64% (Deines et al. 2004) and yields of soybean by as much as 97% (Geier et al. 1996)."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Several species are invasive weeds

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**
	Flora of North America Editorial Committee. 2006. Flora of North America North of Mexico. Vol. 21. New York and Oxford	[No evidence] "Perennials, 50–200+ cm (rhizomatous, producing tubers late in growing season). Stems erect, scabro-hispid to hirsute (sometimes glaucous). Leaves mostly cauline; opposite or alternate proximally, usually alternate distally; petioles 2–8 cm (often ± winged); blades (3-nerved from near bases) lanceolate to ovate, 10–23 × 7–15 cm, bases broadly to narrowly cuneate, margins entire or serrate (flat), abaxial faces puberulent or hirsutulous to tomentulose and gland-dotted (abaxial) or ± scabrous (adaxial). Heads 3–15. Peduncles 1–15 cm. Involucres hemispheric, (10–25 ×) 8–12 mm. Phyllaries (often dark green, drying nearly black) 22–35 (bases appressed, apices ± spreading, sometimes reflexed in fruit), lanceolate, 8.5–15 × 2–4 mm (subequal), (margins ciliate) apices acuminate, abaxial faces hispidulous or puberulent, gland-dotted. Paleae 8–9 mm, 3-toothed (apices hairy). Ray florets 10–20; laminae 25–40 mm. Disc florets 60+; corollas 6–7 mm, lobes yellow; anthers dark brown or black, appendages dark or yellowish. Cypselae 5–7 mm, glabrous or distally hairy; pappi of 2 aristate scales 1.9–3 mm plus 0–1 deltate scales 0.5–0.8 mm."

402	Allelopathic	y
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Helianthus tuberosus has been shown to exhibit allelopathic effects by reducing germination of grasses and crop plants (Tesio et al., 2012)."

Qsn #	Question	Answer
403	**Parasitic**	**n**
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"A multibranched herbaceous perennial growing to 1.5–3 m high and producing rhizomatous subterranean stem tubers and fibrous roots." [Asteraceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	"The aboveground parts of Jerusalem artichoke are not consumed as human food, but both the tops and tubers can be utilized as animal feed, either fresh or in silage and feed formulations. Jerusalem artichoke typically yields around 500 to 700 t·ha–1 of green material. As a forage crop, it can be grown as a permanent planting since the tops are regenerated each year from tubers left in the ground (Gunnarson et al., 1985). All the aerial parts are included in fodder, although the leaves and stems differ in their nutrient and mineral content (Table 6.2). The leaves contain more protein than the stems, while the stems contain more carbohydrate than the leaves (e.g., Hay and Offer, 1992; Luske, 1934). The leaves are therefore generally considered better in terms of fodder than the stems (Hay and Offer, 1992; Malmberg and Theander, 1986; see also Table 5.3). The leaves are a good source of protein for animal forage, being particularly rich in the amino acids lysine and methionine compared to other forage (Stauffer et al., 1981)."

405	Toxic to animals	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] "Helianthus tuberosus … North America. Perennial herbaceous, stout, variable, branching, lanceolate rough thick leaves, opposite lower leaves, alternate upper leaves, rough stems bearing large yellow flower heads, food plant, root tuber eaten as vegetable"
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	[No evidence] "The aboveground parts of Jerusalem artichoke are not consumed as human food, but both the tops and tubers can be utilized as animal feed, either fresh or in silage and feed formulations."

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	Anderson, J. E., Campbell, A., & Kantar, M. B. (2019). Crop Wild Relatives of Root Vegetables in North America. Pp. 243-279. In North American Crop Wild Relatives, Volume 2. Springer, Cham, Switzerland	"Helianthus tuberosus is widely resistant to both insect pathogens and diseases and has often been used as a donor species in Helianthus annuus (sunflower) breeding (Kantar et al. 2014)."
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Jerusalem artichoke also acts as a host to the weevil Cosmobaris americana Casey which attacks sugar beets (Landis et al. 1970) and the treehopper, Publilia concava (Say) (Quisenberry et al. 1978)." [Importance in Hawaii unknown]

Qsn #	Question	Answer
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	"Relative to other crops, Jerusalem artichoke has few serious pest and disease problems. However, high yield losses can occur, especially when fungal or bacterial infestations affect the tubers."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"The edible artichoke tuber has a sweet nutty taste and is used as a vegetable that could be baked, steamed and mashed, or made into soups, sauces or pickles or eaten raw in salads." [No evidence]
	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] "North America. Perennial herbaceous, stout, variable, branching, lanceolate rough thick leaves, opposite lower leaves, alternate upper leaves, rough stems bearing large yellow flower heads, food plant, root tuber eaten as vegetable"

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	[No evidence, and unlikely given habitat] "Jerusalem artichoke is frequently found in moist habitats such as river and stream banks, meadows and waste areas (Alex and Switzer 1976; Gleason and Cronquist 1991), as well as in cultivated fields (Wyse et al. 1986; Wall and Friesen 1989) and orchards (Roland 1946)."
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Not listed among impacts] "Plants compete for space, water and nutrients. The plant establishes well on alluvial plains, displacing plant species adapted to these open habitats by shading and preventing woody species from becoming established (Balogh, 2008)."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Heiser, C. B., Smith, D. M., Clevenger, S. B., & Martin, W. C. (1969). The North American sunflowers (Helianthus). Memoirs of the Torrey Botanical Club, 22(3), 1-218	"Distribution: Damp or moderately dry, open or shaded areas, Nova Scotia to Manitoba, south to northern Florida and Texas."
	Duke, J. A. (1983). Helianthus tuberosus. Handbook of Energy Crops. https://hort.purdue.edu. [Accessed 11 May 2020]	"From the North American Center of Diversity, Jerusalem artichoke is reported to tolerate bacteria, frost, high pH, laterite, low pH, photoperiod, sand, shade, slope, virus, waterlogging, and weeds (2n = 102) (Duke, 1978)." … " It grows best in a loose circumneutral loam, and in full sun, but can tolerate some shade."
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"It does best in friable, moderately well-drained soil in full sun to partial shade."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"Jerusalem artichoke thrives in a wide range of soil types and pH levels, but production is favoured by slightly alkaline soils with optimal pH in the range of 4.5–8.6 (Duke 1983 ; Kosaric et al. 1984). It does best in friable, moderately well-drained soil in full sun to partial shade. Clay soils that are prone to waterlogging, for instance, may become too acid for optimum tuber growth. Greenhouse and field trials on heavy clay loam conducted by Newton et al. (1991) found that soil salinity reduced growth (plant biomass) and tuber biomass of Jerusalem artichoke."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"A multibranched herbaceous perennial growing to 1.5–3 m high and producing rhizomatous subterranean stem tubers and fibrous roots."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The plant has become invasive in parts of Europe, where it forms extensive and dense populations, crowding out native vegetation and preventing natural regeneration by shrubs and trees. Plants compete for space, water and nutrients."

501	Aquatic	n
	Source(s)	**Notes**
	Flora of North America Editorial Committee. 2006. Flora of North America North of Mexico. Vol. 21. New York and Oxford	[Terrestrial] "Roadsides, fields, waste areas;0–1000(–1500) m"

502	Grass	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 11 May 2020]	Family: Asteraceae (alt.Compositae) Subfamily: Asteroideae Tribe: Heliantheae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2020). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 11 May 2020]	Family: Asteraceae (alt.Compositae) Subfamily: Asteroideae Tribe: Heliantheae

Qsn #	Question	Answer
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**y**
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"A multibranched herbaceous perennial growing to 1.5–3 m high and producing rhizomatous subterranean stem tubers and fibrous roots. Tubers knobby, uneven, white, red or purple skinned, ranging in size from 7.5 to 10 cm long, 3–5 cm thick, with nodes, internodes and eyes, the flesh is white"
	Flora of North America Editorial Committee. 2006. Flora of North America North of Mexico. Vol. 21. New York and Oxford	"Perennials, 50–200+ cm (rhizomatous, producing tubers late in growing season)."

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	[No evidence] "Wild forms of H. tuberosus, on the other hand, are common and potentially invasive, especially in the eastern half of the U.S., being regarded as weeds in some situations. Escapes from cultivation (or plantings as food for wildlife) are also a common weed problem in Central and Eastern Europe, where it is often considered to be an invasive species (Balogh, 2001; Konvalinková, 2003; Rehorek, 1997)."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	"Jerusalem artichoke does not produce much seed, and may not produce any in northerly latitudes. Therefore, insect pollination is crucial in sunflowers, but of less importance in the cultivation of Jerusalem artichoke. Nevertheless, insect cross-pollination is vital for the production of seed in plant breeding programs, while viable seed is an important factor in the dispersal of wild Helianthus tuberosus."
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Jerusalem artichoke spreads both by seeds and vegetatively by its numerous tubers;"

603	**Hybridizes naturally**	
	Source(s)	**Notes**
	Heiser, C. B., Smith, D. M., Clevenger, S. B., & Martin, W. C. (1969). The North American sunflowers (Helianthus). Memoirs of the Torrey Botanical Club, 22(3), 1-218	"Artificial hybrids are also known with H. annuus and H. tuberosus." … "At the hexaploid ·1evel artificial hybrids are known with H. tuberosus, H. rigidus and H. resinosus. It seems likely that such hybridization would not be uncommon in nature and that these hybrids and their derivatives would fall into H. strumosus as here delimited." … "Artificial hybrids of the two subspecies of H. rigidus are fertile and artificial interspecific hybrids of both subspecies have been secured with H. strumosus and H. tuberosus." … "Fertile artificial hybrids have been obtained in crosses with both H. resinosus and H. tuberosus."

Qsn #	Question	Answer
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	[Artificial hybrids possible] "H. tuberosus is a hexaploid that can be crossed with H. annuus L. This cross produces plants with shorter stolons and larger tubers, thus enabling easier commercial harvesting (Kosaric et al. 1984). Kostoff (1939) theorized that part of the H. tuberosus hexaploidy genome was synonymous with the genome of the diploid H. annuus. Jerusalem artichoke also produces fertile crosses with H. laetiflorus Pers., H. subrhomboideus Rydb. and H . rigidus (Cass.) Desf. (Clevenger and Heiser 1963; Dorrell and Whelan 1978). Clevenger and Heiser (1963) speculated that H. rigidus and particularly H. laetiflorus are hybrids descended from H. tuberosus and H. subrhomboideus. H. giganteus and H. maximiliani Schrad. are other species that may provide useful genetic crosses (Kosaric et al. 1984). Analysis of these species and the hybrids that are possible can provide useful variability in characteristics for both sunflower and Jerusalem artichoke breeding programs."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	[Largely self-incompatible] "Jerusalem artichoke, like nearly all Helianthus species, is largely self-incompatible, and as a consequence, cross-pollination is essential for the production of viable seed, with self-pollination being a rare event." … "Jerusalem artichoke is an obligate outcrosser and produces seed only when cross-pollinated. When in cultivation in homogenous stands, few seeds are produced. A high level of autoincompatibility (Toxopeus, 1991), irregular meiosis (van de Sande Bakhuyzen and Wittenrood, 1950), and differences in pollen viability among clones (i.e., 47 to 99%) (Atlagic et al., 1993) contribute to the low fertility. The absence of seed may also occur due to climatic reasons in some locations (Lohmeyer and Sukopp, 1992)."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	"Pollination of Helianthus species is predominantly by honeybees and bumblebees (Cockerell, 1914), although other insects may be active. Helianthus are “all-day flowers,” presenting a continuous pollen and nectar resource for bees and other insects."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Jerusalem artichoke spreads both by seeds and vegetatively by its numerous tubers; these may be carried by floods, soil movement and rodents digging for tubers as a source of food (Hartmann et al., 1995)."

607	Minimum generative time (years)	1

Qsn #	Question	Answer
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Once established, Jerusalem artichoke plants exhibit a rapid increase in plant height, number of leaves and tubers through one life cycle (Swanton and Cavers 1989). This robust growth habit enables H. tuberosus to outcompete most other plant species in arable land."
	Anderson, J. E., Campbell, A., & Kantar, M. B. (2019). Crop Wild Relatives of Root Vegetables in North America. Pp. 243-279. In North American Crop Wild Relatives, Volume 2. Springer, Cham, Switzerland	"The crop is grown as a winter or summer annual."

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Jerusalem artichoke spreads both by seeds and vegetatively by its numerous tubers; these may be carried by floods, soil movement and rodents digging for tubers as a source of food (Hartmann et al., 1995)."
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	[Inadvertently dispersed through agricultural activities and movement of soil] "New shoots may arise throughout the growing season whenever rhizomes and tubers are fragmented and dispersed as a result of tillage."

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Lim, T.K. 2015. Edible Medicinal And Non-Medicinal Plants. Volume 9, Modified Stems, Roots, Bulbs. Springer, Dordrecht	"It is now widely cultivated in many places around the world, including North America, France, Italy, Germany, East European countries, China and also (in spite of low suitability) in some tropical countries in the cooler highlands (India, Indonesia, Malaysia, Kenya, Zaire and Nigeria)."

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, Pasture Dispersed by: Humans, Animals, Water, Escapee"
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"New shoots may arise throughout the growing season whenever rhizomes and tubers are fragmented and dispersed as a result of tillage." [May be dispersed due to agricultural activities, but unclear if seeds could become a produce contaminant]

Qsn #	Question	Answer
704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Since seed production is low and seeds are not highly dispersive, H. tuberosus is not often seen invading disturbed areas. Thus , it is likely to manifest its weediness more as a volunteer crop (Wall and Friesen 1989) "

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Jerusalem artichoke spreads both by seeds and vegetatively by its numerous tubers; these may be carried by floods, soil movement and rodents digging for tubers as a source of food (Hartmann et al., 1995)."

706	**Propagules bird dispersed**	**n**
	Source(s)	**Notes**
	Heiser, C. B., Smith, D. M., Clevenger, S. B., & Martin, W. C. (1969). The North American sunflowers (Helianthus). Memoirs of the Torrey Botanical Club, 22(3), 1-218	[Other species may be secondarily dispersed by avian seed predators, but evidence for H. tuberosus is lacking] "Before man appeared on the scene probably both birds and small mammals were important agents in dispersal, for sunflower seeds are an attractive food ·to both groups. Some birds in visiting mature sunflower heads may scatter achenes. Most birds to my knowledge crack sunflower achenes before eating them but it is possible that some are eaten whole and may pass through the digestive system unharmed."
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	[Unlikely given limited seed production] "Since seed production is low and seeds are not highly dispersive, H. tuberosus is not often seen invading disturbed areas. Thus, it is likely to manifest its weediness more as a volunteer crop (Wall and Friesen 1989) ."

707	**Propagules dispersed by other animals (externally)**	
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Jerusalem artichoke spreads both by seeds and vegetatively by its numerous tubers; these may be carried by floods, soil movement and rodents digging for tubers as a source of food (Hartmann et al., 1995)." [Possible that rats or pigs digging for tubers may inadvertently disperse viable rhizome or tuber fragments]

Qsn #	Question	Answer
708	**Propagules survive passage through the gut**	**n**
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	[Unlikely] "Since seed production is low and seeds are not highly dispersive, H. tuberosus is not often seen invading disturbed areas. Thus , it is likely to manifest its weediness more as a volunteer crop (Wall and Friesen 1989)" … "New shoots may arise throughout the growing season whenever rhizomes and tubers are fragmented and dispersed as a result of tillage."

801	**Prolific seed production (>1000/m2)**	**n**
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Very few (often < 5) seeds are produced per flower head. The seeds (achenes) are grey or brown and often mottled with black, flattened, wedge-shaped and smooth (Alex and Switzer 1976) and are 6-8 mm long (Muenscher 1980) and about 2 mm wide."
	Kays, S. J., & Nottingham, S. F. (2007). Biology and Chemistry of Jerusalem Artichoke: Helianthus tuberosus L. CRC Press, Boca Raton, FL	[Low seed production] "Seed yield per plant varies widely with genotype, location, and production conditions. Wild populations tend to flower more and have higher achene viability than cultivated clones (Westley, 1993). In general, low seed production for the species may be in part related to the late flowering and cooler temperatures in the fall. The number of seeds per flower, number of seeds per plant, and mean seed size of six clones representing three ecotypes (two cultivated, two weedy, and two wild) varied substantially (Swanton, 1986). Weedy clones produced ~5 seeds per flower while the cultivated clones had from 0.08 to 2 seeds. Variation in the mean seed weight among clones was relatively small (3.5 to 4.8 mg), though individual seed weights ranged from 0.8 to 10.8 mg. The number of seeds per plant varied from 5.6 to 78. In contrast, the seed yield from five commercial cultivars allowed to outcross ranged from 88 to 1,058 seeds per plant (Lim and Lee, 1989)."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	[Longevity unspecified] "The seeds of H. tuberosus are dormant after maturity; however, Wyse and Wilfahrt (1982) reported that the dormancy could be broken by a cold treatment of l.7° C for a period of 7 d. The seeds are largely infertile (Lukens 1982). Although few plants would generally originate from seed, seed production is important for maintaining genetic diversity. Seed production may be more important among naturally occurring riverbank populations"

Qsn #	Question	Answer
	Lim, K. B., & Lee, H. J. (1989). Seed dormancy of Jerusalem artichoke (Helianthus tuberosus L.) and seed treatment for germination induction. Korean Journal of Crop Science, 34(4), 370-377	[Seeds probably form a persistent seed bank] "Abstract : Five cultivars of Jerusalem artichoke, a potential biomass crop, had seed germination rates ranging from 2.4% in JA2 to 14.7% in Mammoth French. The number of seeds produced by a single plant ranged from 88 to 1058. The germinability of seeds stored for 3 months at room temperature after harvest was almost zero and it was not improved by different temperature, light and GA3 treatments. However, after 27 months at room temperature it rose to 47.5%. Removal or pinpricking of the seed coat were effective in breaking dormancy, giving germination rates of 86.8 and 82.3%, respectively. Stratification was also effective in breaking dormancy; whole dormant seeds incubated for 70 days at 2.5°C on wet cottonwool showed a germination rate of >85%. "

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Chemical control is most effective at the pre-flowering stage. Suitable herbicides include glyphosate, dicamba plus 2,4-D, or 2,4-D ester."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Swanton, C. J., Clements, D. R., Moore, M. J., & Cavers, P. B. (1992). The biology of Canadian weeds. 101. Helianthus tuberosus L. Canadian Journal of Plant Science, 72(4), 1367-1382	"Eliminating H. tuberosus by cultural and/or chemical means is difficult because of the underground rhizomes and tubers. Crop rotations that include small grain crops, such as wheat, barley and oats, may reduce the reproductive capabilities of Jerusalem artichoke. Studies conducted in Minnesota have shown that a single Jerusalem artichoke plant growing in a stand of hard red spring wheat, produced only 1-2 tubers during a growing season, while a single Jerusalem artichoke plant growing in a stand of corn or soybeans, produced 50-60 tubers (Wyse and Wilfahrt (1982). Wyse and Wilfahrt (1982) suggested that repeated mowings or tillage may reduce populations of Jerusalem artichoke over a period of 1-2 yr, provided they were timed prior to the formation of new rhizomes and tubers. Russell (1979) studied the effects of multiple mowings on H. tuberosus and found that stand populations could be reduced by 80 % within a year."
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Mechanical control is difficult due to the numerous underground rhizomes and tubers that allow a rapid recolonization of cleared sites."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Poteet, M.D. (2006). Biodiesel Crop Implementation in Hawaii. Prepared for: The State of Hawaii Department of Agriculture Under Contract Number HDOA-2006-2	[Unknown if birds will also depredate H. tuberosus seeds. Possibly irrelevant, as it can also reproduce by tubers] "A major problem with sunflower production in Hawaii is the prevalence of birds that will consume a large portion of the desired seed. Birds will attack the cotyledon leaves of sunflower much as they feed on soybean plants. This activity can virtually destroy entire stands. Local growers who attempt to produce sunflower at a small scale for personal use have continually met with disappointing yields due to bird predation on the seeds (Osgood, 2006). One possible reason for such heavy bird predation is the need to 'dry down' the crop during cool weather, which Hawaii rarely experiences. The longer time to 'dry down' in the field allows for more bird damage. This factor likely makes sunflower unsuitable for proposed use as a biodiesel crop in Hawaii."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability
• Possibly naturalizing on Oahu, Hawaiian Islands; widely naturalized elsewhere
• A weed impacting crop production and native vegetation in certain parts of the world
• Other Helianthus species are invasive
• Allelopathic
• Thrives in full sun, but tolerates shade
• Tolerates many soil types
• Forms dense stands that exclude other vegetation
• Reproduces by seeds and vegetatively by tubers and rhizomes
• Capable of reaching maturity in one season
• Seeds and tubers dispersed by soil movement, water, and intentionally by people
• Seeds exhibit dormancy and could potentially form a persistent seed bank
• Able to resprout from tubers and rhizomes after cutting or mowing

Low Risk Traits
• A temperate species that may only thrive in higher elevations of tropical islands
• Unarmed (no spines, thorns, or burrs)
• Non-toxic
• Palatable to animals and people
• Mostly outcrossing and largely self-incompatible
• Limited seed production could reduce risk of long-distance dispersal
• Herbicides may provide effective control