

**Australia/New Zealand Weed Risk Assessment adapted for Florida.**

**Data used for analysis published in: Gordon, D.R., D.A. Onderdonk, A.M. Fox, R.K. Stocker, and C. Gantz. 2008. Predicting Invasive Plants in Florida using the Australian Weed Risk Assessment. Invasive Plant Science and Management 1: 178-195.**

<i>Cyperus esculentus (yellow nutsedge)</i>			
Question number	Question	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)	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	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	0
3.02	Garden/amenity/disturbance weed	y	0
3.03	Weed of agriculture	y	0
3.04	Environmental weed	n	0
3.05	Congeneric weed	y	0
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	y	1
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals		
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens		
4.07	Causes allergies or is otherwise toxic to humans	n	0
4.08	Creates a fire hazard in natural ecosystems	n	0
4.09	Is a shade tolerant plant at some stage of its life cycle	n	0
4.1	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils)	y	1
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	n	0
5.01	Aquatic	n	0

5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte	y	1
6.01	Evidence of substantial reproductive failure in native habitat		
6.02	Produces viable seed	y	1
6.03	Hybridizes naturally		
6.04	Self-compatible or apomictic		
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative fragmentation	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	n	-1
7.05	Propagules water dispersed	n	-1
7.06	Propagules bird dispersed	?	
7.07	Propagules dispersed by other animals (externally)	y	1
7.08	Propagules dispersed by other animals (internally)	n	-1
8.01	Prolific seed production	y	1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	y	1
8.03	Well controlled by herbicides	y	-1
8.04	Tolerates, or benefits from, mutilation or cultivation	n	-1
8.05	Effective natural enemies present in Florida, or east of the continental divide		
<b>Total Score</b>			<b>19</b>

<b>Outcome</b>	<b>Reject*</b>
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\*Used secondary screen from: Daehler, C. C., J.L. Denslow, S. Ansari, and H. Kuo. 2004. A risk assessment system for screening out harmful invasive pest plants from Hawaii's and other Pacific islands. *Conserv. Biol.* 18: 360-368.

section	# questions answered	satisfy minimum?
A	8	yes
B	10	yes
C	19	yes
total	37	yes

Data collected 2006-2007

Question number	Reference	Source data
1.01		no evidence of selection for reduced weediness
1.02		
1.03		
2.01		
2.02		
2.03	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	very broad distribution throughout North and South America, Africa, Europe, and parts of Asia and Australia
2.04	1. ter Borg, Schippers, van Groenendael, and Rotteveel (1998) <i>Cyperus esculentus</i> (yellow nutsedge) in N.W. Europe: invasions on a local, regional and global scale. Pp. 261-273 in Starfinger, Edwards, Kowarik, and Williamson (eds.) <i>Plant Invasions: Ecological Mechanisms and Human Responses</i> . Backhuys Publishers, Leiden, The Netherlands. 2. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	1. "The original habitat of the species is open wetland vegetation...or river banks". 2. Tolerates high soil moisture and replaces other <i>Cyperus</i> spp. in very moist places.
2.05	1. Wagner, Herbst, and Sohmer (1999) <i>Manual of the flowering plants of Hawai'i</i> . University of Hawai'i Press/Bishop Museum Press, Honolulu. 2. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	Native to southern Europe, Mediterranean region, South Africa, North America, and the Andean region of South America (1). Present in several regions outside of that distribution (Australia, west Africa, Caribbean, etc.) (2).
3.01	1. Wagner, Herbst, and Sohmer (1999) <i>Manual of the flowering plants of Hawai'i</i> . University of Hawai'i Press/Bishop Museum Press, Honolulu. 2. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	Native to southern Europe, Mediterranean region, South Africa, North America, and the Andean region of South America (1). A weed in several regions outside of that distribution (Australia, west Africa, Caribbean, etc.) (2).
3.02	Anderson (1999) <i>Perennial Weeds: Characteristics and Identification of Selected</i>	<i>C. esculentus</i> is found in "lawns,

	Herbaceous Species. Iowa State University Press, Ames, Iowa.	gardens, ditch banks, roadsides, and waste areas". It "can grow upward through asphalt pavement, penetrate plastic swimming pool liners..." [implies that it is a nuisance]
3.03	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	" <i>C. esculentus</i> is a weed in 21 crops in more than 30 countries."
3.04		no evidence
3.05	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	" <i>Cyperus rotundus</i> is the world's worst weed."
4.01	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	no description of these traits
4.02	1. Reinhardt and Bezuidenhout (2001) Growth stage of <i>Cyperus esculentus</i> influences its allelopathic effect on ectomycorrhizal and higher plant species. <i>Journal of Crop Production</i> 4: 323-333. 2. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	1. "The emergence of maize ( <i>Zea mays</i> ) was retarded in soil where <i>C. esculentus</i> tubers were planted 28 days before planting the crop, irrespective of whether the weeds continued to grow or were physically removed at the time maize was sown." BUT 2. not allelopathic
4.03	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	no description of this
4.04		
4.05	1. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. 2. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	1. no toxicity 2. "In some places the weed is cultivated to obtain the tubers for pig feed."
4.06		
4.07	1. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. 2. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	1. no toxicity 2. tubers used for human food
4.08		no evidence

4.09	1. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu. 2. USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	1. "It is quite intolerant of shade." 2. shade intolerant
4.1	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	"The species grows very well on all soil types"
4.11	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	growth habit: graminoid
4.12		no evidence
5.01		terrestrial
5.02	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	Cyperaceae
5.03	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	does not fix nitrogen (and Cyperaceae)
5.04	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	Rhizomes terminate in single underground tubers. "One tuber produced 36 plants and 332 tubers in the field in 16 weeks...In one area it was estimated that there could be more than 30 million tubers per hectare."
6.01		
6.02	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	"The reports of seed production and viability are mixed across the world, but there seems little doubt that large quantities of good seeds can be produced under favorable growing conditions and that this is an important means of distribution of this species."
6.03		
6.04		
6.05	Hafliger et al. (1982) <i>Monocot Weeds 3. Monocot Weeds Excluding Grasses</i> . CIBA-GEIGY Ltd., Basel, Switzerland.	"The Cyperaceae are annual or perennial herbs with...inconspicuous flowers which are pollinated by the wind."
6.06	1. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds:</i>	1. "Rhizomes also originate from the basal bulb and...the tip turns up to

	Distribution and Biology. The University Press of Hawaii, Honolulu. 2. ter Borg, Schippers, van Groenendael, and Rotteveel (1998) <i>Cyperus esculentus</i> (yellow nutsedge) in N.W. Europe: invasions on a local, regional and global scale. Pp. 261-273 in Starfinger, Edwards, Kowarik, and Williamson (eds.) Plant Invasions: Ecological Mechanisms and Human Responses. Backhuys Publishers, Leiden, The Netherlands.	produce a secondary basal bulb. Still other rhizomes grow out to produce underground tubers" 2. "high vegetative reproductive capacity by means of tubers"
6.07	Holm, Plucknett, Pancho, and Herberger (1977) The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu.	"One tuber produced 36 plants and 332 tubers in the field in 16 weeks." [vegetative reproduction certainly occurs in less than 1 year]
7.01	Anderson (1999) Perennial Weeds: Characteristics and Identification of Selected Herbaceous Species. Iowa State University Press, Ames, Iowa.	"They spread artificially by their tubers and basal bulbs being dragged from place to place by cultivating tools, carried in soil attached to farm equipment, and transported as stowaways in the soil of ornamental and vegetable transplants"
7.02	Stephens (2003) Chufa - <i>Cyperus esculentus</i> L. var. <i>sativus</i> Boeck. University of Florida, IFAS Extension ( <a href="http://edis.ifas.ufl.edu/pdffiles/MV/MV05000.pdf">http://edis.ifas.ufl.edu/pdffiles/MV/MV05000.pdf</a> ).	<i>C. esculentus</i> has been cultivated as a livestock food, and occasionally for human consumption.
7.03	1. Holm, Plucknett, Pancho, and Herberger (1977) The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu. 2. ter Borg, Schippers, van Groenendael, and Rotteveel (1998) <i>Cyperus esculentus</i> (yellow nutsedge) in N.W. Europe: invasions on a local, regional and global scale. Pp. 261-273 in Starfinger, Edwards, Kowarik, and Williamson (eds.) Plant Invasions: Ecological Mechanisms and Human Responses. Backhuys Publishers, Leiden, The Netherlands.	1. "The nutgrass tubers become mixed with shelled beans." 2. "The species was brought from America to Europe with gladiolus cormlets which were introduced to widen the material offered to the market."
7.04	Holm, Plucknett, Pancho, and Herberger (1977) The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu.	fruit a small achene
7.05		no evidence
7.06	ter Borg, Schippers, van Groenendael, and Rotteveel (1998) <i>Cyperus esculentus</i> (yellow nutsedge) in N.W. Europe: invasions on a local, regional and global scale. Pp. 261-273 in Starfinger, Edwards, Kowarik, and Williamson (eds.) Plant Invasions: Ecological Mechanisms and Human Responses.	"birds ( <i>Corvus</i> sp.) were noticed flying with rhizomes, possibly adhering to tubers"

	Backhuys Publishers, Leiden, The Netherlands.	
7.07	ter Borg, Schippers, van Groenendael, and Rotteveel (1998) <i>Cyperus esculentus</i> (yellow nutsedge) in N.W. Europe: invasions on a local, regional and global scale. Pp. 261-273 in Starfinger, Edwards, Kowarik, and Williamson (eds.) Plant Invasions: Ecological Mechanisms and Human Responses. Backhuys Publishers, Leiden, The Netherlands.	"various field observations suggest that mice ( <i>Microtus</i> sp.) collect and concentrate the tubers as a winter stock"
7.08		sedge
8.01	1. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu. 2. Anderson (1999) <i>Perennial Weeds: Characteristics and Identification of Selected Herbaceous Species</i> . Iowa State University Press, Ames, Iowa.	1. "one seedling could develop a plant system in one season capable of producing 90,000 seeds with better than 50-percent viability" 2. "yellow nutsedge produces an abundance of viable seed, as much as 1500 seed per inflorescence with better than 50% viability"
8.02	1. Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu. 2. ter Borg, Schippers, van Groenendael, and Rotteveel (1998) <i>Cyperus esculentus</i> (yellow nutsedge) in N.W. Europe: invasions on a local, regional and global scale. Pp. 261-273 in Starfinger, Edwards, Kowarik, and Williamson (eds.) <i>Plant Invasions: Ecological Mechanisms and Human Responses</i> . Backhuys Publishers, Leiden, The Netherlands.	1. "There is a tuber dormancy in <i>C. esculentus</i> "; <i>After a 4-year fallow period, tuber viability was reduced from 72 to 28 percent.</i> 2. " <i>The tubers can stay dormant in the soil for several years, especially at greater depths.</i> "
8.03	Holm, Plucknett, Pancho, and Herberger (1977) <i>The World's Worst Weeds: Distribution and Biology</i> . The University Press of Hawaii, Honolulu.	An effective sytem for controlling <i>C. esculentus</i> in soybeans included preplanting tillage, late planting of the crop, herbicides, and cultivation.
8.04	USDA, NRCS. 2005. The PLANTS Database, Version 3.5 ( <a href="http://plants.usda.gov">http://plants.usda.gov</a> ). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.	no resprout ability
8.05		