

Assessment date 24 October 2016

<i>Tithonia diversifolia</i> ALL ZONES		Answer	Score
1.01	Is the species highly domesticated?	n	0
1.02	Has the species become naturalised where grown?		
1.03	Does the species have weedy races?		
2.01	Species suited to Florida's USDA climate zones (0-low; 1-intermediate; 2-high) North Zone: suited to Zones 8, 9 Central Zone: suited to Zones 9, 10 South Zone: suited to Zone 10	2	
2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	
2.03	Broad climate suitability (environmental versatility)	y	1
2.04	Native or naturalized in habitats with periodic inundation North Zone: mean annual precipitation 50-70 inches Central Zone: mean annual precipitation 40-60 inches South Zone: mean annual precipitation 40-60 inches	y	1
2.05	Does the species have a history of repeated introductions outside its natural range?	y	
3.01	Naturalized beyond native range	y	2
3.02	Garden/amenity/disturbance weed	y	2
3.03	Weed of agriculture	y	4
3.04	Environmental weed	y	4
3.05	Congeneric weed	y	2
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	unk	0
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals	n	-1
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens	unk	0
4.07	Causes allergies or is otherwise toxic to humans	y	1
4.08	Creates a fire hazard in natural ecosystems	unk	0
4.09	Is a shade tolerant plant at some stage of its life cycle	n	0
4.10	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils). North & Central Zones: infertile soils; South Zone: shallow limerock or Histisols.	unk	0
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	y	1
5.01	Aquatic	n	0
5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte	n	0

6.01	Evidence of substantial reproductive failure in native habitat	n	0
6.02	Produces viable seed	y	1
6.03	Hybridizes naturally	unk	-1
6.04	Self-compatible or apomictic	unk	-1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation	y	1
6.07	Minimum generative time (years)	1	1
7.01	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y	1
7.02	Propagules dispersed intentionally by people	y	1
7.03	Propagules likely to disperse as a produce contaminant	y	1
7.04	Propagules adapted to wind dispersal	y	1
7.05	Propagules water dispersed	y	1
7.06	Propagules bird dispersed	unk	-1
7.07	Propagules dispersed by other animals (externally)	unk	-1
7.08	Propagules dispersed by other animals (internally)	y	1
8.01	Prolific seed production	y	1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	n	-1
8.03	Well controlled by herbicides	n	1
8.04	Tolerates, or benefits from, mutilation or cultivation	y	1
8.05		?	
Total Score			24
Implemented Pacific Second Screening			no
Risk Assessment Results			High

section	# questions answered	satisfy minimum?
A		11 yes
B		8 yes
C		19 yes
total		38 yes

	Reference	Source data
1.01		Cultivated, but no evidence of selection for reduced weediness
1.02		Skip to 2.01
1.03		Skip to 2.01
2.01	<p>1. Global Plant Hardiness Zones for Phytosanitary Risk Analysis. http://naldc.nal.usda.gov/download/36586/PDF (Accessed: 21 September 2016) 2. GRIN US National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?36733 (Accessed: 21 September 2016) 3. Dave's Garden. http://davesgarden.com/guides/pf/go/59827/ (Accessed: 21 September 2016) 4. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 5. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. Figure 3. Florida North Zone: Hardiness zones 8 and 9. Central Zone: Hardiness zones 9 and 10. South Zone: Hardiness zone 10. Hardy in USDA Zones 8, 9, 10, 11, 12, and 13. 2. Native to Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Naturalized in Kenya, Tanzania, Uganda, Chad, Ethiopia, Malawi, Mozambique, Zambia, Zimbabwe, South Africa, Swaziland, Cote D'Ivoire, Guinea, Nigeria, Togo, Burundi, Cameroon, Central African Republic, Rwanda, Zaire, Mauritius, Mayotte, Reunion, China (Guangdong, Yunnan), Taiwan, India, Nepal, Sri Lanka, Myanmar, Thailand, Papua New Guinea, Philippines, Australia (New South Wales, Queensland), United States (Texas, Florida, Hawaii), Cook Islands, French Polynesia, Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Brazil, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, Virgin Islands, Venezuela, Chile, Colombia, and Ecuador. 3. Hardy in USDA Hardiness Zones: 9a to 10b. 4. "Hardiness: USDA Zones 9 - 11. Light frosts and freezes will kill Bolivian sunflowers to the ground, but if the damage isn't too bad, they come back in spring. Some people have had success with this tropical in Zone 8." 5. "Native to Mexico, Central America and Cuba, it has been introduced and now naturalized in tropical parts of Asia and Africa. It is also naturalized in some Pacific islands, where it is found along roadsides and in disturbed areas."</p>
2.02		Native range is well known.

2.03	<p>1. The University of Melbourne. Köppen-Geiger Climate Map of the World. http://people.eng.unimelb.edu.au/mpeel/koppen.html (Accessed: 21 September 2016) 2. GRIN US National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?36733 (Accessed: 21 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. Native to Köppen-Geiger Climate Zones: Af, Am, Aw, BWh, BWk, BSh, BSk, Cwa, Cwb, Cfa, and Cfb. 2. Native to Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Naturalized in Kenya, Tanzania, Uganda, Chad, Ethiopia, Malawi, Mozambique, Zambia, Zimbabwe, South Africa, Swaziland, Cote D'Ivoire, Guinea, Nigeria, Togo, Burundi, Cameroon, Central African Republic, Rwanda, Zaire, Mauritius, Mayotte, Reunion, China (Guangdong, Yunnan), Taiwan, India, Nepal, Sri Lanka, Myanmar, Thailand, Papua New Guinea, Philippines, Australia (New South Wales, Queensland), United States (Texas, Florida, Hawaii), Cook Islands, French Polynesia, Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Brazil, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, Virgin Islands, Venezuela, Chile, Colombia, and Ecuador. 3. "Native to Mexico, Central America and Cuba, it has been introduced and now naturalized in tropical parts of Asia and Africa. It is also naturalized in some Pacific islands, where it is found along roadsides and in disturbed areas."</p>
2.04	<p>1. Climate Charts. World Climate Maps. http://www.climate-charts.com/World-Climate-Maps.html#rain (Accessed: 21 September 2016) 2. GRIN US National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?36733 (Accessed: 21 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. Native and naturalized in areas with rainfall within these ranges. 2. Native to Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Naturalized in Kenya, Tanzania, Uganda, Chad, Ethiopia, Malawi, Mozambique, Zambia, Zimbabwe, South Africa, Swaziland, Cote D'Ivoire, Guinea, Nigeria, Togo, Burundi, Cameroon, Central African Republic, Rwanda, Zaire, Mauritius, Mayotte, Reunion, China (Guangdong, Yunnan), Taiwan, India, Nepal, Sri Lanka, Myanmar, Thailand, Papua New Guinea, Philippines, Australia (New South Wales, Queensland), United States (Texas, Florida, Hawaii), Cook Islands, French Polynesia, Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Brazil, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, Virgin Islands, Venezuela, Chile, Colombia, and Ecuador. 3. "Native to Mexico, Central America and Cuba, it has been introduced and now naturalized in tropical parts of Asia and Africa. It is also naturalized in some Pacific islands, where it is found along roadsides and in disturbed areas."</p>

2.05	<p>1. GRIN US National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?36733 (Accessed: 21 September 2016) 2. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 22 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. Naturalized in Kenya, Tanzania, Uganda, Chad, Ethiopia, Malawi, Mozambique, Zambia, Zimbabwe, South Africa, Swaziland, Cote D'Ivoire, Guinea, Nigeria, Togo, Burundi, Cameroon, Central African Republic, Rwanda, Zaire, Mauritius, Mayotte, Reunion, China (Guangdong, Yunnan), Taiwan, India, Nepal, Sri Lanka, Myanmar, Thailand, Papua New Guinea, Philippines, Australia (New South Wales, Queensland), United States (Texas, Florida, Hawaii), Cook Islands, French Polynesia, Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Brazil, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, Virgin Islands, Venezuela, Chile, Colombia, and Ecuador. 2. "In South Africa, the two Tithonia species were introduced in the early 1900s as ornamental plants and have now been declared alien invasive weeds classified as category 1 weeds." 3. "Native to Mexico, Central America and Cuba, it has been introduced and now naturalized in tropical parts of Asia and Africa."</p>
3.01	<p>1. GRIN US National Plant Germplasm System. https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?36733 (Accessed: 21 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Mexia/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. Naturalized in Kenya, Tanzania, Uganda, Chad, Ethiopia, Malawi, Mozambique, Zambia, Zimbabwe, South Africa, Swaziland, Cote D'Ivoire, Guinea, Nigeria, Togo, Burundi, Cameroon, Central African Republic, Rwanda, Zaire, Mauritius, Mayotte, Reunion, China (Guangdong, Yunnan), Taiwan, India, Nepal, Sri Lanka, Myanmar, Thailand, Papua New Guinea, Philippines, Australia (New South Wales, Queensland), United States (Texas, Florida, Hawaii), Cook Islands, French Polynesia, Fiji, New Caledonia, Niue, Samoa, Tonga, Vanuatu, Brazil, Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Grenada, Guadeloupe, Hispaniola, Jamaica, Martinique, Montserrat, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, Virgin Islands, Venezuela, Chile, Colombia, and Ecuador. 2. "Locations within which Tithonia diversifolia is naturalised include Australia, south-eastern USA, tropical and subtropical African and many oceanic islands with warm climates." 3. "Native to Mexico, Central America and Cuba, it has been introduced and now naturalized in tropical parts of Asia and Africa. It is also naturalized in some Pacific islands, where it is found along roadsides and in disturbed areas."</p>

3.02	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 22 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 4. Muoghalu, J.I., Chuba, D.K. 2005. Seed germination and reproductive strategies of <i>Tithonia diversifolia</i> (Hemsl.) Gray and <i>Tithonia rotundifolia</i> (P.M.) Blake. <i>Applied Ecology and Environmental Research</i> 3 (1):39-46. (Accessed: 28 September 2016) 5. Global Compendium of Weeds. http://www.hear.org/gcw/species/tithonia_diversifolia/ (Accessed: 29 September 2016)</p>	<p>1. "Both <i>Tithonia</i> species are aggressive colonizers of disturbed, sun-exposed ecosystems with a high water table, including plantations, abandoned sites, and along railways and roads." 2. "It is abundant in East Africa and is spreading rapidly in habitats such as grasslands, disturbed land and riparian zones (banks of watercourses)."; "<i>Tithonia diversifolia</i> can quickly colonise disturbed areas." 3. "Rapid vegetative reproduction and significant production of lightweight seeds, which can be dormant in the soil for up to four months, allow <i>T. diversifolia</i> to quickly invade disturbed habitats." 4. Weed of abandoned lawns and roadsides 5. Classified as a garden thug</p>
3.03	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 22 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 3. Muoghalu, J.I., Chuba, D.K. 2005. Seed germination and reproductive strategies of <i>Tithonia diversifolia</i> (Hemsl.) Gray and <i>Tithonia rotundifolia</i> (P.M.) Blake. <i>Applied Ecology and Environmental Research</i> 3 (1):39-46. (Accessed: 28 September 2016) 4. Global Compendium of Weeds. http://www.hear.org/gcw/species/tithonia_diversifolia/ (Accessed: 29 September 2016)</p>	<p>1. "The escalating invasion by the two weedy sunflowers is increasingly threatening the biodiversity and ecological integrity of natural systems as well as agricultural and forestry systems in South Africa." 2. "It can also establish itself as a weed of cropland" 3. Weed of arable crops 4. Classified as an agricultural weed</p>
3.04	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 22 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 28 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 4. Global Compendium of Weeds. http://www.hear.org/gcw/species/tithonia_diversifolia/ (Accessed: 29 September 2016)</p>	<p>1. "The escalating invasion by the two weedy sunflowers is increasingly threatening the biodiversity and ecological integrity of natural systems as well as agricultural and forestry systems in South Africa." 2. "can form dense infestations in areas of native vegetation in which it can negatively impact upon native biodiversity" 3. "Rapid vegetative reproduction and significant production of lightweight seeds, which can be dormant in the soil for up to four months, allow <i>T. diversifolia</i> to quickly invade disturbed habitats. By forming dense stands it prevents the growth of young native plants." 4. Classified as an environmental weed</p>
3.05	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 22 September 2016) 2. Muoghalu, J.I., 2008. Growth, reproduction and resource allocation of <i>Tithonia diversifolia</i> and <i>Tithonia rotundifolia</i>. <i>Weed Research</i> 48. (Accessed: 28 September 2016) 3. Global Compendium of Weeds. http://www.hear.org/gcw/species/tithonia_rotundifolia/ (Accessed: 28 September 2016)</p>	<p>1. "In South Africa, the two <i>Tithonia</i> species were introduced in the early 1900s as ornamental plants and have now been declared alien invasive weeds classified as category 1 weeds." 2. <i>Tithonia rotundifolia</i> is an invasive weed of Africa 3. <i>Tithonia rotundifolia</i> is classified as a noxious weed</p>
4.01	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 2. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia_diversifolia.htm (Accessed: 27 September 2016) 3. Useful Tropical Plants. http://tropical.theferns.info/viewtropical.php?id=Tithonia+diversifolia (Accessed: 29 September 2016)</p>	<p>1,2,&3. No evidence of these characteristics</p>

4.02	<p>1. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 2. Tongma, Kobayashi, and Usui. Weed Science. https://www.jstor.org/stable/4046060?seq=1#page_scan_tab_contents (Accessed: 29 September 2016)</p>	<p>1. "Impact mechanisms: Allelopathic" 2. Displayed various levels of growth inhibition in a laboratory setting with tests conducted using concentrated extracts; insufficient evidence</p>
4.03		No evidence
4.04	<p>1. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 3. The Organic Farmer. http://theorganicfarmer.org/Articles/tithonia-can-improve-soil-fertility-farm (Accessed: 27 September 2016) 4. Feedipedia. http://www.feedipedia.org/node/15645 (Accessed: 28 September 2016) 5. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia.diversifolia.htm (Accessed: 28 September 2016) 6. Orwa C, A Mutua, Kindt R, Jamnadass R, S Anthony. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp (Accessed: 29 September 2016)</p>	<p>1. "Unfortunately, I can't grow Bolivian sunflower in my yard because the squirrels and the deer eat them to the ground. The white-tailed deer eat the leaves, and the gray squirrels eat the stems. Even pieces of stem that I tried to start in nursery pots and hid behind the greenhouse were discovered and eaten by the squirrels." 2. "Tithonia diversifolia is a fast-growing species, used as a garden ornamental, a green manure in agroforestry systems, a live fence (hedge) and as a fodder crop for livestock such as goats and cattle." 3. "It can also be used as fodder for cattle, goats and sheep." 4. "As fodder, it is rich in protein, valuable for ruminants and rabbits" 5. "The large size of the plant has interested some farmers in Columbia as a biomass plant to add organic material to poor soil and as a feed source for some livestock." 6. "Fodder: A suitable species for fodder for cows and goats. The leaves, soft branches and even the plant's yellow flowers are eaten. T. diversifolia has a high nutritive-quality index."</p>
4.05	<p>1. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 3. The Organic Farmer. http://theorganicfarmer.org/Articles/tithonia-can-improve-soil-fertility-farm (Accessed: 27 September 2016) 4. Feedipedia. http://www.feedipedia.org/node/15645 (Accessed: 28 September 2016) 5. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia.diversifolia.htm (Accessed: 28 September 2016) 6. Orwa C, A Mutua, Kindt R, Jamnadass R, S Anthony. 2009 Agroforestry Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp (Accessed: 29 September 2016)</p>	<p>1. "Unfortunately, I can't grow Bolivian sunflower in my yard because the squirrels and the deer eat them to the ground. The white-tailed deer eat the leaves, and the gray squirrels eat the stems. Even pieces of stem that I tried to start in nursery pots and hid behind the greenhouse were discovered and eaten by the squirrels." 2. "Tithonia diversifolia is a fast-growing species, used as a garden ornamental, a green manure in agroforestry systems, a live fence (hedge) and as a fodder crop for livestock such as goats and cattle." 3. "It can also be used as fodder for cattle, goats and sheep." 4. "As fodder, it is rich in protein, valuable for ruminants and rabbits" 5. "The large size of the plant has interested some farmers in Columbia as a biomass plant to add organic material to poor soil and as a feed source for some livestock." 6. "Fodder: A suitable species for fodder for cows and goats. The leaves, soft branches and even the plant's yellow flowers are eaten. T. diversifolia has a high nutritive-quality index."</p>
4.06	<p>1. FloridaGardener.com. http://www.floridagardener.com/pom/tithonia.htm (Accessed: 29 September 2016) 2. de F. Fernandes, de Miranda, Duarte, and Barreto. IMA Fungus. The Global Mycological Journal. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3905938/ (Accessed: 29 September 2016)</p>	<p>1. "Pests or diseases: Young foliage attacked by snails and slugs" 2. "Little is known about fungal pathogens infecting this plant."</p>
4.07	<p>1. Goon, Anthony Teik Jin and Goh, Chee Leok. Indian Journal of Dermatology. US National Library of Medicine National Institutes of Health. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3276901/ (Accessed: 29 September 2016) 2. Ket, Ng See and Leok, Goh Chee. The Principles and Practice of Contact and Occupational Dermatology in the Asia-Pacific Region. (Accessed: 29 September 2016)</p>	<p>1. Can cause contact dermatitis 2. "Those allergic to the plant develop airborne contact dermatitis. Repeated exposure produces a chronic lichenified dermatitis with acute exudative flares"</p>
4.08		Unknown

4.09	<p>1. Dave's Garden. http://davesgarden.com/guides/pf/go/59827/ (Accessed: 21 September 2016) 2. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 3. FloridaGardener.com. http://www.floridagardener.com/pom/tithonia.htm (Accessed: 22 September 2016)</p>	<p>1. "Full sun" 2. "Sunflowers need full sun." 3. "Light Requirements: Full sun for best growth and flowering"</p>
4.10	<p>1. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. "Special soil tolerances: infertile"; insufficient evidence</p>
4.11	<p>1. USDA Plants Database. http://plants.usda.gov/core/profile?symbol=TIDI2 (Accessed: 21 September 2016) 2. Orwa C, A Mutua, Kindt R , Jamnadass R, S Anthony. 2009 Agroforestry Database:a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp (Accessed: 29 September 2016) 3. Wagner, W.L., Herbst, D.R., Sohmer, S.H., 1999. Manual of the Flowering Plants of Hawaii. Bishop Museum Press, Honolulu. (Accessed: 29 September 2016)</p>	<p>1. "Growth Habit: Forb/herb, Subshrub" 2. "woody herb or succulent (scandent) shrub" 3. "Shrubs 2-5 m tall"</p>
4.12	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 2. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 22 September 2016) 3. Invasive Species Specialist Group. Global Invasive Species Database. http://www.iucngisd.org/gisd/species.php?sc=1320 (Accessed: 22 September 2016)</p>	<p>1. "Tithonia diversifolia can quickly colonise disturbed areas. It can also establish itself as a weed of cropland and can form dense infestations in areas of native vegetation in which it can negatively impact upon native biodiversity." 2. "By forming dense stands it prevents the growth of young native plants. Depending on the area, T. diversifolia may be either annual or perennial." 3. "Tithonia diversifolia to quickly invade disturbed habitats. In forming dense stands, it prevents the growth of young native plants."</p>
5.01	<p>1. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. Terrestrial</p>
5.02	<p>1. USDA Plants Database. http://plants.usda.gov/core/profile?symbol=TIDI2 (Accessed: 21 September 2016) 2. Orwa C, A Mutua, Kindt R , Jamnadass R, S Anthony. 2009 Agroforestry Database:a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp (Accessed: 29 September 2016) 3. Wagner, W.L., Herbst, D.R., Sohmer, S.H., 1999. Manual of the Flowering Plants of Hawaii. Bishop Museum Press, Honolulu. (Accessed: 29 September 2016)</p>	<p>1. "Growth Habit: Forb/herb, Subshrub" 2. "woody herb or succulent (scandent) shrub" 3. "Shrubs 2-5 m tall"</p>
5.03	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 27 September 2016) 2. J. Kandungu, P. Anjarwalla, L. Mwaura, D. A. Ofori, R. Jamnadass, P. C. Stevenson and P. Smith. Pesticidal Plant Leaflet. http://projects.nri.org/adappt/docs/Tithonia_factsheet.pdf (Accessed: 27 September 2016) 3. PI@ntNet. http://publish.plantnet-project.org/project/plantinvasivekruger/collection/collection/synthese/details/TITDI (Accessed: 27 September 2016) 4. Haiti Reconstruction. http://haitireconstruction.ning.com/page/nitrogen-fixing-plants (Accessed: 27 September 2016)</p>	<p>1. Herbaceous 2. "T. diversifolia is a woody herb" 3. "Tithonia diversifolia is a robust annual or perennial herbaceous and bushy plant with a woody base, growing up to 3 m tall." 4. Nitrogen fixing plant NOT GENERALLY A WOODY PLANT</p>

5.04	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 2. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia_diversifolia.htm (Accessed: 27 September 2016) 3. Useful Tropical Plants. http://tropical.theferns.info/viewtropical.php?id=Tithonia+diversifolia (Accessed: 29 September 2016)</p>	1,2,&3. No evidence of these specialized structures
6.01		No evidence
6.02	<p>1. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 2. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 3. Muoghalu, J.I., Chuba, D.K. 2005. Seed germination and reproductive strategies of <i>Tithonia diversifolia</i> (Hemsl.) Gray and <i>Tithonia rotundifolia</i> (P.M.) Blake. <i>Applied Ecology and Environmental Research</i> 3 (1):39-46. (Accessed: 28 September 2016)</p>	<p>1. "Each composite flower has 11-13 ray florets and 200-300 disc florets. All can give rise to seeds." 2. "Being able to produce flowers and seeds throughout the year, coupled with the ability of seeds to be dispersed by wind, water and animals, makes it particularly easy for <i>T. diversifolia</i> to quickly colonize new areas." 3. Reproduces by seed</p>
6.03		No evidence
6.04	<p>1. Noyes, R.D., 2007. Apomixis in the Asteraceae: diamonds in the rough. <i>Functional Plant Science and Biotechnology</i> 1, 207-222. (Accessed: 28 September 2016)</p>	1. No effective apomixis
6.05	<p>1. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 2. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia_diversifolia.htm (Accessed: 27 September 2016) 3. Monarch Butterfly Garden. http://monarchbutterflygarden.net/butterfly-plants/mexican-sunflower/ (Accessed: 27 September 2016)</p>	<p>1. "The flowers smell like honey and are attractive to bees and butterflies." 2. "The plant's flowers are visited by butterflies and many bees" 3. "Mexican sunflower - nectar flower favorite for Monarchs"</p>
6.06	<p>1. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 2. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 3. Muoghalu, J.I., Chuba, D.K. 2005. Seed germination and reproductive strategies of <i>Tithonia diversifolia</i> (Hemsl.) Gray and <i>Tithonia rotundifolia</i> (P.M.) Blake. <i>Applied Ecology and Environmental Research</i> 3 (1):39-46. (Accessed: 28 September 2016)</p>	<p>1. "The easiest way to start a new Bolivian sunflower is just to take a piece of stem, say 10 in (25 cm) long and an inch (2.5 cm) or so in diameter, and stick it in the ground. Don't water too much, and it should start producing roots and new leaves in a few days."; "Sometimes branches break off and may take root where they lie on the ground" 2. "Rapid vegetative reproduction" 3. Reproduces by vegetative regrowth when the stem is cut</p>
6.07	<p>1. Ayeni, A.O., Lordbanjou, D.T., Majek, B.A., 1997. <i>Tithonia diversifolia</i> (Mexican sunflower) in south-western Nigeria: occurrence and growth habit. <i>Weed Research</i> 37, 443-449. (Accessed: 29 September 2016) 2. Muoghalu, J I. <i>Weed Research</i>. http://onlinelibrary.wiley.com/doi/10.1111/j.1365-3180.2007.00613.x/abstract (Accessed: 29 September 2016)</p>	<p>1. Can germinate and produce seed in one year 2. "<i>Tithonia rotundifolia</i> attained reproductive maturity at 2 months and <i>T. diversifolia</i> 4 months after planting. <i>Tithonia rotundifolia</i> completed its life cycle after 4 months, just as <i>T. diversifolia</i> was starting to flower."</p>
7.01	<p>1. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 28 September 2016)</p>	<p>1. Imported to Nigeria through maize seed 2. "<i>Tithonia diversifolia</i> is a prolific seeder which retains its seeds until the plant dries in the dry season when the seeds disperse and are spread by wind, water and the movement of people, livestock and vehicles."</p>

7.02	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 2. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia.diversifolia.htm (Accessed: 27 September 2016) 3. The Organic Farmer. http://theorganicfarmer.org/Articles/tithonia-can-improve-soil-fertility-farm (Accessed: 27 September 2016) 4. Annie's Annuals & Perennials. http://www.anniesannuals.com/plants/view/?id=1655 (Accessed: 28 September 2016) 5. Useful Tropical Plants. http://tropical.theferns.info/viewtropical.php?id=Tithonia+diversifolia (Accessed: 29 September 2016)</p>	<p>1. "Tithonia diversifolia is a fast-growing species, used as a garden ornamental, a green manure in agroforestry systems, a live fence (hedge) and as a fodder crop for livestock such as goats and cattle." 2. "Its fast growth, upright habit and colorful flowers have made it a seemingly popular choice for an instant screening plant."; "The large size of the plant has interested some farmers in Columbia as a biomass plant to add organic material to poor soil and as a feed source for some livestock." 3. "Many communities living in Kenya use tithonia for fencing around homesteads. Increasingly, many communities are now adopting the use of tithonia for composting and as fodder for cattle, goats and sheep." 4. Available for purchase in US nurseries. 5. "The plant is harvested from the wild for local use as a medicine and fuel. It is sometimes grown as a companion plant, helping to improve the soil and increasing the yields of a range of crops. It is also often grown as an ornamental."</p>
7.03	<p>1. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 2. Chukwuka, K.S., Ogunyemi, S., Fawole, I., 2007. Ecological distribution of Tithonia diversifolia (Hemsl). A. Gray - a new exotic weed in Nigeria. Journal of Biological Sciences 7, 709-719. (Accessed: 28 September 2016)</p>	<p>1. Imported to Nigeria through maize seed 2. Thought to have been introduced to Nigeria as a produce contaminant through Zea mays from Israel</p>
7.04	<p>1. Floridata. http://floridata.com/Plants/Asteraceae/Tithonia%20diversifolia/1098 (Accessed: 22 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 22 September 2016) 3. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia.diversifolia.htm (Accessed: 27 September 2016) 4. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. "The seeds are small and can ride on the wind for several meters." 2. "Tithonia diversifolia is a prolific seeder which retains its seeds until the plant dries in the dry season when the seeds disperse and are spread by wind, water and the movement of people, livestock and vehicles." 3. "Because of their small size, the seed can easily be spread by wind, further increasing the range of this plant." 4. "Being able to produce flowers and seeds throughout the year, coupled with the ability of seeds to be dispersed by wind, water and animals, makes it particularly easy for T. diversifolia to quickly colonize new areas."; "The 'seeds' are actually achenes; 4-8 mm long and topped with a ring (pappus) of scales and two awns (about 5 mm long). They are covered in close-lying, appressed pubescent hairs, blackish, are somewhat four-angled and are spread by wind."</p>
7.05	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 27 September 2016) 2. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. "Tithonia diversifolia is a prolific seeder which retains its seeds until the plant dries in the dry season when the seeds disperse and are spread by wind, water and the movement of people, livestock and vehicles." 2. "Being able to produce flowers and seeds throughout the year, coupled with the ability of seeds to be dispersed by wind, water and animals, makes it particularly easy for T. diversifolia to quickly colonize new areas."</p>
7.06		No evidence
7.07		No evidence
7.08	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 27 September 2016)</p>	<p>1. "Tithonia diversifolia is a prolific seeder which retains its seeds until the plant dries in the dry season when the seeds disperse and are spread by wind, water and the movement of people, livestock and vehicles."</p>

8.01	<p>1. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 27 September 2016) 2. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia.diversifolia.htm (Accessed: 27 September 2016) 3. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016) 4. Muoghalu, J.I., Chuba, D.K. 2005. Seed germination and reproductive strategies of <i>Tithonia diversifolia</i> (Hemsl.) Gray and <i>Tithonia rotundifolia</i> (P.M.) Blake. <i>Applied Ecology and Environmental Research</i> 3 (1):39-46. (Accessed: 28 September 2016)</p>	<p>1. "Tithonia diversifolia is a prolific seeder which retains its seeds until the plant dries in the dry season" 2. "The six to seven inch bright golden daisy of the Bolivian Sunflower is not a single flower, but is a head made up of many small flowers. Around the rim are eleven to thirteen rays that have the bright "petals". Inside the floral circle are 200 to 300 tubular florets, each one able to form a seed." 3. "Typically mature plants produce 80,000 to 160,000 seeds per square meter annually, 70% of which fully develop." 4. Produces 134,451.75 ± 49,792.14 seeds per plant</p>
8.02	<p>1. CABI Invasive Species Compendium. http://www.cabi.org/isc/datasheet/54020 (Accessed: 28 September 2016)</p>	<p>1. "significant production of lightweight seeds, which can be dormant in the soil for up to four months"</p>
8.03	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 27 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 28 September 2016) 3. Ayeni, A.O., Agbato, S.O., Majek, B.A., 1997. Seed Depth Influence on Mexican Sunflower (<i>Tithonia diversifolia</i>) Emergence and Control. <i>Weed Technology</i> 11, 417-427. (Accessed: 28 September 2016)</p>	<p>1. "Currently, there are no herbicides registered to control either of the two <i>Tithonia</i> species." 2. "Control is generally best applied to the least infested areas before dense infestations are tackled. Consistent follow-up work is required for sustainable management."; "Suitable herbicides can be applied as a foliar spray or a spot spray. When using any herbicide always read the label first and follow all instructions and safety requirements. If in doubt consult an expert." 3. Application of imazethapyr-pendimethalin mixture at 0.09 + 1.31 kg/ha (equivalent to 4L/ha commercial product) was an effective control (unknown whether this is dangerous to surrounding desirable plants)</p>
8.04	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 27 September 2016) 2. BioNET-EAFRINET. http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Tithonia_diversifolia_(Mexican_Sunflower).htm (Accessed: 27 September 2016) 3. University of Florida Okeechobee IFAS Extension. http://okeechobee.ifas.ufl.edu/News%20columns/Tithonia.diversifolia.htm (Accessed: 27 September 2016) 4. Muoghalu, J.I., Chuba, D.K. 2005. Seed germination and reproductive strategies of <i>Tithonia diversifolia</i> (Hemsl.) Gray and <i>Tithonia rotundifolia</i> (P.M.) Blake. <i>Applied Ecology and Environmental Research</i> 3 (1):39-46. (Accessed: 28 September 2016)</p>	<p>1. "Mechanical control is often inefficient due to rapid re-invasion from the seed bank and the ability of <i>T. diversifolia</i> to grow from cut stems." 2. "Slashing can result in re-sprouting from uncut stumps." 3. "This thicket continued to take over until the 2004 and 2005 hurricanes knocked it all down. It has since recovered well, and the new growth is back as thick as it ever was." 4. Coppices profusely when the stem is cut</p>
8.05	<p>1. Agricultural Research Council. http://www.arc.agric.za/arc-ppri/Pages/Tithonia-species.aspx (Accessed: 27 September 2016)</p>	<p>1. "For <i>T. diversifolia</i>, a highly damaging leaf-feeding beetle, <i>Physonota maculiventris</i> (Coleoptera: Chrysomelidae: Cassidinae), was screened and found to be adequately safe for release against this weed in South Africa. An application for permission to release this beetle was submitted to the authorities in May 2015, and the approval is still pending."</p>