

Taxon: *Juncus polyanthemus* Buchenau

Family: Juncaceae

Common Name(s): Australian silver rush
manyflower rush

Synonym(s): *Juncus polyanthemus* Buchenau

Assessor: Chuck Chimera

Status: Assessor Approved

End Date: 17 Oct 2017

WRA Score: 12.0

Designation: H(HPWRA)

Rating: High Risk

Keywords: Tropical Rush, Naturalized, Disturbance-Adapted, Rhizomatous, Mucilaginous Seeds

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	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		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
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	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets		
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
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)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal		
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut		
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Australia; in Hawai'i naturalized in muddy, disturbed areas above 700 m, Maui, and it has been collected from pond cultivation on O'ahu." [No evidence of domestication]

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 11 Oct 2017]	"Native: Australasia Australia: Australia - New South Wales, - Queensland Pacific Southwestern Pacific: New Caledonia"

202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 11 Oct 2017]	

203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	Blooming Advantage. 2017. <i>Juncus polyanthemus</i> . Australian Gray Rush. http://www.bloomingadvantage.com/static/Juncus-polyanthemus.html . [Accessed 17 Oct 2017]	"Hardiness Zone: 8,9,10,11"
	San Marcos Growers. 2017. <i>Juncus polyanthemus</i> - Australian Rush. https://www.smgrowers.com/ . [Accessed 11 Oct 2017]	"It is hardy to at least 10-15 °F and useful in gardens in USDA Zone 8 and above."

Qsn #	Question	Answer
204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 11 Oct 2017]	"Native: Australasia Australia: Australia - New South Wales, - Queensland Pacific Southwestern Pacific: New Caledonia"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Presumably yes. Sold as an ornamental online (mainland US) and naturalized in the Hawaiian Islands

301	Naturalized beyond native range	y
	Source(s)	Notes
	St.John, H. 1953. Specimen Details for <i>Juncus polyanthemus</i> Buchenau. ID Number 413618. Bishop Museum, Honolulu, HI. http://nsdb.bishopmuseum.org/ . [Accessed 11 Oct 2017]	"Locality USA - Hawaii - Hawaii - Kulani Trail, O'laa Forest Reserve, O'laa, Puna District" ... "On moist trail. in dense <i>Cibotium</i> and <i>Metrosideros</i> forest."
	St.John, H. 1953. Specimen Details for <i>Juncus polyanthemus</i> Buchenau. ID Number 683361. Bishop Museum, Honolulu, HI. http://nsdb.bishopmuseum.org/ . [Accessed 11 Oct 2017]	"Locality: USA - Hawaii - Hawaii - South Kohala Distr., northwest slope of Mauna Kea, northwest Waimea" ... "Weed in gutter on roof of building, 1-story high strip mall, in full sun, in saturated peat."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Native to Australia; in Hawai'i naturalized in muddy, disturbed areas above 700 m, Maui, and it has been collected from pond cultivation on O'ahu."
	Waite, M., & Pratt, L. (2007). Plant inventory of the O'laa Trench at Hawaii Volcanoes National Park. Technical Report 139. Pacific Cooperative Studies Unit, Honolulu, HI	<i>Juncus polyanthemus</i> included in inventory. Presumably naturalized on Hawaii Island

Qsn #	Question	Answer
302	Garden/amenity/disturbance weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Juncus polyanthemus ... References: Australia-N-9, Australia-N- 945, Australia-N-7, Australia-N-354, Global-A-1207, Australia-A-87, Australia- N-1902, Australia-W-1977." [Cited as a weed of unspecified impacts. Disturbance-adapted and potential agricultural weed]
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"naturalized in muddy, disturbed areas above 700 m,"
	PlantNET. 2017. New South Wales Flora Online - Juncus polyanthemus. National Herbarium of NSW, Royal Botanic Garden, Sydney. http://plantnet.rbgsyd.nsw.gov.au . [Accessed 11 Oct 2017]	[Colonizes cleared (i.e. disturbed) pastures] "Frequently hybridizes with J. usitatus and J. mollis, especially as a colonist of cleared wet pastures on NC. "

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Cited as an agricultural weed in Reed, C.F. (1977). Economically important foreign weeds. Potential problems in the United States. United States Department of Agriculture., Washington, D.C., USA, Agriculture Handbook. [Impacts unspecified]

304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

305	Congeneric weed	y
	Source(s)	Notes
	Medeiros, A.C., Loope, L.L. & Chimera, C.G. 1998. Flowering Plants and Gymnosperms of Haleakala National Park. Technical Report 120. Pacific Cooperative Studies Unit, Honolulu, HI	"Juncus planifolius" ... "An aggressive herb that in recent years has invaded and come to dominate disturbed bog turf at Big and Mid-Camp Bogs on the northeast rift of the Park. In addition, it is found around Palikea Camp and along Palikea Stream at 3700 feet, and along the central pali at 4500 feet. It is especially persistent in disturbed sites such as fencelines, trails and areas of high pig activity. First collected in Hawaiian Islands on Hawai'i at Kilauea in 1941 on road shoulders (G.E. Olson s.n., BISH). First collected on Maui along forestry road in Waikamoi in 1964 (M.R. Crosby & W.R. Anderson 18 12, BISH)."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	Juncus acutus and J. aciculatus are described as significant environmental weeds

401	Produces spines, thorns or burrs	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs, rhizomes short, horizontal; stems dark brown at base, crowded on rhizome, 4-13 dm long, 3-4 mm in diameter, pith interrupted. Leaves basal, bladeless, sheaths dark brown at base becoming pale brown toward apex."

402	Allelopathic	n
	Source(s)	Notes
	Ervin, G. N., & Wetzel, R. G. (2000). Allelochemical autotoxicity in the emergent wetland macrophyte <i>Juncus effusus</i> (Juncaceae). <i>American Journal of Botany</i> , 87(6), 853-860	[Unknown. Related species potentially allelopathic] "Bioassays for allelochemical toxicity of aboveground <i>Juncus effusus</i> tissues were conducted with seeds and seedlings of <i>Eleocharis obtusa</i> and <i>Scirpus cyperinus</i> , two emergent sedge species (Cyperaceae) found sympatric with <i>J. effusus</i> , and with seeds and seedlings of <i>J. effusus</i> itself to evaluate potential autotoxicity."... "Although the extracts induced no significant reduction in growth of <i>E. obtusa</i> or <i>S. cyperinus</i> , biomass-specific chlorophyll a concentration was significantly reduced in <i>E. obtusa</i> seedlings. In contrast, seedlings of <i>J. effusus</i> exhibited significant reductions of biomass and chlorophyll a concentrations, and seedling shoot development was retarded in response to leachate exposure. Results of the present study suggest that <i>J. effusus</i> seedlings possess autotoxic sensitivity to extracts of dead, aboveground tissues of adult plants."

403	Parasitic	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs, rhizomes short, horizontal; stems dark brown at base, crowded on rhizome, 4-13 dm long, 3-4 mm in diameter, pith interrupted." [Juncaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	" <i>Juncus effusus</i> ... Confining goats to infested pasture areas can eventually eliminate soft rush..." [Related species palatable. <i>Juncus polyanthemus</i> would presumably be similarly palatable to grazing animals]
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Juncus effusus</i> ... Continuous grazing can eliminate the plant from pastures" [Related species palatable. <i>Juncus polyanthemus</i> would presumably be similarly palatable to grazing animals]

405	Toxic to animals	n
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence

Qsn #	Question	Answer
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
	Cornell University. 2017. Plants Poisonous to Livestock and other Animals. http://poisonousplants.ansci.cornell.edu/index.html . [Accessed 17 Oct 2017]	No evidence

406	Host for recognized pests and pathogens	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No evidence
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	Bodmin, K. A., Champion, P. D., James, T. & Burton, T. (2015) New Zealand Rushes: <i>Juncus</i> factsheets. NIWA, Hamilton, NZ	[No evidence. Does not occur in fire prone habitat] "Habitat: Coastal swamps and wet pastures in E Australia and New Caledonia. One NZ collection was made from a swamp forest remnant, the other was on an iron pan lake margin."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[No evidence. Does not occur in fire prone habitat] "naturalized in muddy, disturbed areas above 700 m"

409	Is a shade tolerant plant at some stage of its life cycle	
	Source(s)	Notes
	San Marcos Growers. 2017. <i>Juncus polyanthemus</i> - Australian Rush. https://www.smgrowers.com/ . [Accessed 17 Oct 2017]	"Exposure: Cool Sun/Light Shade" ... Quite adaptable, growing in shallow water, along the water's edge or up on the dry land in full sun to part shade."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"naturalized in muddy, disturbed areas" [Open, high light environments]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	n
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Qsn #	Question	Answer
	Source(s)	Notes
	Blooming Advantage. 2017. <i>Juncus polyanthemus</i> . Australian Gray Rush. http://www.bloomingadvantage.com/static/Juncus-polyanthemus.html . [Accessed 17 Oct 2017]	"Soil: Moist, Loam"

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs, rhizomes short, horizontal; stems dark brown at base, crowded on rhizome, 4-13 dm long, 3-4 mm in diameter, pith interrupted."

412	Forms dense thickets	n
	Source(s)	Notes
	Bodmin, K. A., Champion, P. D., James, T. & Burton, T. (2015) New Zealand Rushes: <i>Juncus</i> factsheets. NIWA, Hamilton, NZ	"Habitat: Coastal swamps and wet pastures in E Australia and New Caledonia. One NZ collection was made from a swamp forest remnant, the other was on an iron pan lake margin." ... "Not commonly found in New Zealand." [No evidence]
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs, rhizomes short, horizontal; stems dark brown at base, crowded on rhizome, 4-13 dm long, 3-4 mm in diameter, pith interrupted." ... "in Hawai'i naturalized in muddy, disturbed areas above 700 m" [No indication of dense stand formation]

501	Aquatic	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized in muddy, disturbed areas above 700 m, Maui, and it has been collected from pond cultivation on O'ahu." [Not aquatic, but may invade the perimeter of aquatic habitats]
	San Marcos Growers. 2017. <i>Juncus polyanthemus</i> - Australian Rush. https://www.smgrowers.com/ . [Accessed 11 Oct 2017]	"Quite adaptable, growing in shallow water, along the water's edge or up on the dry land in full sun to part shade."

502	Grass	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 11 Oct 2017]	Family: Juncaceae

Qsn #	Question	Answer
503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html . [Accessed 11 Oct 2017]	Family: Juncaceae
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs, rhizomes short, horizontal; stems dark brown at base, crowded on rhizome, 4-13 dm long, 3-4 mm in diameter, pith interrupted. Leaves basal, bladeless, sheaths dark brown at base becoming pale brown toward apex."
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	PlantNET. 2017. New South Wales Flora Online - <i>Juncus polyanthemus</i> . National Herbarium of NSW, Royal Botanic Garden, Sydney. http://plantnet.rbgsyd.nsw.gov.au . [Accessed 11 Oct 2017]	"Distribution and occurrence: Coast, north from near Port Kembla; also in Qld. Usually grows in swampy situations. NSW subdivisions: NC, CC, SC, CWS Other Australian states: Qld" [No evidence]
602	Produces viable seed	y
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Capsules pale to medium brown, shiny, thin, globose, ca. 2 mm long. Seeds rusty brown, asymmetrical, apiculate, ca. 0.45 mm long."
603	Hybridizes naturally	y
	Source(s)	Notes
	de Jong, N. H. (1997). An analysis of plant communities at Coomonderry Swamp with comparisons to other wetlands on the south coast of New South Wales. <i>Cunninghamia</i> , 5, 81-127	"Both <i>Juncus polyanthemus</i> and <i>Juncus procerus</i> (as well as the introduced <i>Juncus cognatus</i>) were found at this site beyond their previous known ranges. Hybrids between these two species, between <i>Juncus polyanthemus</i> and <i>Juncus usitatus</i> , and between <i>Juncus continuus</i> and <i>Juncus usitatus</i> were recorded (L. Johnson Nat. Herb. pers. comm.)."
	PlantNET. 2017. New South Wales Flora Online - <i>Juncus polyanthemus</i> . National Herbarium of NSW, Royal Botanic Garden, Sydney. http://plantnet.rbgsyd.nsw.gov.au . [Accessed 11 Oct 2017]	"Frequently hybridizes with <i>J. usitatus</i> and <i>J. mollis</i> , especially as a colonist of cleared wet pastures on NC."
604	Self-compatible or apomictic	

Qsn #	Question	Answer
	Source(s)	Notes
	Michalski, S. G., & Durka, W. (2012). Identification and characterization of microsatellite loci in the rush <i>Juncus effusus</i> (Juncaceae). <i>American Journal of Botany</i> , 99(2): e53-e5	[Unknown. Related species self-compatible] " <i>Juncus effusus</i> is self-compatible and, like most other <i>Juncus</i> species, putatively predominantly selfing (Buchenau, 1892)."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	[Unknown] "Flowers solitary in many-branched, spreading, cymose inflorescences up to 12 cm long, dichotomously branched, appearing lateral, lowest bract terete, appearing to be a continuation of the stem, 10-40 cm long, usually much longer than inflorescence; perianth parts pale, shorter than capsule, not spreading in fruit, inner ones wider than outer ones, with wide hyaline margins, outer ones longer than inner ones; stamens 3."

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	"Anemophily is the predominant mode of pollination. Adaptations include small flowers often aggregated in many-flowered inflorescences, prominent stigmatic surfaces, abundant pollen production, and smooth pollen tetrads."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	McCorry, M. J., & Renou, F. (2003). Ecology and management of <i>Juncus effusus</i> (soft rush) on cutaway peatlands. Forest Ecosystem Research Group Report 69. University College Dublin, Dublin	" <i>J. effusus</i> is capable of vegetative reproduction and can form extensive clonal patches due to the growth of rhizomes (Richards and Clapham, 1941b; Grime et al., 1990)." [Related species can spread vegetatively]
	Benson, D., & McDougall, L. 2002. Ecology of Sydney plant species. Part 9 Monocotyledon families Agavaceae to Juncaginaceae. <i>Cunninghamia</i> 7(4): 695-930	" <i>Juncus polyanthemus</i> ... Growth form: Shortly to strongly rhizomatous perennial herb, with flowering stems 65–115 cm long." [Presumably can spread some distance by rhizomes, similar to related <i>Juncus</i> species]
	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	"Vegetative propagation by means of large rhizome systems is common in many species, especially in <i>Juncus</i> ."

607	Minimum generative time (years)	
	Source(s)	Notes
	McCorry, M. J., & Renou, F. (2003). Ecology and management of <i>Juncus effusus</i> (soft rush) on cutaway peatlands. Forest Ecosystem Research Group Report 69. University College Dublin, Dublin	" <i>J. effusus</i> usually flowers in the second year and probably sets seed every year (Lazenby, 1955b)."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Perennial herbs, rhizomes short, horizontal; stems dark brown at base, crowded on rhizome"

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Benson, D., & McDougall, L. 2002. Ecology of Sydney plant species. Part 9 Monocotyledon families Agavaceae to Juncaginaceae. <i>Cunninghamia</i> 7(4): 695-930	"Fruit/seed: Smooth shiny capsule, with numerous seeds, mucilaginous when wet." [Mucilaginous seeds would presumably facilitate external attachment]
	McCorry, M. J., & Renou, F. (2003). Ecology and management of <i>Juncus effusus</i> (soft rush) on cutaway peatlands. Forest Ecosystem Research Group Report 69. University College Dublin, Dublin	" <i>Juncus effusus</i> ... "Seeds may also be dispersed by machinery and by adhering to animals, aided by the stickiness of the seed coat. Thompson and Grime (1979) found seeds of <i>J. effusus</i> frequently at sites where it was not represented in the established vegetation, suggesting effective dispersal of seeds." [Related species adapted to external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	Notes
	San Marcos Growers. 2017. <i>Juncus polyanthemus</i> - Australian Rush. https://www.smgrowers.com/ . [Accessed 11 Oct 2017]	"An attractive plant that is useful in the garden or as a container specimen for its geometric hard lines that contrast well with softer foliage. In its natural setting this rush can be found growing in coastal areas of Australia." [Cultivated and available as an ornamental]
	Blooming Advantage. 2017. <i>Juncus polyanthemus</i> . Australian Gray Rush. http://www.bloomingadvantage.com/static/Juncus-polyanthemus.html . [Accessed 17 Oct 2017]	[Sold as an ornamental] "Dramatic vertical accent, especially at water's edge or in a large container planting. Flower clusters bloom in rose hues and fade to buff. A very showy rush with a clumping habit."

703	Propagules likely to disperse as a produce contaminant	
	Source(s)	Notes
	WRA Specialist. 2017. Personal Communication	Unknown. Cultivated as an ornamental around natural and artificial water features. Seeds could become contaminants of other aquatic & semi-aquatic ornamentals.

704	Propagules adapted to wind dispersal	
	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	[Unknown for <i>J. polyanthemus</i>] "Dispersal is otherwise by seeds. The mucilaginous seeds of some species are adapted to epizoochory and their small size and ability to adhere to animals explain the wide and discontinuous distributions of many species. The fusiform seeds of some <i>Juncus</i> species may be anemochorous or (and) hydrochorous."

705	Propagules water dispersed	y
	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	"Dispersal is otherwise by seeds. The mucilaginous seeds of some species are adapted to epizoochory and their small size and ability to adhere to animals explain the wide and discontinuous distributions of many species. The fusiform seeds of some <i>Juncus</i> species may be anemochorous or (and) hydrochorous."

Qsn #	Question	Answer
	Benson, D., & McDougall, L. 2002. Ecology of Sydney plant species. Part 9 Monocotyledon families Agavaceae to Juncaginaceae. <i>Cunninghamia</i> 7(4): 695-930	[Occurs along creeks] "Fruit/seed: Smooth shiny capsule, with numerous seeds, mucilaginous when wet." ... "Select locations: CC: Dora Creek, Manly Dam, Doonside, Silverwater, Voyager Point, Seven Mile Beach."

706	Propagules bird dispersed	y
	Source(s)	Notes
	Hamilton, D. P., McBride, C. G., Özkundakci, D., Schallenberg, M., Verburg, P., de Winton, M., Kelly, D., Hendy, C. & Ye, W. (2013). Effects of climate change on New Zealand lakes. Pp. 337-366 in <i>Climate Change and Inland Waters: Impacts and Mitigation for Ecosystems and Societies</i> . John Wiley & Sons, Hoboken, NJ	"Continued establishment of "colonizer" plants (de Lange et al. 2009) from Australia such as bladderwort (<i>Utricularia gibba</i>), <i>Grateola pedunculata</i> and <i>Juncus polyanthemus</i> point to seed transport by waterfowl migration as an occasional pathway between the two land masses." [Although likely dispersed externally, seeds are effectively dispersed long distances by migrating birds]

707	Propagules dispersed by other animals (externally)	y
	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	"Dispersal is otherwise by seeds. The mucilaginous seeds of some species are adapted to epizoochory and their small size and ability to adhere to animals explain the wide and discontinuous distributions of many species."
	Benson, D., & McDougall, L. 2002. Ecology of Sydney plant species. Part 9 Monocotyledon families Agavaceae to Juncaginaceae. <i>Cunninghamia</i> 7(4): 695-930	"Fruit/seed: Smooth shiny capsule, with numerous seeds, mucilaginous when wet." [Mucilage would aid in external attachment]

708	Propagules survive passage through the gut	
	Source(s)	Notes
	Gill, R. M. A., & Beardall, V. (2001). The impact of deer on woodlands: the effects of browsing and seed dispersal on vegetation structure and composition. <i>Forestry</i> , 74(3), 209-218	"Table 3: Plant species (present in the British Isles) which have been shown to germinate from dung of red (<i>Cervus elaphus</i>) and fallow (<i>Dama dama</i>) deer (Malo and Suarez, 1995; Welch, 1985)" [<i>Juncus effusus</i> germinates from Red deer dung. Possible that <i>J. polyanthemus</i> may survive gut passage]

801	Prolific seed production (>1000/m2)	
	Source(s)	Notes
	Benson, D., & McDougall, L. 2002. Ecology of Sydney plant species. Part 9 Monocotyledon families Agavaceae to Juncaginaceae. <i>Cunninghamia</i> 7(4): 695-930	"Fruit/seed: Smooth shiny capsule, with numerous seeds, mucilaginous when wet." [Densities unknown]

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	Notes
	Bakker, J. P., Poschlod, P., Strykstra, R. J., Bekker, R. M., & Thompson, K. 1996. Seed banks and seed dispersal: important topics in restoration ecology §. <i>Acta Botanica Neerlandica</i> , 45(4): 461-490	"Table 4. Top 30 species ranked after their maximum longevity (method N, data from soil samples of field sites; method B, data from burial experiments)" [<i>Juncus effusus</i> seeds have been documented to persist in soil samples for >73 years. Unknown for <i>Juncus polyanthemus</i>]

803	Well controlled by herbicides	y
	Source(s)	Notes
	Rana, N., & Sellers, B. A. (2009). Soft Rush (<i>Juncus effusus</i>) control in Florida pastures. <i>Weed Technology</i> , 23(2), 321-323	"...effective control of soft rush can be obtained with the use of 2,4-D amine or products that contain 2,4-D amine." [Herbicides that effectively control <i>Juncus effusus</i> would presumably have similar effects on <i>Juncus polyanthemus</i>]
	Motooka, P., Castro, L., Nelson, D., Nagai, G. & Ching, L. 2003. <i>Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide</i> . CTAHR, UH Manoa, Honolulu, HI	"Difficult because of thick rhizomes and roots. Susceptible to glyphosate at 1-1.5% product applied to foliage (Hank Oppenheimer, Maui Pine" [Herbicides that effectively control <i>Juncus effusus</i> would presumably have similar effects on <i>Juncus polyanthemus</i>]

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	San Marcos Growers. 2017. <i>Juncus polyanthemus</i> - Australian Rush. https://www.smgrowers.com/ . [Accessed 11 Oct 2017]	"Though not necessary, this rush can be cut back nearly to the ground in late winter so fresh new growth emerges in spring."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1999. <i>Manual of the flowering plants of Hawaii</i> . Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"in Hawai'i naturalized in muddy, disturbed areas above 700 m," [Unknown]

Summary of Risk Traits:

High Risk / Undesirable Traits

- Thrives in tropical climates
- Naturalized in Hawaiian Islands (Maui, Oahu & possibly Hawaii island]
- Other *Juncus* species have become invasive
- Reproduces by seeds & vegetatively by rhizomes
- Hybridizes with other *Juncus* species
- Mucilaginous seeds dispersed externally by birds, other animals, and people (vehicles, equipment etc.)
- Cultivated and intentionally dispersed by people
- Able to resprout after cutting

Low Risk Traits

- Unarmed (no spines, thorns, or burrs)
- Palatable to grazing animals
- Non-toxic
- Ornamental
- Herbicides may provide effective control