Family: *Dryopteridaceae*

Taxon: *Nephrolepis biserrata*

Synonym: *Aspidium biserratum Sw.* *Common Name* giant swordfern

Questionaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** H(HPWRA)

Status: Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score** 13

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
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**	**n=0, y = 1*multiplier (see Appendix 2)**	**y**
303	**Agricultural/forestry/horticultural weed**	**n=0, y = 2*multiplier (see Appendix 2)**	
304	**Environmental weed**	**n=0, y = 2*multiplier (see Appendix 2)**	
305	**Congeneric weed**	**n=0, y = 1*multiplier (see Appendix 2)**	**y**
401	**Produces spines, thorns or burrs**	**y=1, n=0**	**n**
402	**Allelopathic**	**y=1, n=0**	**n**
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**	**y=1, n=0**	**n**
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	**y**
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y=1, n=0**	**y**
411	**Climbing or smothering growth habit**	**y=1, n=0**	**n**

412	**Forms dense thickets**	**y=1, n=0**	**y**
501	**Aquatic**	**y=5, n=0**	**n**
502	**Grass**	**y=1, n=0**	**n**
503	**Nitrogen fixing woody plant**	**y=1, n=0**	**n**
504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**y=1, n=0**	**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**	**y=1, n=-1**	
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**	
702	**Propagules dispersed intentionally by people**	**y=1, n=-1**	**y**
703	**Propagules likely to disperse as a produce contaminant**	**y=1, n=-1**	
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)**	**y=1, n=-1**	**n**
708	**Propagules survive passage through the gut**	**y=1, n=-1**	**n**
801	**Prolific seed production (>1000/m2)**	**y=1, n=-1**	**y**
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**y=1, n=-1**	
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)**	**y=-1, n=1**	

Designation: H(HPWRA) **WRA Score** 13

Supporting Data:

101	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	No evidence of domestication significantly alterhing species
201	1971. Wiggins, I. L./Porter, D. M./Anderson, E. F.. Flora of the Galápagos Islands. Stanford University Press, Stanford, CA.	West Indies, southern Florida, and Mexico to Peru and southern Brazil; widely distributed in the tropics of the Old World.
201	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Distribution — Pantropical
201	2010. eFloras. Flora of North America - Nephrolepis biserrata. 2: .Missouri Botanical Gardenand Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=200004790	Terrestrial or less commonly epiphytic in forested, relatively wet habitats, e.g., swamps, but occasionally thickets, roadsides, or clearings; 0 m; Fla.; Mexico; West Indies; Central America; South America; Africa; se Asia.
202	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Distribution — Pantropical
203	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	It is usually hardy only in zones 10 & 11, but is often successful in zone 9b.
203	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Habitat & Ecology — Usually in lowlands (sea level up to 750 m, rarely higher, to 1500 m), in open, disturbed situations, occasionally in forest; epiphytic or terrestrial. In Kalimantan reported as covering large tracts of recently burned forest.
204	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Distribution — Pantropical
205	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	indigenous to an immense area covering most parts of the tropical Southern Hemisphere and has become naturalized in almost every tropical region of the globe.
301	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	A large coarse fern which is very widespread and has escaped from cultivation, becoming naturalized in many countries.
301	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	naturalized in almost every tropical region of the globe
302	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	It can be easily grown as a garden plant but tends to become invasive.
302	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	The plants grow large & fast, & quickly make large colonies. They are mildly invasive, although easily removed from where they are not wanted.
302	1999. Croft, J.. Ferns and Man in New Guinea. Australian National Botanic Gardens, http://www.anbg.gov.au/fern/ferns-man-ng.html	Nephrolepis biserrata Uses: urban ornamental, also prolific weed
302	2004. Bakar, B. H.. Invasive Weed Species in Malaysian Agro-Ecosystems : Species, Impacts and Management. Malaysian Journal of Science. 23: 1-42.	Table 1. Some invasive weed species in Malaysian agro-ecosystems. [includes N. biserrata]
303	1973. Wee, Y. C.. Viable seeds and spores of weed species in peat soil under pineapple cultivation. Weed Research. 14: 193 - 196.	Soil samples were taken from twenty-two fields in a peat area in W. Malaysia where pineapples had been grown for different periods. The numbers of viable seeds and spores in the top 15 cm of fields under cultivation for 6 months, 2, 6 and 10 years varied from 66–122 millions/ha. Of this total, 90% were spores of Nephrolepis biserrata and eight other ferns. The total numbers of seeds of the two sedges, one grass and nine dicotyledons recorded, ranged from 0–7 to 6.3 millions/ha.
303	2004. Bakar, B. H.. Invasive Weed Species in Malaysian Agro-Ecosystems : Species, Impacts and Management. Malaysian Journal of Science. 23: 1-42.	Table 1. Some invasive weed species in Malaysian agro-ecosystems. [includes N. biserrata, but with no information on impacts]

303	2007. Randall, R.P.. Global Compendium of Weeds. http://www.hear.org/gcw/	Listed as an agricultural weed
303	2010. Learn 2 Grow. Plant Search - Nephrolepis biserrata. Learn 2 Grow, http://www.learn2grow.com/plants/nephrolepis-biserrata/	Broad sword fern has escaped cultivation and is an agricultural weed in some tropical areas.
304	2007. Randall, R.P.. Global Compendium of Weeds - Nephrolepis biserrata [Online Database]. Hawaii Ecosystems at Risk Project (HEAR), http://www.hear.org/gcw/species/nephrolepis_biserrata/	Listed as an environmental weed, but no evidence of impacts found [sufficient evidence found to answer yes to Question 3.02]
305	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds.. CABI Publishing, Wallingford, UK	Nephrolepis multifora…builds dense populations & displaces native vegetation. It climbs high into the canopies of shrubs & trees, smothering them & preventing regeneration. Fronds also form a thick mat on the ground, preventing any establishment of native plants.
401	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Plants forming tufts of 3–5 fronds. Runners 1–2.5 mm thick, branching angle divaricate. Scales on runners very sparse to dense, spreading or squarrose. Tubers absent. [no spines, thorns, or burrs]
402	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	No evidence of allelopathy
403	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Not parasitic
404	1991. Chee, Y.K./Faiz, A.. Sheep grazing reduces chemical weed control in rubber. Forages for Plantation Crops. Proc. of a Workshop.	Young shoots of the ferns Nephrolepis biserrata and Dicranopteris linearis are also eaten.
404	2006. Babayemi, O.J./Bamikole, M. A./Omojola, A. B.. Evaluation of the nutritive value and free choice intake of two aquatic weeds (Nephrolepis biserrata and Spirodela polyrhiza) by West African dwarf goats. Tropical and Subtropical Ecosystems. 6: 15-21.	The results showed that aquatic fern and duckweed are potential sources of nutrients but the latter was more preferred than the former by West African dwarf goats.
404	2008. Oloyede, F. A./Alafe, B. O./Oloyede., F. M.. Nutrient Evaluation of Nephrolepis biserrata (Nephrolepidaceae, Pteridophyta). Botanica Lithuanica. 14: 207-210.	Studies on some fern species have revealed their suitability for use in fortifying livestock & fish feeds to enhance food production. The intake of Nephrolepis biserrata (Swartz) Schott by ruminants in the tropics has been reported. Thus, its nutrient compositions were determined in this study. Proximate analysis showed 6.13 % protein, 0.87 % crude fiber, 0.33 % fat, 1.88 % ash, 80 moisture, 10.87 % carbohydrate, 20 g/100 g total solid & 4.79 mg/100 g ascorbic acid (vitamin C). The leaflet is a rich source of mineral elements (mg/100 g dry matter): chromium 6.30 +/- 0.01, iron 1182.00 +/- 0.49, manganese 100.80 +/- 0.02, copper 158.75 +/- 0.38, cobalt 0.45 +/- 0.02, cadmium 0.02 +/- 0.03, lead 68.10 +/- 0.17, magnesium 338.70 +/- 0.01, calcium 223.20 +/- 0.06, mercury 27.59 +/- 0.11, nickel 9.00 +/- 0.03, potassium 500.00 +/- 0.04 & sodium 250.00 +/- 0.05. Zinc, selenium & arsenium were not detected. Analysis of the toxicants also showed oxalate & hydrogen cyanide to be 0.575 mg/100 g and 2.16 mg/100 g respectively. The results are discussed in terms of the nutritive value as well as the public health implication of having N. biserrata as part of the ruminant diet.
405	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	No evidence of toxicity
405	1991. Chee, Y.K./Faiz, A.. Sheep grazing reduces chemical weed control in rubber. Forages for Plantation Crops. Proc. of a Workshop.	Young shoots of the ferns Nephrolepis biserrata and Dicranopteris linearis are also eaten. [no evidence of toxicity]
405	2010. ASPCA. Bold Sword Fern Scientific Name: Nephrolepis biserrata. ASPCA, http://www.aspca.org/pet-care/poison-control/plants/bold-sword-fern.html	Toxicity: Non-Toxic to Cats, Non-Toxic to Dogs, Non-Toxic to Horses
406	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Nephrolepis species suffer little from attacks by pests or diseases and because of their vigor usually grow out of any damage.
407	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Table 1. Fronds Eaten in Asia and the Pacific Region…includes Nephrolepis biserrata [no evidence of toxicity]

408	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	In Southeast Asia, pubescent forms occur mainly on Borneo, where they seem to be increasing as a result of recent forest fires – the burnt areas are quickly covered with a dense mat of sterile specimens of this form – & on New Guinea. [no evidence that the fern promotes fire, although dense cover may make it more likely to burn]
409	1971. Wiggins, I. L./Porter, D. M./Anderson, E. F.. Flora of the Galápagos Islands. Stanford University Press, Stanford, CA.	In shaded, moist places
409	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	It grows in huge colonies in a variety of situations (usually shady) and as a terrestrial or an epiphyte.
410	2010. Learn 2 Grow. Plant Search - Nephrolepis biserrata. Learn 2 Grow, http://www.learn2grow.com/plants/nephrolepis-biserrata/	Soil pH: Acidic, Neutral, Alkaline; Soil type: Loam, Sand
411	1985. Pichi Sermolli, R. E. G.. A Contribution to the Knowledge of the Pteridophyta of Rwanda, Burundi, and Kivu (Zaire) II. Bulletin du Jardin botanique national de Belgique. 55: 123-206.	Epiphytic on trees in equatorial moist forest, or terrestrial clim- bing on shrubs on river banks or growing in crevices of lava flows, 800-1550 m. [epiphytic, but not really climbing]
411	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Plants forming tufts of 3–5 fronds. Runners 1–2.5 mm thick, branching angle divaricate. Scales on runners very sparse to dense, spreading or squarrose. Tubers absent.
412	2000. Nelson, G.. The ferns of Florida: a reference and field guide. Pineapple Press Inc, Sarasota, FL	this species can form dense, nearly impenetrable thickets more than 2 m tall.
412	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	In Southeast Asia, pubescent forms occur mainly on Borneo, where they seem to be increasing as a result of recent forest fires – the burnt areas are quickly covered with a dense mat of sterile specimens of this form – & on New Guinea.
412	2006. Babayemi, O.J./Bamikole, M. A./Omojola, A. B.. Evaluation of the nutritive value and free choice intake of two aquatic weeds (Nephrolepis biserrata and Spirodela polyrhiza) by West African dwarf goats. Tropical and Subtropical Ecosystems. 6: 15-21.	an evergreen perennial herb that forms congested colonies in very wet soils & along the edge of streams or marshes…sometimes on surface of lake and stagnant water.
501	1981. Nauman, C. E.. The Genus Nephrolepis in Florida. American Fern Journal. 71: 35-40.	This is a species of swamps and wet hammocks in which it is usually terrestrial, but may be epiphytic or epipetric.
502	2010. Integrated Taxonomic Information System. Nephrolepis biserrata [Online Database]. Integrated Taxonomic Information System, http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=17603	A pteridophyte
503	2010. Integrated Taxonomic Information System. Nephrolepis biserrata [Online Database]. Integrated Taxonomic Information System, http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=17603	Not nitrogen fixing [a pteridophyte]
504	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Plants forming tufts of 3–5 fronds. Runners 1–2.5 mm thick, branching angle divaricate. Scales on runners very sparse to dense, spreading or squarrose. Tubers absent.
601	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	No evidence of substantial reproductive failure in native habitat
602	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Species of Nephrolepis can be propagated readily from spores
602	2010. Learn 2 Grow. Plant Search - Nephrolepis biserrata. Learn 2 Grow, http://www.learn2grow.com/plants/nephrolepis-biserrata/	reproduces by spores or is easily divided to form new plants
603	1979. Nauman, C. E.. A New Nephrolepis Hybrid from Florida. American Fern Journal. 69: 65-70.	Two of these species, N. exaltata & N. biserrata, occur in Florida and have been a source of difficulty, in part because of plants intermediate in a number of characteristics. The intermediates appear to represent hybrid populations between these two species.

603	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	Nephrolepis × averyi Nauman...= Nephrolepis biserrata × N. exaltata, intermediate between the putative parents...Note — Only found in mixed populations of the parent species.
604	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Unknown if separate gametophytes are required for cross-fertilization
605	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	No specialist pollinators required
606	2010. Learn 2 Grow. Plant Search - Nephrolepis biserrata. Learn 2 Grow, http://www.learn2grow.com/plants/nephrolepis-biserrata/	It spreads slowly by rhizomes (below ground stems) and stolons (above ground lateral stems).
607	2001. Meerow, A. W.. Native Ground Covers for South Florida. Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL http://edis.ifas.ufl.edu.	Growth Rate: Fast
701	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Wind-dispersed spores [no information found on inadvertent transportation, but possible]
702	1998. Riffle, R. L.. The Tropical Look - An Encyclopedia of Dramatic Landscape Plants. Timber Press, Portland, OR	Planted ornamentally
703	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Wind-dispersed spores [no information found regarding produce contamination, but possible given ornamental uses]
704	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Wind-dispersed spores
705	1981. Nauman, C. E.. The Genus Nephrolepis in Florida. American Fern Journal. 71: 35-40.	This is a species of swamps and wet hammocks in which it is usually terrestrial, but may be epiphytic or epipetric. [distribution suggests spores probably float]
706	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Wind-dispersed sporers [no evidence of bird dispersal]
707	1987. Jones, D. L.. Encyclopedia of Ferns. Timber Press, Portland, OR.	Wind-dispersed spores [no evidence of animal dispersal, but theoretically possible if spores stuck in animal fur, mud on feet, legs, hooves, etc.]
708	2006. Babayemi, O.J./Bamikole, M. A./Omojola, A. B.. Evaluation of the nutritive value and free choice intake of two aquatic weeds (Nephrolepis biserrata and Spirodela polyrhiza) by West African dwarf goats. Tropical and Subtropical Ecosystems. 6: 15-21.	No evidence that spores would survive ingestion
801	1973. Wee, Y. C.. Viable seeds and spores of weed species in peat soil under pineapple cultivation. Weed Research. 14: 193 - 196.	Soil samples were taken from twenty-two fields in a peat area in W. Malaysia where pineapples had been grown for different periods. The numbers of viable seeds and spores in the top 15 cm of fields under cultivation for 6 months, 2, 6 and 10 years varied from 66–122 millions/ha. Of this total, 90% were spores of Nephrolepis biserrata and eight other ferns. The total numbers of seeds of the two sedges, one grass and nine dicotyledons recorded, ranged from 0–7 to 6.3 millions/ha.
802	2010. WRA Specialist. Personal Communication.	Spore longevity/viability unknown
803	2010. Traore, K./Soro, D./Camara, B./Sorho, F.. Effectiveness of glyphosate herbicide in a juvenile oil palm plantation in Côte d'Ivoire. Journal of Animal & Plant Sciences. 6: 559- 566.	The dominant weed species at La ME station were Chromolaena odorata, Desmodium adscendens, Emilia praetermissa, Heterotis rotundifolia , Mariscus cylindristachyus, Nephrolepis biserrata, Oplismenus burmannii, Panicum laxum, Phaulopsis falcisepala (Traoré et al., 2005). All these were effectively controlled by herbicide treatment.
804	2005. Hovenkamp, P. H./Miyamoto, F.. A conspectus of the native and naturalized species of Nephrolepis (Nephrolepidaceae) in the world. Blumea. 50: 279–322.	In Southeast Asia, pubescent forms occur mainly on Borneo, where they seem to be increasing as a result of recent forest fires – the burnt areas are quickly covered with a dense mat of sterile specimens of this form – & on New Guinea. [recovers quickly after fires]
804	2010. Learn 2 Grow. Plant Search - Nephrolepis biserrata. Learn 2 Grow, http://www.learn2grow.com/plants/nephrolepis-biserrata/	They are frost sensitive and are killed to the ground by a few degrees of a freeze. However, they will return if the cold weather is not a prolonged freeze.
805	2010. WRA Specialist. Personal Communication.	Unknown if natural enemies are present locally