

Taxon: Plantago lanceolata	Family: Plantaginaceae
Common Name(s): plantain buckhorn English plantain narrow-leaved plantain	Synonym(s):

Assessor: Chuck Chimera	Status: Assessor Approved	End Date: 28 Oct 2014
WRA Score: 18.0	Designation: H(HPWRA)	Rating: High Risk

Keywords: Naturalized, Herb, Weed, Fodder Plant, Easily Dispersed

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)	Intermediate
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)	y
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	y
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
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	n
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation		
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
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	y
704	Propagules adapted to wind dispersal	y=1, n=-1	n
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	y=1, n=-1	y
801	Prolific seed production (>1000/m ²)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
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
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	[No evidence for wild-type] " <i>Plantago</i> comprises nearly 270 species and is cosmopolitan, but mostly temperate in distribution. <i>Plantago lanceolata</i> is extremely variable, but much of the variation reflects differences in habitat (e.g. hairy plants in more dry habitats). The leaves tend to be upright and more linear-lanceolate when the surrounding cover is tall. In grazed areas, its habit is prostrate and the leaves are more ovate." ... "Improved pasture cultivars have been bred in New Zealand; they include 'Grassland Lancelot' and 'Ceres Tonic'."
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"	Intermediate
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Narrow-leaved plantain is well established throughout the world except in subarctic and low-lying tropical areas (Tessene 1968)."
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"This remarkably widespread species is apparently native to Europe, North Africa and West and South Asia (USDA-ARS, 2003) but has been introduced extremely widely elsewhere and now occurs e.g. in every continental state of USA as well as in Hawaii, in Australia and New Zealand, 'throughout Japan' (Morita, 2002) and in many countries of Africa, where it thrives at high altitude."
202	Quality of climate match data	High
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	
203	Broad climate suitability (environmental versatility)	y

Qsn #	Question	Answer
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	" <i>P. lanceolata</i> is so widely distributed that it is probably not restricted by climate (Holm et al., 1977). Suitable climates include those with winter rainfall (temperate), all-year rainfall (temperate), summer rainfall (temperate), summer rainfall (sub-tropical) (Wells et al., 1986). The deep taproot enables this species to withstand periods of drought. It is seldom reported to be an important weed in the tropics because more vigorous plants keep its growth in check. In open areas, plants will overwinter below ground and, if frosted, they can re-grow from underground storage organs."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Originally from Europe and northern and central Asia, <i>Plantago lanceolata</i> is now cosmopolitan. In Africa it occurs mainly in the eastern and southern parts, including South Africa. It is common in Mauritius and Rodrigues."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Narrow-leaved plantain is well established throughout the world except in subarctic and low-lying tropical areas (Tessene 1968). Holm et al. (1917) state that it is one of the world's 12 most successful noncultivated colonizing species. Grose (1957) stated that in Wiltshire, England, <i>P. lanceolata</i> is "by any reckoning our most abundant plant."
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"This remarkably widespread species is apparently native to Europe, North Africa and West and South Asia (USDA-ARS, 2003) but has been introduced extremely widely elsewhere and now occurs e.g. in every continental state of USA as well as in Hawaii, in Australia and New Zealand, 'throughout Japan' (Morita, 2002) and in many countries of Africa, where it thrives at high altitude."

Qsn #	Question	Answer
301	Naturalized beyond native range	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.	"in Hawaii naturalized and sometimes locally common in beach parks, coastal sites, open pastures and sometimes in open sites in mesic forest and subalpine shrubland, 0-3,110 m, on Midway Atoll, French Frigate Shoals, and documented from all of the main islands except Niihau and Kahoolawe."
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Originally from Europe and northern and central Asia, <i>Plantago lanceolata</i> is now cosmopolitan. In Africa it occurs mainly in the eastern and southern parts, including South Africa. It is common in Mauritius and Rodrigues."

302	Garden/amenity/disturbance weed	y
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"It is a serious weed of lawns, dry grasslands and roadsides, although it is a palatable species to livestock in dry pastures." ... "Major infestations of narrow-leaved plantain have been observed in old hayfields and pastures, lawns, farmyards, waste places and along roadsides in parts of the Maritime Provinces, southern Quebec, Ontario and British Columbia. In lawns, the clumps of this species create unsightly irregularities."

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	[Minor crop weed] "This species is quick to colonize, establish and spread in disturbed agricultural areas. Its small size and low vigour, however, mean that it is seldom reported as a principal weed for a particular crop (Holm et al., 1977). It has been reported as a weed of lucerne in Iran (Mirkamaly and Maddah, 1973) and of citrus and mango in Mauritius (McIntyre and Barbe, 1994)."

304	Environmental weed	y
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	" <i>P. lanceolata</i> has been described as an agricultural, pastoral and environmental weed competing with other plants for light, water and nutrients and replacing preferred vegetation. <i>P. lanceolata</i> and <i>P. major</i> have together been reported as weeds in over 50 countries affecting a wide range of crops (Holm et al., 1977). Holm et al. (1979) record <i>P. lanceolata</i> as a serious weed in Italy, and a principal weed in Canada, Ecuador, Iran, Mauritius and New Zealand."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The plant is a widespread weed and rapidly colonizes open areas. It forms dense swards that crowd out native vegetation and prevent the establishment of native species."

305	Congeneric weed	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	" <i>Plantago coronopus</i> " ... "It is invasive because it forms dense mats of small rosettes, displacing native vegetation and preventing regeneration of native plants."

401	Produces spines, thorns or burrs	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 or biennial herbs from a taproot, caudex usually with tufts of long hairs around leaf bases. Leaves basal, narrowly lanceolate to oblanceolate; 5-40 cm long, 0.5-4 cm wide, 5-nerved, long-villous or sometimes glabrous, margins remotely denticulate to subentire, along-attenuate to a winged petiole 0-15 cm long."

402	Allelopathic	
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	[May have allelopathic effects on conspecific plants] "Newman and Rovira (1975) examined the role of root exudates from several British grassland species. In pots, plants of <i>P. lanceolata</i> grew more slowly when receiving their own leachate than when receiving leachate from other species. This result may partly explain why <i>P. lanceolata</i> almost always occurs as well-spaced individuals in mixed stands with other species."

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.	[No evidence] "Perennial or biennial herbs from a taproot, caudex usually with tufts of long hairs around leaf bases."

404	Unpalatable to grazing animals	n
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Clark and Fletcher (1906) noted that in Canada, narrow-leaved plantain is "palatable to livestock and provides fodder of fair quality, although inferior to the grasses." Narrow-leaved plantain is one of the most palatable species to sheep (Milton 1933). Sheep will 'actually chisel the crowns out of the ground using the lower incisors" (Sagar and Harper 1964)."
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Leaves are edible and sometimes eaten as vegetable. <i>Plantago lanceolata</i> is occasionally grown as a fodder crop and considered to be of better quality than <i>Plantago major</i> ."

Qsn #	Question	Answer
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	" <i>P. lanceolata</i> has been used for sward improvement (Stewart, 1996; Trzaskos, 1996; Kozlowski et al., 1997). The commercial cultivars 'Grasslands Lancelot' (Rumball et al., 1997) and 'Ceres Tonic' (Pyne Gould Guinness Ltd, 1996) have been developed in New Zealand for forage yield and suitability for livestock grazing. Sagar and Harper (1964) note that <i>P. lanceolata</i> is one of the most palatable species for sheep."

405	Toxic to animals	n
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	[No evidence] "In mixed pastures <i>Plantago lanceolata</i> establishes quickly and is preferentially grazed, which may lead to its disappearance from the sward. The inflorescences are avoided by grazing animals."

406	Host for recognized pests and pathogens	y
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Diseases and pests: Seedling mortality of <i>Plantago lanceolata</i> is common, and is due to a complex of fungal species interacting with abiotic factors. Stalk disease is caused by the fungus <i>Phomopsis subordinaria</i> . <i>Plantago lanceolata</i> is a host of <i>Meloidogyne</i> nematodes."
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"In Europe, <i>P. lanceolata</i> is an important winter host plant for aphids and other vectors of sugar-beet viruses (Heathcote et al. 1965)."

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Pollen of this species can cause allergies and respiratory problems (Lamp and Collet, 1979; Mehta and Wheeler, 1991)."
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"The airborne pollen of narrow-leaved plantain, shed in large amounts, is an important contributor to summer hay fever (Bassett et al. 1978)."
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	[Not toxic in and of itself, but could accumulate toxic heavy metals in plant tissue] "Care should be taken when collecting <i>Plantago lanceolata</i> from the wild for medicinal purposes, since plants may contain high concentrations of heavy metals such as lead and cadmium where they grow along roads."

408	Creates a fire hazard in natural ecosystems	n
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Qsn #	Question	Answer
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 28 Oct 2014]	[Herbaceous weed that is not reported to increase fire risk in native or introduced ranges] "P. lanceolata has been described as an agricultural, pastoral and environmental weed competing with other plants for light, water and nutrients and replacing preferred vegetation. P. lanceolata and P. major have together been reported as weeds in over 50 countries affecting a wide range of crops (Holm et al., 1977). Holm et al. (1979) record P. lanceolata as a serious weed in Italy, and a principal weed in Canada, Ecuador, Iran, Mauritius and New Zealand."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"P. lanceolata is the only weedy plantain that exhibits seed germination in darkness and seedling establishment in tall dense layers of vegetation (Blom 1978). This species showed exceptional plasticity under varying shade conditions in an experiment by Grime and Jeffrey (1965). In a closed grassland, they found ascending leaves of P. lanceolata up to 40 cm in height."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"P. lanceolata occurs on a wide range of soil types (Sagar and Harper 1964) but is most common on neutral to basic soils (Bassett and Crompton 1968). Zeiner (1946) claimed that it was intolerant of acid soils (pH 4.4-4.5) in a study of plant communities after disturbance in Indiana. Dale et al. (1965) found that this species preferred medium- to fine-textured soils in Ontario, medium organic matter and neutral to basic pH."
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"The chemical and physical characteristics of the soils in which <i>Plantago</i> species grow have been described by Troelstra (1992). Sagar and Harper (1964) note that P. lanceolata is found on a wide variety of soil types in the British Isles and occurs on sand-dunes, and spray-washed cliffs, but is absent from acidic uplands. It is mainly a species of basic and neutral grasslands."

411	Climbing or smothering growth habit	n
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Small perennial herb up to 60(-100) cm tall, with a thick rhizome and fibrous roots. Leaves in a dense rosette, arranged spirally; stipules absent; petiole up to as long as the blade; blade linear lanceolate to narrowly ovate or spatulate, (2-)10-20(-40) cm x 1-3 (-7) cm, base tapering into the petiole, apex acute to acuminate, both surfaces glabrous or appressed pubescent to villous, margins entire or shallowly dentate, veins 3-5, distinct, parallel."

412	Forms dense thickets	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The plant is a widespread weed and rapidly colonizes open areas. It forms dense swards that crowd out native vegetation and prevent the establishment of native species"
501	Aquatic	n
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	[Terrestrial] " <i>Plantago lanceolata</i> occurs in disturbed areas. It is a very common weed of cultivated areas and roadsides, as well as open woodland and grassland. "
502	Grass	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.	Plantaginaceae
503	Nitrogen fixing woody plant	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 or biennial herbs from a taproot, caudex usually with tufts of long hairs around leaf bases." [Plantaginaceae]
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Small perennial herb up to 60(-100) cm tall, with a thick rhizome and fibrous roots." ... "Individual plants have been known to persist for at least 12 years. Old plants develop a thick rhizome producing new aerial shoots, which leads to clumping." [This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes/ stolons]

Qsn #	Question	Answer
601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	" <i>Plantago lanceolata</i> is common and extremely widespread and not threatened by genetic erosion. Several small genebank collections exist, especially in South America and Europe."
602	Produces viable seed	y
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Fruit a circumscissile, ellipsoid capsule 3–5 mm long, (1–)2–3-seeded. Seeds oblong-ellipsoid, 2. –3 mm long, yellow-brown to dark brown, mucilaginous when wet. " ... "Seed production is highest in open, cultivated land, and least in mowed or grazed areas. The seeds are ripe 2–3 weeks after fertilization."
603	Hybridizes naturally	n
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Rahn (1957) attempted to cross <i>P. lanceolata</i> with <i>P. major</i> , <i>P. media</i> and <i>P. lagopus</i> L. but was unsuccessful. Sagar and Harper (1964) reported that all attempts to produce artificial hybrids between <i>P. lanceolata</i> , <i>P. media</i> and <i>P. major</i> have failed. They concluded that there is an absolute barrier to hybridization between these species."
604	Self-compatible or apomictic	n
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"In general, <i>Plantago lanceolata</i> seems to be a strict outbreeder although other studies state that it is self-fertile. Genetic studies revealed that several sexual forms exist in <i>Plantago lanceolata</i> : bisexual plants with long anthers and viable pollen, bisexual plants with short anthers and pollen with poor viability and female plants with rudimentary stamens."
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Reproduction is via seed in this species. <i>P. lanceolata</i> is an obligate out-breeder and its flowers are self-incompatible (Sagar and Harper, 1964; Sharma et al., 1992; Sharma and Koul, 1995)."
605	Requires specialist pollinators	n
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"The flowers are wind-pollinated (Bassett 1973). Insects such as honey bees (<i>Apis mellifera</i>) collect pollen but do not effect pollination (Sagar and Harper 1964)."

Qsn #	Question	Answer
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"The species is considered mainly anemophilous (wind-pollinated) (Sagar and Harper, 1964), but there is evidence to suggest biotic pollination by syrphid flies (Stelleman, 1982) and bees (<i>Apis dorsata</i> and <i>Apis florea</i>) (Sharma et al., 1993). Gynodioecy is observed in <i>P. lanceolata</i> , i.e. populations contain both hermaphrodites and sterile males (Poot et al., 1997)."

606	Reproduction by vegetative fragmentation	
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Individual plants have been known to persist for at least 12 years. Old plants develop a thick rhizome producing new aerial shoots, which leads to clumping." ... " <i>Plantago lanceolata</i> can be multiplied by seeds or vegetatively."
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Vegetative reproduction - Sagar and Harper (1964) planted 3- to 4-cm long root fragments of <i>P. lanceolata</i> in boxes of soil and obtained regeneration from a September planting but not from November or February plantings. There are no reports of similar regeneration in the field. Watson (1975) propagated clonal material of <i>P. lanceolata</i> by removing the rosette at ground level and then excising and rooting the side shoots which appeared subsequently."

607	Minimum generative time (years)	1
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"In tropical climates, <i>Plantago lanceolata</i> may flower all year round, with a life cycle that may be accomplished in 6 weeks. In temperate regions, the plants overwinter below the ground in open areas, or as small rosettes if more cover is present."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Sagar and Harper (1964) suggested that the seed coat, which swells when wet and is adhesive, could serve as a dispersal mechanism. Young and Evans (1973) stated that the sticky seeds of <i>P. lanceolata</i> could be spread during mowing of damp lawns."
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"Seed production is highest in open, cultivated land, and least in mowed or grazed areas. The seeds are ripe 2–3 weeks after fertilization. They readily adhere to animals or people, which promotes dispersal." ... " <i>Plantago lanceolata</i> occurs in disturbed areas. It is a very common weed of cultivated areas and roadsides, as well as open woodland and grassland."

702	Propagules dispersed intentionally by people	y
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Qsn #	Question	Answer
	Source(s)	Notes
	Irwin Hunter & Co. 2014. Ceres Tonic plantain. http://irwinhunter.com.au/product/ceres-tonic-plantain/ . [Accessed 28 Oct 2014]	[Cultivar of <i>Plantago lanceolata</i> sold commercially for fodder] "Tonic plantain has been selected for its ability to produce high levels of dry matter production in a range of soil types where good grazing management and soil nutrition practices are adopted."
	Stewart, A. V. 1996. Plantain (<i>Plantago lanceolata</i>)-a potential pasture species. Proceedings of the New Zealand Grassland Association 58: 77-86	{Cultivars of <i>Plantago lanceolata</i> intentionally planted as a source of fodder} "The release of a second cultivar, Ceres Tonic, now provides good opportunity to research this species and utilize any benefits it can provide." ... "Tonic remains erect under a wide range of conditions while Lancelot has the plasticity to become prostrate under close grazing."

703	Propagules likely to disperse as a produce contaminant	y
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Because of the small size of its seeds, <i>P. lanceolata</i> may be introduced as a contaminant of agricultural produce."
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Clark and Fletcher (1906) reported that <i>P. lanceolata</i> was dispersed from the Atlantic to the Pacific as a contaminant of crop seeds, particularly clovers."

704	Propagules adapted to wind dispersal	n
	Source(s)	Notes
	DiTomaso, J. 2007. Weeds of California and Other Western States, Volume 2. UCANR Publications, Oakland, CA	"Reproduce by seed. Seeds become sticky with mucilage when moistened. Seeds fall near the parent plant and disperse to greater distances with water, soil movement, mud, as a seed contaminant, and on vehicle tires and landscape and agricultural equipment."

705	Propagules water dispersed	y
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"The seeds are ripe 2-3 weeks after fertilization. They readily adhere to animals or people, which promotes dispersal. They can also be transported by water.:"

706	Propagules bird dispersed	y
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Salisbury (1961) reported that viable seeds of <i>P. lanceolata</i> had been found in the droppings of cattle, pigeons and sparrows. Seeds that gave 56% germination before passing through a bird yielded 100% germination of retrieved seeds afterwards. Sagar and Harper (1964) reported viable seeds in the droppings of house sparrow, bullfinch and greenfinch."

Qsn #	Question	Answer
707	Propagules dispersed by other animals (externally)	y
	Source(s)	Notes
	Gurib-Fakim, A., 2006. <i>Plantago lanceolata</i> L. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. http://www.prota4u.org/search.asp . [Accessed 24 Oct 2014]	"The seeds are ripe 2–3 weeks after fertilization. They readily adhere to animals or people, which promotes dispersal."

Qsn #	Question	Answer
708	Propagules survive passage through the gut	y
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Sagar and Harper (1964) note that seeds retain over 50% viability after passing through cattle."

Qsn #	Question	Answer
801	Prolific seed production (>1000/m ²)	
	Source(s)	Notes
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	[Possibly in certain settings] "Seed production and dispersal Salisbury (1961) and Biicher (1943) noted that most plants in natural habitats in Europe produce very few seeds. In a dry grassland at London, Ontario, mean seed number per plant in late October was 127 (minimum 35, maximum 261) for a sample of 10 plants (2.6 spikes per plant), while beside a deciduous woodland path in the same area, there were 60 seeds/plant (minimum 29, maximum 89) and an average of 1.8 spikes per plant. In a rich arable field in the same area, individual plants growing without competition produced > 10 000 seeds on >30 spikes (Heagy and Cavers, unpublished). In London, Ontario the greatest seed production of naturally-occurring plants was recorded by Heagy and Cavers (unpublished) in a lawn that had been left unmown for 2 mo during a summer drought (20-40 spikes per plant with >2500 seeds)."

Qsn #	Question	Answer
802	Evidence that a persistent propagule bank is formed (>1 yr)	y
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Evidence suggests that there is little dormancy in this species, and virtually all seeds germinate within the first year (Roberts and Boddrell, 1984; Pons, 1992). However, germination rate seems to increase with storage over 6 months (Sousa et al., 1998). Unlike some close relatives, such as <i>P. major</i> , seed of this species does not require light for germination (Pons and Toorn, 1988; Blom, 1992) although the effect of light intensity on germination rate seems unclear (Roberts and Boddrell, 1984; Sousa et al., 1998). Optimum germination has been obtained at 21% soil moisture (Blom, 1992)."

Qsn #	Question	Answer
	Cavers, P. B., Basset, I. J. and Compton, C. W. 1980. The biology of Canadian weeds. 47. <i>Plantago lanceolata</i> L. Canadian Journal of Plant Science 60: 1269-1282	"Viability of seeds and germination - Grime (1979) found that most seeds of <i>P. lanceolata</i> germinated or died within the first year but there were always some viable seeds left at the time that a fresh crop was deposited on the soil. Goss (1924) reported that seeds buried at a depth of 105 cm for 3 yr had 62% viability compared to 33.5% for seeds buried at a 20-cm depth. After 16 yr, 1,570 survived at 105 cm deep but none at shallower depths. Wesson and Wareing (1969) suggested that the survival of seeds of <i>P. lanceolata</i> for several years in the soil occurred because they acquired an induced dormancy during deep burial which could only be broken by exposure to light. They found that the water content of the medium was important in dormancy induction. Lewis (1958) recorded 96% viability at a 12.5 cm depth in a mineral soil after 2 yr and 76% after 4 yr, but no seeds survived for even 1 yr in peat."

803	Well controlled by herbicides	y
	Source(s)	Notes
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Around young trees and shrubs: glyphosate applied twice a year controlled <i>P. lanceolata</i> over several years (Frank and Simon,1981). Alternate treatments of glyphosate and a mixture of diuron + paraquat were also satisfactory (McIntyre and Barbe, 1994). In arable crops: butralin + linuron was found to be particularly effective (Ferreiro, 1978) and mecoprop has been recommended to control field margin weeds (including <i>Plantago lanceolata</i> ; Birnie, 1984). In turf: 2,4-D used alone and bromoxynil and mecoprop together were effective (Wehner et al., 1981). Bingham et al. (1986) reported that <i>P. lanceolata</i> was controlled better with a mecoprop than a dichlorprop mixture."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Effective herbicides are 2,4-D, MCPA dicamba, or fenoprop"

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	Western Australian Herbarium. 2014. FloraBase - The Western Australian Flora - <i>Plantago lanceolata</i> . https://florabase.dpaw.wa.gov.au/browse/profile/7303 . [Accessed 28 Oct 2014]	"Fire response. Resprouts after fire."
	CABI. 2014. <i>Plantago lanceolata</i> in: Invasive Species Compendium, http://www.cabi.org/isc . [Accessed 24 Oct 2014]	"Tolerates, or benefits from, cultivation, browsing pressure, mutilation, fire etc"

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes

Qsn #	Question	Answer
	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, but widely distributed in the Hawaiian islands] "in Hawaii naturalized and sometimes locally common in beach parks, coastal sites, open pastures and sometimes in open sites in mesic forest and subalpine shrubland, 0-3,110 m, on Midway Atoll, French Frigate Shoals, and documented from all of the main islands except Niihau and Kahoolawe."

Summary of Risk Traits:

High Risk / Undesirable Traits

- Broad distribution, climate tolerance, & elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in temperate and tropical climates
- Widely naturalized
- Weed of disturbed sites, agriculture and the natural environment
- Other *Plantago* species are invasive
- Host for recognized pests and pathogens
- Prolific pollen causes hay fever
- Shade tolerant
- Tolerates many soil types
- Can form dense stands
- Produces seeds which are dispersed by adhering to people, animals and equipment
- Seeds also dispersed by water & internally by birds and other animals
- Able to reach maturity in 1 year
- Can form a persistence seed bank
- Can tolerate browsing and resprouts after fire

Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Provides fodder for livestock
- Mostly self-incompatible
- Not able to hybridize with other *Plantago* species
- Herbicides provide effective control