Taxon: Ageratum conyzoides L. **Family:** Asteraceae

Common Name(s): billygoat-plant
billygoat-weed
blue top
bluebonnet
goatweed
tropical whiteweed
whiteweed

Synonym(s): A. sandwicenseH. Lev.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 18 Mar 2016

WRA Score: 26.0 **Designation:** H(Hawai'i) **Rating:** High Risk

Keywords: Annual, Crop Weed, Allelopathic, Toxic Properties, Wind-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)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
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	y=1, n=0	y
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	y
405	Toxic to animals	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
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
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		
604	Self-compatible or apomictic	y=1, n=-1	y
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	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	n
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
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	y
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	n
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	n
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**
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence of domestication] "The species is native to tropical Central and South America and is now found naturalized pantropically in disturbed areas as weeds. It is common in the warm tropics throughout Africa, Asia and the South Pacific Islands."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2016. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2016. 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**
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"The species is native to tropical Central and South America and is now found naturalized pantropically in disturbed areas as weeds."

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"A. conyzoides grows in a wide range of arable crops including, to some extent, grasslands in many tropical and subtropical countries. It sometimes extends into the temperate zone." ... "The extreme adaptability of A. conyzoides has made it a very successful colonizer in many regions of the world, and it colonizes rapidly in disturbed or cultivated areas."
	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 a widespread and often common weed, from sea level to at least 1,300 m, on all of the main islands."
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It occurs in the warm tropics from sea level to 2,000 m in wet and dry disturbed areas."

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**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 Hawai'i a widespread and often common weed, from sea level to at least 1,300 m, on all of the main islands. Naturalized prior to 1871 (Hillebrand, 1888)"
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"The species is native to tropical Central and South America and is now found naturalized pantropically in disturbed areas as weeds. It is common in the warm tropics throughout Africa, Asia and the South Pacific Islands."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It is common in the warm tropics throughout Africa, Asia and the South Pacific Islands."

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 Hawai'i a widespread and often common weed, from sea level to at least 1,300 m, on all of the main islands. Naturalized prior to 1871 (Hillebrand, 1888)"

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 16 Mar 2016]	"Naturalized: Africa East Tropical Africa: Kenya; Tanzania; Uganda Macaronesia: Portugal - Madeira Islands Northeast Tropical Africa: Ethiopia Northern Africa: Egypt Southern Africa: Botswana; South Africa; Swaziland West Tropical Africa: Cote D'Ivoire; Gambia; Ghana; Guinea; Guinea-Bissau; Liberia; Nigeria; Senegal; Sierra Leone West-Central Tropical Africa: Cameroon; Congo; Gabon Western Indian Ocean: Madagascar; Mauritius Asia-Temperate Arabian Peninsula: Yemen China: China Eastern Asia: Japan Asia-Tropical Indian Subcontinent: India Indo-China: Indochina; Myanmar; Thailand; Vietnam Malesia: Indonesia; New Guinea; Philippines Australasia Australia: Australia Northern America : Mexico North-Central U.S.A.: United States - Missouri Northeastern U.S.A.: United States - Connecticut Southeastern U.S.A.: United States - Alabama, - Florida, - Georgia, - Kentucky, - Maryland, - Mississippi, - North Carolina Southwestern U.S.A.: United States - California Pacific North-Central Pacific: United States - Hawaii Northwestern Pacific: Guam; Micronesia; Northern Mariana Islands; Palau South-Central Pacific: French Polynesia Southwestern Pacific: Fiji; New Caledonia; Niue; Tonga Southern America Northern South America: French Guiana; Guyana; Suriname"

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It is usually found in waste places, gardens, old cultivations, grasslands, low secondary growth forests, forest edges, roadsides, water courses, etc., where there is ample exposure to sunlight (Dung et al. 1996)."

303	Agricultural/forestry/horticultural weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"Ageratum conyzoides (Asteraceae, Billy goat weed) has invaded agricultural fields. It interferes with crops and causes yield reductions of major staple crops of India." ... "Ageratum has significant negative impacts. In arable and cultivated lands, it reduces the yields of wheat, corn and rice and other important crops. The precise figures regarding the percent loss of yield are not known, yet it depends upon the intensity of infestation of weed. Roder et al. (1998) have reported that yield of rice is negatively associated with the density of Ageratum. Farmers in the lower Shivalik ranges of the Himalayas had even abandoned their fields because Ageratum had ruined their croplands."
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"Ageratum conyzoides is an important weed in all crops in the tropics and subtropics apart from those under deep shade. It is often one of the first species to colonise degraded areas and so able to prevent other plants from establishing. It is also an alternative host of some economically important crop pathogens and nematodes."
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It also occurs as a major to intermediate weed in rice fields, orchards, plantations, pastures and cultivated vegetable and cropping areas."

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

Qsn #	Question	Answer
	Queensland Government. 2011. Weeds of Australia - Ageratum conyzoides. http://keyserver.lucidcentral.org/weeds/data/080c0106-040c-4508-8300-0b0a06060e01/media/html/Ageratum_conyzoides.htm. [Accessed 18 Mar 2016]	"Billygoat weed (Ageratum conyzoides) is regarded as an environmental weed in eastern Queensland. This species is a common weed of disturbed sites, waste areas, roadsides, gardens, pastures and crops (particularly plantation crops such as sugar cane) in warmer areas. It is mainly regarded as a pest of agriculture and habitation, but it also invades natural areas. In northern Queensland it is a weed of rainforests and associated ecosystems, and is found in forests gaps and disturbed areas. For example, it is a common weed of powerline corridors in the Wet Tropics World Heritage Area and is also known to invade revegetation sites in this region. Billygoat weed (Ageratum conyzoides) is listed as a low priority pest plant of regional significance in the Mackay-Whitsunday region in central Queensland and has been recorded in conservation areas near Mackay (i.e. Mount Jukes National Park and Mount Blackwood National Park). This species is also a common weed of riparian areas in south eastern Queensland and has also been recorded in conservation areas in this region (e.g. in Brisbane Forest Park). In the Northern Territory, billygoat weed (Ageratum conyzoides) is currently found in the East Alligator River and Finnis River catchments. It is also a minor weed in aboriginal lands in the Northern Land Council area, which is considered to pose a low level of threat to natural areas. In Fiji, this species is abundantly naturalised in clearings, cultivated areas, grasslands and forests (often along trails and roads). During a recent study, billygoat weed (Ageratum conyzoides) was found to be one of the most common invasive plant species in Himachal Pradesh province in north-western India, and was one of three species that has displaced native flora and reduced their abundance to such an extent that they were threatening the integrity of native ecosystems. In sites invaded by billygoat weed (Ageratum conyzoides), the species diversity of was reduced by 30%. This weed is also thought to be among the most invasive species in southern Africa, and is regarded as a threat to the biodiversity of this region. Here it is noted to invade riverbeds, riverbanks, forest margins, plantations, grassland, wetlands, and croplands and often forms dense stands that exclude other species."
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"Its competitive ability impacts upon native biodiversity and it is also poisonous."

305	Congeneric weed	y
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"A. houstonianum is reported as a weed of tea, cinchona, and coffee plantations in Indonesia. It is one of the most serious weeds of sugarcane in Australia because in dense stands it prevents a good cane fire, causes difficulty and increased costs in both manual and mechanical harvest, and hinders surface drainage in the wet season (Young 1962)."

401	Produces spines, thorns or burrs	n

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.	[No evidence] "Malodorous annual or short-lived perennial herbs 3-15 dm tall; stems sparingly branched, sparsely to densely pilose. Leaves ovate to broadly ovate, 3-10 cm long, 3-7 cm wide, lower surface conspicuously dotted with glands, margins crenate, base cuneate to truncate, petioles 1-5 cm long."

402	Allelopathic	y
	Source(s)	**Notes**
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"Recently, Ageratum has also been reported to affect the crops and other native species by releasing a number of phenolic acids and volatile oils from its leaves and flowers (Kong et al. 2002; Singh et al. 2003). Under environmental stress, these weeds release greater amounts and types of secondary metabolites that provide them extra selective advantage over the natives, enabling them to colonise quickly at the cost of natives."
	Kong, C., Hu, F., & Xu, X. (2002). Allelopathic potential and chemical constituents of volatiles from Ageratum conyzoides under stress. Journal of Chemical Ecology, 28 (6), 1173-1182	"The allelopathic potential of Ageratum conyzoides was investigated under different environmental stress conditions, including nutrient deficiency, physical damage, 2,4-D treatment, competition with Bidens pilosa, infection with Erysiphe cichoracearum, and feeding by Aphiids gossypii. The inhibitory effects of A. conyzoides volatiles on peanut (Arachis hypogaea), redroot amaranth (Amaranthus retroflexus), cucumber (Cucumis sativus), and ryegrass (Lolium multiforum) increased when plants were grown under nutrient-deficient conditions or in competition with B. pilosa; however, there was no difference with physical damage or 2,4-D treatment. Phytoinhibitory effects decreased under fungal infection and aphid feeding. Volatiles from A. conyzoides plants infected with E. cichoracearum or exposed to A. gossypii feeding inhibited or killed fungi and insects. Precocenes and their derivatives, monoterpenes, and sesquiterpenes were the major volatile components of A. conyzoides."

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.	"Malodorous annual or short-lived perennial herbs 3-15 dm tall; stems sparingly branched, sparsely to densely pilose." [Asteraceae. No evidence]

404	Unpalatable to grazing animals	y
	Source(s)	**Notes**
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Attributes for successful invasion of A. conyzoides include: ... unpalatable due to high phytotoxin content"

Qsn #	Question	Answer
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	[Competes with fodder plants. Suggests lack of palatability] "The third weed, Ageratum conyzoides (Asteraceae, Billy goat weed) has invaded agricultural fields. It interferes with crops and causes yield reductions of major staple crops of India. When it invades rangeland areas, it out competes native grasses causing scarcity of fodder."

405	Toxic to animals	y
	Source(s)	**Notes**
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Not only does A. conyzoides affect farmers and scientists, but it also has adverse effects on human and animal health. People in contact with this weed suffer from nausea, giddiness, irritation and asthma (Kohli and Batish, 1996; Negi and Hajra, 2007). Livestock do not feed on it as it causes ulceration and toxicity."

406	Host for recognized pests and pathogens	y
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"A. conyzoides is an alternate host of Cassytha filiformis L. (Raabe 1965), Cercospora agerati Steven, and Puccinia conoclinii Sey. (Stevens 1925); of the nematodes Meloidogyne sp., Pratylenchus pratensis (de Man) Filip (Raabe, unpublished, see footnote, Cyperus rotundus, "agricultural importance"), Rotylenchulus reniformis Linford & Oliveira (Linford and Yap 1940), Aphelenchoides fragariae (Ritz.-Bos) Christie (Sher 1954), Meloidogyne incognita (Kofoid & White) Chitwood, M. javanica Treub, M. arenaria Chitwood, and M. arenaria thamesis Chitwood (Valdez 1968); and of the viruses which produce spotted wilt (Sakimura 1937), anemone mosaic, and tobacco leaf curl..."

407	Causes allergies or is otherwise toxic to humans	y
	Source(s)	**Notes**
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"Its strong and pungent smell causes giddiness and nausea as well as allergic reactions in humans."
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Not only does A. conyzoides affect farmers and scientists, but it also has adverse effects on human and animal health. People in contact with this weed suffer from nausea, giddiness, irritation and asthma (Kohli and Batish, 1996; Negi and Hajra, 2007)."

Qsn #	Question	Answer
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"The fragrant flowers and foliage are used for scenting edible coconut oil in the southeastern Polynesia (Brown 1935 ; Facciola 1990). The leaves are eaten in a soup called 'olulu-ogwai' by the Igbo communities in Nigeria (CINE 2007)." ... "The plant has been reported to contain pyrrolizidine alkaloids (Trigo et al. 1988 ; Röder et al. 1990 ; Wiedenfeld and Röder 1991) which have been linked to liver and lung cancers and a range of other deleterious effects (Couet et al. 1996). Preliminary study found that rats that consumed a diet of 50 % A. conyzoides leaves for 2 weeks or 25 % A. conyzoides for 4 weeks appeared to lose weight compared to control rats that were fed with normal cubed diet for rodents (Sani and Stoltz 1993)." ... "However, results of recent animal studies suggested that ingestion of Ageratum conyzoides leaf extract daily for 21 days may not be hepatotoxic at the doses (200 mg/kg body weight, 400 mg/kg body weight and 600 mg/kg body weight of the extract) investigated (Antai et al. 2009). Treatment of rats with the respective doses of the extract did not signifi cantly alter the serum and liver levels of total protein, ALT, AST and ALP in all test groups. Results of acute anc sub- chronic (28-day) oral toxicity studies suggested the hydroalcoholic extract of A. conyzoides to be relatively safe when administered orally in rats (Diallo et al. 2010)."

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	CABI, 2016. Ageratum conyzoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	[No evidence] "A. conyzoides grows on wasteland, roadsides, degraded pasture and rapidly colonizes cultivated areas on both light and heavy soils. Although preferring a moist habitat, it also grows in dry areas. It can be found in wide-spaced annual row crops and permanent tree crops."
	Kodandapani, N. (2013). Contrasting fire regimes in a seasonally dry tropical forest and a savanna ecosystem in the Western Ghats, India. Fire Ecology, 9(2), 102-115	[No evidence] "Exotic species such as Lantana camara, Eupatorium odoratum L., Ageratum conyzoides L., and Parthenium hysterophorus L. also occur in the landscape. This vegetation is restricted to the high rainfall regions of the landscape (generally above 1800 mm yr-1)."
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	No evidence

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Ageratum conyzoides is a shade-tolerant plant and flourishes well in any type of garden soil such as clayey, sandy or loamy with wide range of pH."
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It thrives best in rich, moist, mineral soils in areas with high air humidity and tolerates shade."

Qsn #	Question	Answer
	CABI, 2016. Ageratum conyzoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"It thrives best in rich, moist, mineral soils with high air humidities, and tolerates shade."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Ageratum conyzoides is a shade-tolerant plant and flourishes well in any type of garden soil such as clayey, sandy or loamy with wide range of pH. Soils rich in moisture, minerals and air are best suited to its growth."
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"Ageratum is highly adaptable and can grow in a variety of habitats. It prefers sandy soil with sufficient moisture in the cultivated fields, grasslands and disturbed sites."
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It thrives best in rich, moist, mineral soils in areas with high air humidity and tolerates shade."

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.	"Malodorous annual or short-lived perennial herbs 3-15 dm tall; stems sparingly branched, sparsely to densely pilose."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"...either of he two species can form thick carpets of plants which compete with crops for nutrients and moisture. When a stand of these weeds is destroyed, another quickly takes its place."
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Ageratum conyzoides is a serious problem of cultivated lands in the hilly tracts of northwestern India (Bansal, 1988), where it forms dense thickets in commonly grown crops such as chickpea, rice, maize and wheat, and adversely affects crop yields"

501	Aquatic	n
	Source(s)	**Notes**
	Lim, T.K. 2013. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Terrestrial herb] "It occurs in the warm tropics from sea level to 2,000 m in wet and dry disturbed areas. It is usually found in waste places, gardens, old cultivations, grasslands, low secondary growth forests, forest edges, roadsides, water courses, etc., where there is ample exposure to sunlight (Dung et al. 1996)."

502	Grass	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 16 Mar 2016]	"Family: Asteraceae (alt.Compositae)"

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.	"Malodorous annual or short lived perennial herbs 3-15 dm tall; stems sparingly branched, sparsely to densely pilose." [Asteraceae. No evidence]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"As a shallow rooter it is easy to remove by hand at low densities."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	[No evidence] "Ageratum conyzoides, an annual, is a native of tropical America. Its range as a weed extends from lat 30° N to 30° S." ... "It has escaped from the New World, where it is usually an ornamental, to become one of the most common weeds in the warm regions of the world."

602	Produces viable seed	y
	Source(s)	**Notes**
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"It produces a large number (8000–10000/plant) of fruits (achene) that have a pappus."
	Haselwood, E.L., Motter, G.G., & Hirano, R.T. (eds.). 1983. Handbook of Hawaiian Weeds. University of Hawaii Press, Honolulu, HI	"Propagation: By seed. One flower head produces many seeds which are di spersed by wind and water."

603	Hybridizes naturally	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Johnson, M. F. (1971). A monograph of the genus Ageratum L.(Compositae-Eupatorieae). Annals of the Missouri Botanical Garden, 58(1): 6-88	[Unknown] "Data concerning hybridization in the field, degrees of crossability, pollinators, and biological species limits are lacking. It is anticipated that these studies will be carried out later."
	WRA Specialist. 2016. Personal Communication	Unknown

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"A. conyzoides appears to have no photoperiodic requirement. It will flower at low or high night temperatures, produces an economical amount of pollen in its small seedheads, and is self-pollinated."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Ngongolo, K., Mtoka, S., Mahulu, A., & Mafuwe, K. (2014). Floral visitors of the Ageratum conyzoides in Amani Nature Reserve, Tanzania. International Journal of Development and Sustainability, 3(5), 1060-1065	"A total of 182 visitors were observed during the study. The member of family Hymenoptera (96.296%) visited frequently than other groups. Fewer visitations to the flowers were observed by Syriphid sp (0.529%). The 92.593% of the floral visitors to the flowers were observed to probe. Other species observed visiting the flower of Ac were Cercesis sp, Chrysoma sp, Componotus sp, Hesperida sp and Apis mellifera."
	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.	"Heads usually in flat-topped cymes; involucra! bracts 3-4 mm long, glabrous to sparsely hirsute; corollas bluish lavender, rarely whitish; pappus of 5 well-developed awn-tipped scales, rarely reduced or not awn-tipped."
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"self pollinated."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Attributes for successful invasion of A. conyzoides include: ... high reproductive potential (both sexual and vegetative)"
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"It also spreads fast vegetatively through stolons."

607	Minimum generative time (years)	1
	Source(s)	**Notes**

Qsn #	Question	Answer
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"It can complete its lifecycle (germination to flowering) in less than two months."
	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.	[Annual] "Malodorous annual or short-lived perennial herbs 3-15 dm tall"

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"This species reproduces mainly by seed which are dispersed on the hairs of livestock and wild animals, clothes and agricultural machinery."

702	**Propagules dispersed intentionally by people**	**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 current evidence] "in Hawai'i a widespread and often common weed, from sea level to at least 1,300 m, on all of the main islands. Naturalized prior to 1871"

703	**Propagules likely to disperse as a produce contaminant**	**y**
	Source(s)	**Notes**
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"Ageratum conyzoides was originally introduced as a garden plant (and probably as a contaminant with other garden plant seeds) is widely utilised in traditional medicine systems wherever it grows (Okunade 2002)."
	USDA, ARS, Germplasm Resources Information Network, 2016. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 18 Mar 2016]	"Weed: potential seed contaminant"

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"It produces a large number (8000–10000/plant) of fruits (achene) that have a pappus. These are easily disseminated by air, water and animals."

705	**Propagules water dispersed**	**y**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"It produces a large number (8000–10000/plant) of fruits (achene) that have a pappus. These are easily disseminated by air, water and animals."

706	Propagules bird dispersed	n
	Source(s)	**Notes**
	CABI, 2016. Ageratum conyzoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Seeds are dispersed by wind and water (Baker, 1965)."

707	Propagules dispersed by other animals (externally)	y
	Source(s)	**Notes**
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"It produces a large number (8000–10000/plant) of fruits (achene) that have a pappus. These are easily disseminated by air, water and animals."
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"This species reproduces mainly by seed which are dispersed on the hairs of livestock and wild animals, clothes and agricultural machinery."

708	Propagules survive passage through the gut	n
	Source(s)	**Notes**
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	[Wind & externally dispersed. Unpalatable, so seeds unlikely to be consumed & dispersed internally] "The flowering period of the weed is long, and flowers retain their violet colour for a longer period of time. The fruit is a typical achene with pappus and easily spread by wind and animal hair." ... "unpalatable due to high phytotoxin content;"

801	Prolific seed production (>1000/m2)	y
	Source(s)	**Notes**
	Holm, L.G., Plucknett, D.L., Pancho, J.V. & Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. The University Press of Hawaii, Honolulu	"It may produce 40,000 seeds per plant and in some areas one-half of the seeds will germinate shortly after they are shed."
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"It produces a large number (8000–10000/plant) of fruits (achene) that have a pappus. These are easily disseminated by air, water and animals."

Qsn #	Question	Answer
802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**n**
	Source(s)	**Notes**
	CABI, 2016. Ageratum conyzoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"A. conyzoides does not possess any marked dormancy (Sauerborn, 1985) but requires light for germination (Sauerborn et al., 1988) and is therefore unable to germinate when buried below the soil surface."
	Kohli, R. K., Batish, D. R., Singh, H. P., & Dogra, K. S. (2006). Status, invasiveness and environmental threats of three tropical American invasive weeds (Parthenium hysterophorus L., Ageratum conyzoides L., Lantana camara L.) in India. Biological Invasions, 8(7), 1501-1510	"The seeds are photoblastic and remain viable for one year."

803	**Well controlled by herbicides**	**y**
	Source(s)	**Notes**
	CABI, 2016. Ageratum conyzoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"Chemical Control: A wide range of herbicides have been used to control the weed selectively in major crops. Bentazone, butachlor, 2,4-D, MCPA and oxidiazon are effective treatments in rice (Ampong Nyarko and de Datta, 1991); nicosulphuron is used in maize (Ferreira et al., 1996); cyanazine, metolachlor, metribuzin and cinmethylin are used in soyabean (de Souza, 1988), acetochlor gives good control in maize (Silva et al., 1986); and atrazine and simazine are used in peaches (Gautam and Chauhan, 1984). Metribuzin provides residual control in tea (Satyanarayana et al., 1981) and terbutryne with ametryne are selective in sugarcane (Reddi et al., 1977). Imazethapyr provides effective control in soyabean (Angiras and Rana, 1995)."
	Kaur, S., Batishz, D. R., Kohli, R. K., & Singh, H. P. (2011). Ageratum conyzoides: an Alien Invasive Weed. Pp. 57-76 in J.R. Bhatt et al.(eds.). India. Invasive Alien Plants An Ecological Appraisal for the Indian Subcontinent, CAB International, Wallingford, UK	"Pre-emergence application of commercial herbicides such as atrazine, diuron, methazole, metribuzin or simazine is an effective control strategy. For established infestations, the application of 2,4-D and 2,4,5-T provides excellent control of this weed (Rao, 2000). However, due to toxicological implications, synthetic herbicides are not recommended as a good method of controlling A. conyzoides."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**n**
	Source(s)	**Notes**
	CABI, 2016. Ageratum conyzoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc	"A. conyzoides is shallow-rooted and relatively easy to control using mechanical means. As it is a prolific seeder, it is important to destroy plants before they flower."
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"As a common agricultural weed, it is managed in small and large cropping situation by tillage and can contribute to soil fertility as a mulch."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	

Qsn #	Question	Answer
	Source(s)	**Notes**
	BioNET-EAFRINE. 2011. Ageratum conyzoides (Billygoat Weed). http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Ageratum_conyzoides_%28Billygoat_Weed%29.htm. [Accessed 17 Mar 2016]	"The editors know of no biological control agents available for the control of Ageratum conyzoides."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability & elevation range exceeds 1000 m, demonstrating environmental versatility
• Thrives in tropical climates
• Widely naturalized, including all main Hawaiian Islands
• Disturbance-adapted weed of crops
• Environmental weed
• Other Ageratum species are invasive
• Allelopathic
• Unpalatable & toxic to animals
• Toxic & allergenic to people
• Alternate host of crop pests & pathogens
• Tolerates shade
• Tolerates many soil types
• Forms dense stands in crop lands
• Reproduces by seeds & vegetatively
• Self-compatible
• Reaches maturity rapidly (as early as 2 months from seed)
• Seeds dispersed by wind, water, & attached to on the hairs of livestock and wild animals, clothes and agricultural machinery
• Prolific seed production

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Used medicinally
• Seeds are non-dormant & might not form a long-lived seed bank
• Controlled effectively by mechanical & chemical means