Taxon: Cyperus papyrus **Family:** Cyperaceae

Common Name(s): Nile grass
paper reed
papyrus sedge

Synonym(s): Chlorocyperus papyrus (L.) Rikli
Papyrus domesticus Poir.

Assessor: Assessor **Status:** Assessor Approved **End Date:** 25 May 2014

WRA Score: 20.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Naturalized, Environmental Weed, Aquatic Sedge, Thicket-forming, Rhizomatous

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed		
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		
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	y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	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	y
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
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	2
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	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	y
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		
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		
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	IUCN .2012. Guide to some invasive plants affecting Lake Tanganyika. IUCN ISI and Lake Tanganyika Authority. Nairobi, Kenya	"This is a herbaceous perennial native to tropical Africa which forms tall stands of reed-like swamp vegetation in shallow water. Papyrus sedge have a long history of use by humans notably by the ancient Egyptians as the source of papyrus paper; in addition the highly buoyant stems can be made into boats. Papyrus is now cultivated as an ornamental plant." [Long history of cultivation does not appear to have limited its ability to persist and spread in the environment]

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**High**
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 21 May 2014]	"Native: AFRICA Northern Africa: Egypt Northeast Tropical Africa: Chad; Ethiopia; Sudan East Tropical Africa: Kenya; Tanzania [incl. Zanzibar]; Uganda West-Central Tropical Africa: Burundi; Congo; Gabon; Rwanda; Zaire West Tropical Africa: Benin; Cote D'Ivoire; Guinea; Liberia; Nigeria; Senegal South Tropical Africa: Angola; Malawi; Mozambique; Zambia Southern Africa: Botswana; Namibia; South Africa - KwaZulu-Natal, Limpopo, Mpumalanga Western Indian Ocean: Madagascar; Mauritius; Reunion"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed]	

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"Cyperus papyrus occurs from sea level up to 2500 m altitude in swamps and along the margins of lakes and rivers." [Elevation range exceeds 1000 m in tropical latitudes, demonstrating environmental versatility]
	Duke, J.A.1983. Handbook of Energy Crops - Cyperus papyrus. http://www.hort.purdue.edu/newcrop/duke_energy/Cyperus_papyrus.html. [Accessed 25 May 2014]	"The papyrus reeds form vast stands in swamps, in shallow lakes, and along stream banks throughout Africa. It is considered a weed in the Sudan, Dahomey and Egypt. Uganda has ca 6,500 km2 of permanent swamp or wetlands, much of it covered in papyrus. Occurs also in Sicily and Palestine. According to Baumann (1960) the plant grows over a wide area bounded roughly by the 38th and 26th parallels on the north and south, and by the 65th and 32nd on the east and west, but is virtually absent in the lower Nile marshes where it flourished in ancient times. Ecology Many African swamps known as the Sudd in Central Africa, are dominated by papyrus thickets, which totally block navigation. It is estimated that the Sudd areas of the White Nile, and the "Papyrus Swamps" around Lake Kioga and Victoria are responsible for the loss of 50% of that river's water through evaporation and plant transpiration. Engineers plan to shortcut the Sudd and hence increase Egypt's summer water supply. In Egypt the plant flowers throughout the year, except winter. Papyrus is estimated to range from Subtropical to Tropical Desert to Wet Forest Life Zones, tolerating annual precipitation of 1-42 dm, annual temperatures of 20-30°C, and pH of 6.0-8.5. "

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"General distribution: Native to eastern tropical Africa and Madagascar. Widely cultivated and planted as an ornamental elsewhere. Introduced and naturalized or escaped from cultivation in the New World, occurring in the United States (Florida, Louisiana, and California) and the West Indies."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"General distribution: Native to eastern tropical Africa and Madagascar. Widely cultivated and planted as an ornamental elsewhere."

301	**Naturalized beyond native range**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	"Cyperus papyrus is naturalized in Australia (Wilson, 1993) and in Florida, U.S.A. (Wunderlin,1998),"
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"Distribution in Puerto Rico: Naturalized in wet areas of standing water along river banks, creeks, swales, and roadside ditches; Ciales, Lares, and Río Grande."
	Erickson, T.A. & Puttock, C.F. 2006. Hawai'i Wetland Field Guide: An Ecological And Identification Guide to Wetlands And Wetland Plants of the Hawaiian Islands. Bess Press Books, Honolulu, HI	"in the Hawaiian Islands it is cultivated in water gardens and now naturalized on Kauai, Oahu and Hawaii. First recorded in cultivation in 1910, it is a recent garden escape into permanent coastal wetlands, from sea level to 30 m elevation. Introduced aggressive-invasive."
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2014. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm. [Accessed 21 May 2014]	"Native to eastern tropical Africa and Madagascar, now widely cultivated elsewhere as an ornamental in water gardens and greenhouses. In the Hawaiian Islands, naturalized on Kaua`i, Hawai`i. "
	Stephens, K.M. & Dowling, R.M. 2002. Wetland Plants of Queensland: A Field Guide. CSIRO Publishing, Collingwood, Australia	"Papyrus is found as a garden escape and is naturalised in creeks and lagoons, mainly near habitation, in southeast Queensland."
	Flora of North America Editorial Committee. 2002. Flora of North America: Volume 23: Magnoliophyta: Commelinidae (in Part): Cyperaceae. Oxford University Press, Oxford, UK	"Stream banks, marshes; 0-30 m; introduced; Fla.;"

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	[A nuisance weed that can become a commercial or environmental weed under certain conditions] "The plant is sometimes considered a nuisance, forming floating islands that obstruct navigation and water flow."

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Serag, M. S. 2003. Ecology and biomass production of Cyperus papyrus L. on the Nile bank at Damietta, Egypt. Journal of Mediterranean Ecology, 4: 15-24	"Many African swamps known as the Sudd in Central Africa are dominated by papyrus thickets, which totally block navigation. It is considered a weed in the Sudan, Ethiopia and Uganda." [May interfere with commercial activities]

304	Environmental weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	"Cyperus papyrus is naturalized in Florida, U.S.A. (Wunderlin, 1998), where it is evidently not yet invasive, but would appear to have the potential to invade aquatic and wetland habitats in tropical and subtropical areas given its dominance in swamps of northern Uganda."
	IUCN .2012. Guide to some invasive plants affecting Lake Tanganyika. IUCN ISI and Lake Tanganyika Authority. Nairobi, Kenya	"It is regarded as a minor environmental weed or potential environmental weed since it has escaped cultivation and invaded the margins of permanent water bodies."
	Brisbane City Council. 2014. Weed identification Tool - papyrus. Cyperus papyrus. http://weeds.brisbane.qld.gov.au/weeds/papyrus. [Accessed 25 May 2014]	"Papyrus (Cyperus papyrus) has spread from cultivation as a garden and pond plant and invaded the margins of permanent water bodies in south-eastern Queensland and northern New South Wales. This rapidly growing species can spread to cover areas of open water, preventing other aquatic species from growing, and reducing light levels to submerged native plants. It is regarded as a minor environmental weed or potential environmental weed in parts of Queensland and New South Wales. For example, infestations were recently targeted for removal from Seaham Swamp Nature Reserve, at Port Stephens on the mid-north coast of New South Wales. Papyrus (Cyperus papyrus) is also a weed of deep water channels in the Warriewood Wetlands and a common weed in the Lakes of Cherrybrook Reserve in suburban northern Sydney."
	Mauremootoo, J. 2012. Invasive Plant Management Strategy For Terrestrial Protected Areas in: Fogo, Santo Antão, São Vicente. www.inspiralpathways.com	[Threatens an endangered plant] "Isolated very humid locations in Ribeira de Paul in Santo Antão are the only known locations for the Critically Endangered (sensu IUCN) endemic sedge Carex antoniensis (Leyens & Lobin, 1996). In some of these locations this unique species is threatened by the encroachment of Cyperus papyrus (papyrus sedge or paper reed). Regular careful hand weeding of papyrus for would be a very cost-effective contribution to saving C. antoniensis as part of a species recovery programme. IP management could be accompanied by awareness raising activities that would publicise the unique biodiversity of Ribeira de Paúl and the practical action being undertaken to conserve it." ,,, "Similar actions could be taken for another Critically Endangered endemic sedge Carex paniculata ssp. Hanseni, known only from the valleys of Cova/Paúl/Ribeira da Torre where it is also threatened by papyrus sedge."

305	Congeneric weed	y
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Cyperus eragrostis" ... "Once established, it is very persistent and forms dense infestations that block channels and drains, reduce native species diversity and impede growth of desired species."
	USDA Natural Resources Conservation Service. 2014. Hawaii State-listed Noxious Weeds. http://plants.usda.go/java/noxious?rptType=State&statefips=15. [Accessed 22 May 2014]	Cyperus esculentus listed as a Hawaii state noxious weed

401	Produces spines, thorns or burrs	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"Robust perennial, 100-500 cm tall; rhizome short, decumbent, coarse, woody, 1-3 cm thick. Culms loosely tufted along rhizome, erect, firm, obtusely triquetrous, smooth, 5-16 mm wide midculm, to 20 mm wide at base. Leaves reduced to bladeless sheaths or sheaths of sterile shoots sometimes bearing short blades; proximal sheaths coriaceous, distal ones herbaceous distally, finely and closely veined, scabridulous to smooth on veins abaxially, obliquely truncate at orifice, brown; ligule absent."
	IUCN .2012. Guide to some invasive plants affecting Lake Tanganyika. IUCN ISI and Lake Tanganyika Authority. Nairobi, Kenya	"The spread and management of papyrus are similar to phragmites and it is often a component of floating islands. However, unlike the common reed, it is not spiny so is safe to handle and use for handicrafts, rafts and even boats."

402	Allelopathic	
	Source(s)	**Notes**
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	[Unknown for C. papyrus] "To varying degrees, the following characteristics undoubtedly contribute to the aggressive, invasive tendencies of Cyperus spp. and other sedges: large numbers of small, readily dispersed achenes; vegetative reproduction; longevity of tubers, rhizomes, or other subterranean structures; production of allelopathic compounds; paucity of pathogens; short life reproductive cycle, especially in annual species; tolerance of broad ranges of environmental conditions; C4 photosynthesis; and resistance to control with herbicides and cultural methods, including tillage."

403	Parasitic	n
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"Robust perennial, 100-500 cm tall; rhizome short, decumbent, coarse, woody, 1-3 cm thick." [Cyperaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Muthuri, F. M., & Kinyamario, J. I. 1989. Nutritive value of papyrus (Cyperus papyrus, Cyperaceae), a tropical emergent macrophyte. Economic Botany, 43(1), 23-30	"Under natural conditions, very little papyrus biomass is utilized by herbivores. This is partly because there are few large herbivores adapted to the unstable swamp substrate. However, in areas bordering the swamps, cattle usually graze on papyrus and other sedges, especially during the dry season. When chopped into small pieces and treated with urea phosphate, papyrus was voluntarily eaten by cattle (Hakanen 1984)."
	Quattrocchi, U.. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"young shoots frequently grazed by livestock"

Qsn #	Question	Answer
405	**Toxic to animals**	**n**
	Source(s)	**Notes**
	Muthuri, F. M., & Kinyamario, J. I. 1989. Nutritive value of papyrus (Cyperus papyrus, Cyperaceae), a tropical emergent macrophyte. Economic Botany, 43(1), 23-30	"In general, papyrus has some grazing potential and could be used as fodder especially in the dry season when other forage is scarce and of low nutritive value." [No evidence of toxicity]
	Quattrocchi, U.. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"young shoots frequently grazed by livestock"
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	n
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2004. PlantzAfrica.com - Cyperus papyrus. http://www.plantzafrica.com/plantcd/cyperuspap.htm. [Accessed 25 May 2014]	"No pests have been observed to attack Cyperus papyrus, with the exception of a rust fungus which appears to be specific to the family."
	Shoot Gardening. 2014. Cyperus papyrus (Egyptian papyrus). http://www.shootgardening.co.uk/plant/cyperus-papyrus. [Accessed 25 May 2014]	"Pests: Generally pest-free Diseases: Generally disease-free"

407	Causes allergies or is otherwise toxic to humans	
	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	"starchy rhizomes and culms eaten raw or cooked by humans, young shoots frequently grazed by livestock" [No evidence of toxicity]
	California Poison Control System. 2009. Know Your Plants. http://www.calpoison.org/hcp/KNOW%20YOUR%20PLANTS-plant%20list%20for%20CPCS%2009B.pdf. [Accessed]	[Possibly extremely toxic, in contrast to other references] "Table 3. Toxic Plants by Common Name" [Cyperus papyrus - Rating = 4 - Ingestion of these plants, especially in large amounts, is expected to cause serious effects to the heart, liver, kidneys or brain. If ingested in any amount, call the poison center immediately.]
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

Qsn #	Question	Answer
408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	Kotze, D. C. 2013. The effects of fire on wetland structure and functioning. African Journal of Aquatic Science, 38(3): 237-247	"However, a few species, such as Cyperus papyrus, have rhizomes which are above ground and therefore susceptible to fire when aerially exposed..." [Unlikely to increase fire risk unless aquatic habitat is drained, or water levels drop]
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Unlikely given aquatic habitat] "A truly aquatic sedge, it grows in standing water and in rivers and lakes throughout its range."

409	**Is a shade tolerant plant at some stage of its life cycle**	
	Source(s)	**Notes**
	Shoot Gardening. 2014. Cyperus papyrus (Egyptian papyrus). http://www.shootgardening.co.uk/plant/cyperus-papyrus. [Accessed 25 May 2014]	"Light: Full Sun, Partial Shade"
	South African National Biodiversity Institute. 2004. PlantzAfrica.com - Cyperus papyrus. http://www.plantzafrica.com/plantcd/cyperuspap.htm. [Accessed 25 May 2014]	"They need full sun but also need to be sheltered from strong winds, and for best effect should be allowed to form a large colony."

410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	Learn 2 Grow. 2014. Papyrus: for Ancient Egyptian Flair. http://www.learn2grow.com/gardeningguides/tropicalplants/featuredplants/Papyrus.aspx. [Accessed 25 May 2014]	"In addition to looking great instantly, papyrus is really adaptable. It thrives equally in standing water or dry ground (in any type of soil)."
	Shoot Gardening. 2014. Cyperus papyrus (Egyptian papyrus). http://www.shootgardening.co.uk/plant/cyperus-papyrus. [Accessed 25 May 2014]	"Soil type: Clay, Loamy Soil drainage: Boggy damp conditions, Moisture-retentive, Pond/In water Soil pH: Acid, Alkaline, Neutral"

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"Robust perennial, 100-500 cm tall; rhizome short, decumbent, coarse, woody, 1-3 cm thick. Culms loosely tufted along rhizome, erect, firm, obtusely triquetrous, smooth, 5-16 mm wide midculm, to 20 mm wide at base. Leaves reduced to bladeless sheaths or sheaths of sterile shoots sometimes bearing short blades; proximal sheaths coriaceous, distal ones herbaceous distally, finely and closely veined, scabridulous to smooth on veins abaxially, obliquely truncate at orifice, brown; ligule absent."

412	**Forms dense thickets**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	"Cyperus papyrus forms dense stands in aquatic and wetland habitats and dominates swamps with low biodiversity in northern Uganda (Mabberley, 1997)."
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"Cyperus papyrus is the dominant species in most African permanent swamps. It is estimated that monotypic and mixed papyrus swamps cover 40,000 km² in Central and East Africa alone."
	IUCN .2012. Guide to some invasive plants affecting Lake Tanganyika. IUCN ISI and Lake Tanganyika Authority. Nairobi, Kenya	"Papyrus forms vast stands in swamps, shallow lakes, and along stream banks throughout the wetter parts of Africa." ... "It is a rapidly growing species that can spread to cover areas of open water preventing other aquatic natives from growing and reducing light levels to submerged plants."

501	Aquatic	y
	Source(s)	**Notes**
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"A truly aquatic sedge, it grows in standing water and in rivers and lakes throughout its range."
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"It may form floating mats in open water, but is usually anchored by its rhizome in shallow water. It is adversely affected by seasonal flooding regimes exceeding 3–4 m in amplitude, flash flooding or very low water levels during the dry season."
	Riffle, R.L. 1998. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"These fascinating plants require full sun and, while they grow in moist soil, only reach their prime when grown as aquatics with a couple of inches of water above their rhizomatous roots. They are also not for small ponds as they dominate the aquatic landscape."

502	Grass	n
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	Cyperaceae

Qsn #	Question	Answer
503	**Nitrogen fixing woody plant**	**n**
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	Cyperaceae

504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"Robust perennial, 100-500 cm tall; rhizome short, decumbent, coarse, woody, 1-3 cm thick. Culms loosely tufted along rhizome, erect, firm, obtusely triquetrous, smooth, 5-16 mm wide midculm, to 20 mm wide at base."
	Gordon, D. R., Mitterdorfer, B., Pheloung, P. C., Ansari, S., Buddenhagen, C., Chimera, C., ... & Williams, P. A. 2010). Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly, 25(2): 56-74	"This question addresses taxa that have specialized organs and should not include plants with just rhizomes/ stolons (see 6.06)."

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"Cyperus papyrus is widespread in Africa and elsewhere in the world, and reproduces both sexually and vegetatively, hence there is little risk of genetic erosion. However, it has almost entirely disappeared from the lower reaches of the Nile river, and the extent of many local papyrus swamps in Central and East Africa has diminished due to drainage and infilling for cultivation and construction, as well as water pollution and overharvesting of papyrus by the local population. In some parts of Kenya the area with papyrus swamps decreased by 50% between 1969 and 2000."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2014. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm. [Accessed 21 May 2014]	"Achenes brown, oblong, trigonous, apex obtuse."
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"Cyperus papyrus can be propagated by seed or rhizome pieces, with the latter most commonly used. The seeds need light to germinate."

Qsn #	Question	Answer
	New Zealand Plant Conservation Network. 2013. Flora Details - Cyperus papyrus. http://www.nzpcn.org.nz/flora_details.aspx?ID=4349. [Accessed 25 May 2014]	"Viable seed production not known from New Zealand."

603	Hybridizes naturally	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	Unknown

604	Self-compatible or apomictic	
	Source(s)	**Notes**
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	"Although there is a paucity of information, it is suspected that most sedges are cross-pollinated (allogamous). For example, Cyperus esculentus is self-incompatible, and therefore an obligate outcrosser (Brown & Marshall, 1981) with greater genetic variability within sexually reproducing populations than C. rotundus, which rarely produces viable seed (Horak & Holt, 1986; Horak et al., 1987)."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"The Cyperaceae are clearly adapted to anemophily, as is evidenced by their small, inconspicuous flowers and hidden or reduced perianth, the long stigmatic branches, the filaments elongating considerably during anthesis, and anthers shedding abundant pollen."
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	[No evidence] "Inflorescence an umbelliform, compound corymb with numerous, ascending to spreading rays, 15-50 × 10-40 cm; involucral bracts short, 7-14, like the sheaths, horizontally spreading, much shorter than corymb rays, 2-15 cm long; rays numerous, subequal in length, 8-50 cm long; secondary rays bearing spikes 3-5, to 8 cm long; spikes cylindrical, 10-35 × 7-18 cm, subloosely to subdensely bearing 5-40 spicately arranged spikelets; spikelets linear, subcompressed, wavy-margined, 4-10 (-12) × 0.7- 1 mm, acuminate, cuneate at base, with 5-20 florets; rachilla hyaline-winged; scales elliptic to ovate-elliptic, boat-shaped, dorsally obtuse, 1.7- 2.3 × 0.7-1.4 mm, submembranous, brownish and closely 2- to 3-nerved, often obscurely so along either side of carina, stramineous to golden brown on sides with scarious margins, carina 3-nerved, green or light brownish, shortly prolonged beyond the obtuse apex as a mucro. Stamens 3, the anthers 0.7-1.7 mm long, with a rounded or linear, papillate apiculum; style 3-branched."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"Cyperus papyrus can be propagated by seed or rhizome pieces, with the latter most commonly used. The seeds need light to germinate."
	Schurr, F. M., Spiegel, O., Steinitz, O., Trakhtenbrot, A., Tsoar, A., & Nathan, R. 2009. Long-distance seed dispersal. Annual Plant Reviews, 38: 204-237	"Figure 6.4. Examples for the three general phases of passive dispersal" ... "(b) Transport phase: a floating island composed of papyrus (Cyperus papyrus L.) transports seeds, entire plants and other organisms across Lake Malawi (Oliver and McKaye, 1982, © Kenneth McKaye)." [Floating mats can separate and spread entire plants vegetatively]
	Aber, J. S., Pavri, F. & Aber, S. 2012. Wetland Environments: A Global Perspective. John Wiley & Sons, Chichester, UK	"In the general scheme of life, those species that reproduce the most effectively are also the most successful. Some plants reproduce sexually, usually via pollination, and others reproduce vegetatively by sending out runners or growing from plant fragments. Certain hydrophytes can do both. Papyrus (Cyperus papyrus), for example, reproduces in both ways and is among the fastest-growing plants in the world, which explains its phenomenal success in Africa (Dugan 2005)."

607	Minimum generative time (years)	2
	Source(s)	**Notes**
	Shoot Gardening. 2014. Cyperus papyrus (Egyptian papyrus). http://www.shootgardening.co.uk/plant/cyperus-papyrus. [Accessed 25 May 2014]	"2-5 years To maturity"
	Aber, J. S., Pavri, F. & Aber, S. 2012. Wetland Environments: A Global Perspective. John Wiley & Sons, Chichester, UK	"In the general scheme of life, those species that reproduce the most effectively are also the most successful. Some plants reproduce sexually, usually via pollination, and others reproduce vegetatively by sending out runners or growing from plant fragments. Certain hydrophytes can do both. Papyrus (Cyperus papyrus), for example, reproduces in both ways and is among the fastest growing plants in the world, which explains its phenomenal success in Africa (Dugan 2005)."
	South African National Biodiversity Institute. 2004. PlantzAfrica.com - Cyperus papyrus. http://www.plantzafrica.com/plantcd/cyperuspap.htm. [Accessed 25 May 2014]	[Probably able to reproduce vegetatively at least after 1 year of growth, if not sooner] "Propagation is by division of the rhizome in spring. Germination from seed is not recommended. The time period from seed to flowering is not known but it is undoubtedly several years."

Qsn #	Question	Answer
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	New Zealand Plant Conservation Network. 2013. Flora Details - Cyperus papyrus. http://www.nzpcn.org.nz/flora_details.aspx?ID=4349. [Accessed 25 May 2014]	[May be inadvertently dispersed through disposal of garden waste] "Perennial. Reproduces in New Zealand probably only by asexual spread through layering (seed is occasionally produced but it is not yet known if it is viable). Dispersed by deliberate planting or garden discards. However some occurrences are in very remote situations and are difficult to explain if they had originated from garden discards."

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Staples, G.W. & Herbst, D.R. 2005. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"Papyrus is seldom found in cultivation in home gardens, primarily because of its large size. It is sometimes used in spacious estate, hotel and commercial plantings as an accent plant around pools or waterfalls, which its commanding stature accomplishes well."
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	"Plants may grow to 5 m high, making it one of the largest sedges (Koyama, 1985), and it is cultivated as an ornamental and curiosity in greenhouses and outdoors in ponds and water gardens in tropical and subtropical regions of the world (Bailey, 1935, 1949; Bailey & Bailey, 1976)."
	Riffle, R.L. 1998. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	"They are also not for small ponds as they dominate the aquatic landscape, In the right situation, however, nothing equals their presence." [Ornamental]

703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	Floridata. 2004. Cyperus papyrus. http://www.floridata.com/ref/c/cypa_pap.cfm. [Accessed 25 May 2014]	[No evidence. Appears to spread mostly vegetatively in cultivation] "When used in smaller pools and fishponds, grow papyrus in containers placed underwater. This keeps it from invading other plants' territories and simplifies maintenance. "

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2004. PlantzAfrica.com - Cyperus papyrus. http://www.plantzafrica.com/plantcd/cyperuspap.htm. [Accessed 25 May 2014]	"As in most sedges, pollination is effected by wind, not insects, and the mature fruits after release are distributed by wind and water."

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	"Distribution in Puerto Rico: Naturalized in wet areas of standing water along river banks, creeks, swales, and roadside ditches; Ciales, Lares, and Río Grande."

Qsn #	Question	Answer
	IUCN .2012. Guide to some invasive plants affecting Lake Tanganyika. IUCN ISI and Lake Tanganyika Authority. Nairobi, Kenya	"Pollination is by wind and the mature fruits after release are distributed by water. It has a prodigious growth rate."
	Bryson, C. T., & Carter, R. 2008. The significance of Cyperaceae as weeds. Pp. 15-101. in Naczi, R.F.C. & Ford, B.A. (eds). Sedges, uses, diversity, and systematic of the Cyperaceae, Missouri Botanical Garden Press, St. Louis, MO	"Vegetative growth when coupled with fragmentation and transport of asexual propagules can also result in more distant dispersal. This is perhaps most effective in the dispersal of fragments broken from rafts (sudds) of floating or submerged natant aquatic sedges by water currents or wind. Such dispersal has been noted in C. cephalotes Vahl, C. colymbetes Kotschy & Peyr., C. mundtii Kunth, C. papyrus, C. pectinatus, and Oxycaryum cubense (Poepp. & Kunth) Palla (Kern, 1974; Haines & Lye, 1983; Gordon-Gray, 1995)."

706	Propagules bird dispersed	n
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2004. PlantzAfrica.com - Cyperus papyrus. http://www.plantzafrica.com/plantcd/cyperuspap.htm. [Accessed 25 May 2014]	[Although seeds may adhere to waterbirds, the primary vectors of dispersal are primarily water, and possibly wind] "During summer these stalks bear small brown spikelets (groups of flowers) and eventually numerous tiny dark brown fruits are borne in the axils of glumes (tiny scales). The culms are connected by stout horizontal rhizomes which creep along the substrate under water and are anchored by numerous roots." ... "Interestingly, in the Okavango at least, the plants have been observed to colonize the channels that are cleared by hippopotamus through the dense swamp vegetation. In turn, the 'feather-duster' flowering heads of papyrus make ideal nesting sites for many social species of birds. As in most sedges, pollination is effected by wind, not insects, and the mature fruits after release are distributed by wind and water."

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	South African National Biodiversity Institute. 2004. PlantzAfrica.com - Cyperus papyrus. http://www.plantzafrica.com/plantcd/cyperuspap.htm. [Accessed 25 May 2014]	[Although seeds may adhere to animals, the primary dispersal vectors are water, and wind] "As in most sedges, pollination is effected by wind, not insects, and the mature fruits after release are distributed by wind and water."
	Brisbane City Council. 2014. Weed identification Tool - papyrus. Cyperus papyrus. http://weeds.brisbane.qld.gov.au/weeds/papyrus. [Accessed 25 May 2014]	[Possibly] "This species reproduces by seed and vegetatively via its creeping underground stems (i.e. rhizomes). The rhizomes spread laterally and can eventually form massive colonies, while the seeds may be dispersed by water or in mud attached to animals and vehicles."

708	Propagules survive passage through the gut	
	Source(s)	**Notes**
	Platt, S. G., Elsey, R. M., Liu, H., Rainwater, T. R., Nifong, J. C., Rosenblatt, A. E., Heithaus, M. R. and Mazzotti, F. J. 2013, Frugivory and seed dispersal by crocodilians: an overlooked form of saurochory?. Journal of Zoology, 291: 87–99	[Viability of consumed achenes unknown] "Table 1 Fruits and seeds reported in stomach contents and feces of crocodilians" [Crocodylus niloticus = Cyperus papyrus] ... "Table 2 Fruits consumed by crocodilians" [Includes Cyperus papyrus]

Qsn #	Question	Answer
801	**Prolific seed production (>1000/m2)**	**n**
	Source(s)	**Notes**
	Duke, J.A.1983. Handbook of Energy Crops - Cyperus papyrus. http://www.hort.purdue.edu/newcrop/duke_energy/Cyperus_papyrus.html. [Accessed 25 May 2014]	"Propagation is done in Egypt by rootstock divisions any time in spring and summer. It is recorded, however, to produce fertile seeds under our climatic conditions. In Egypt, it is sufficient to keep seed pots under boxes covered with glass to obtain the required result. Seedlings can be raised from seed. No escape seedlings, however, have been found in Egypt, and it is said that under the most favorable conditions seeds do not germinate without the intervention of man. "
	New Zealand Plant Conservation Network. 2013. Flora Details - Cyperus papyrus. http://www.nzpcn.org.nz/flora_details.aspx?ID=4349. [Accessed 25 May 2014]	[Not in New Zealand] "Viable seed production not known from New Zealand."

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	
	Source(s)	**Notes**
	Boar, R. R. 2006. Responses of a fringing Cyperus papyrus L. swamp to changes in water level. Aquatic Botany, 84(2): 85-92	"Episodic germination events suggest that papyrus has a persistent seed bank adapted to take rapid advantage of gaps created unpredictably by El Nino-scale fluctuations in lake level."
	Terer, T., Muasya, A. M., Higgins, S., Gaudet, J. J., & Triest, L. 2014. Importance of seedling recruitment for regeneration and maintaining genetic diversity of Cyperus papyrus during drawdown in Lake Naivasha, Kenya. Aquatic Botany, 116, 93-102	"The present study and earlier results by Gaudet (1977) and Boar (2006), show that C. papyrus in Lake Naivasha has a persistent seedbank, although seed longevity is still unknown."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	Little, E. C. S. 1968. The control of water weeds. Weed Research, 8(2): 79-105	"Cyperus papyrus This important vigorous weed, a main constituent of the Sudd region of the Sudan, is widely distributed over Africa, especially in the Sudan on the Nile [339], but there is little information available as to methods of control."
	Brisbane City Council. 2014. Weed identification Tool - papyrus. Cyperus papyrus. http://weeds.brisbane.qld.gov.au/weeds/papyrus. [Accessed 25 May 2014]	"Impact and control methods Foliar spray or Slashing and mowing" [Efficacy unspecified]

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Vaughan, G., 2011. Cyperus papyrus L. [Internet] Record from PROTA4U. Brink, M. & Achigan-Dako, E.G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.or /search.asp. [Accessed 23 May 2014]	"Stems and rhizomes can be harvested year-round as the plant is a perennial with little seasonal variation in growth. However, in the Lake Bunyonyi region (Uganda) harvesting is concentrated in the dry season, perhaps because the swamps are more easy to enter when the water level is low, and around the beginning of each school semester, when households must pay school fees. Ecological studies indicate that annual harvest rates of 20% or more of the biomass reduce this biomass drastically over the long-term, so only 10–15% of the biomass should be taken annually for a sustainable exploitation."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Mauremootoo, J. 2012. Invasive Plant Management Strategy For Terrestrial Protected Areas in: Fogo, Santo Antão, São Vicente. www.inspiralpathways.com	"There are not international biological control programmes for C. papyrus so biological control prospects will not be investigated for this species."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Environmentally versatile in tropical & subtropical climates
• Widely naturalized
• An environmental weed that threatens endangered species
• Sometimes considered a nuisance, forming floating islands that obstruct navigation and water flow
• Other Cyperus species are invasive
• Possible toxicity to humans
• Tolerates many soil types
• Thicket-forming aquatic weed
• Seeds dispersed by water, wind & possibly by adhering to mud on vehicles or animals
• Spreads vegetatively
• May form a persistent seed bank
• Able to resprout after repeated cutting

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Palatable to grazing animals
• Ornamental
• Limited seed production may minimized dispersal if confined to water gardens or contained water features