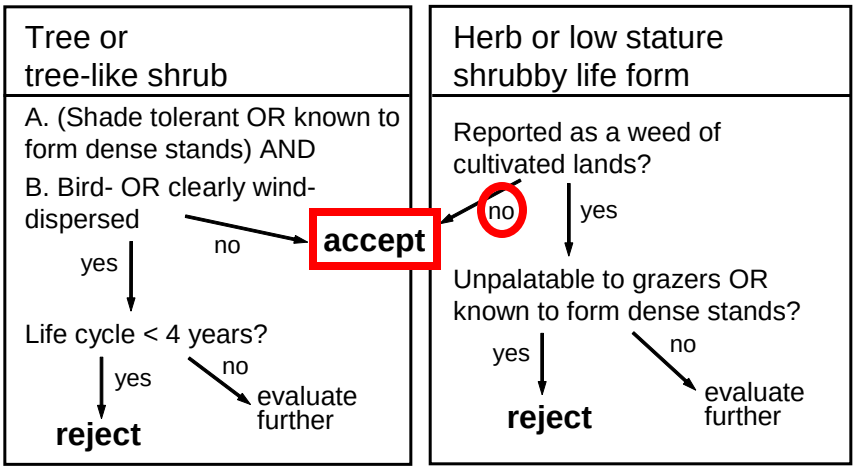
Salvia hispanica (Chia)		**Answer**	**Score**
1.01	Is the species highly domesticated?	y	-3
1.02	Has the species become naturalised where grown?	?	
1.03	Does the species have weedy races?		
2.01	Species suited to FL climates (USDA hardiness zones; 0-low, 1-intermediate, 2-high)	2	
2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	
2.03	Broad climate suitability (environmental versatility)	y	1
2.04	Native or naturalized in regions with an average of 11-60 inches of annual precipitation	y	1
2.05	Does the species have a history of repeated introductions outside its natural range?	y	
3.01	Naturalized beyond native range	y	2
3.02	Garden/amenity/disturbance weed	?	
3.03	Weed of agriculture	n	0
3.04	Environmental weed	n	0
3.05	Congeneric weed	y	2
4.01	Produces spines, thorns or burrs	n	0
4.02	Allelopathic	?	
4.03	Parasitic	n	0
4.04	Unpalatable to grazing animals		
4.05	Toxic to animals	n	0
4.06	Host for recognised pests and pathogens	n	0
4.07	Causes allergies or is otherwise toxic to humans	n	0
4.08	Creates a fire hazard in natural ecosystems		
4.09	Is a shade tolerant plant at some stage of its life cycle	n	0
4.10	Grows on infertile soils (oligotrophic, limerock, or excessively draining soils). North & Central Zones: infertile soils; South Zone: shallow limerock or Histisols.	?	
4.11	Climbing or smothering growth habit	n	0
4.12	Forms dense thickets	n	0
5.01	Aquatic	n	0
5.02	Grass	n	0
5.03	Nitrogen fixing woody plant	n	0
5.04	Geophyte	n	0
6.01	Evidence of substantial reproductive failure in native habitat	?	
6.02	Produces viable seed	y	1
6.03	Hybridizes naturally	?	
6.04	Self-compatible or apomictic	y	1
6.05	Requires specialist pollinators	n	0
6.06	Reproduction by vegetative propagation		
6.07	Minimum generative time (years)	1	1

Completed: September 2013

7.01	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
7.02	Propagules dispersed intentionally by people	y	1
7.03	Propagules likely to disperse as a produce contaminant		
7.04	Propagules adapted to wind dispersal	n	-1
7.05	Propagules water dispersed		
7.06	Propagules bird dispersed	?	
7.07	Propagules dispersed by other animals (externally)	n	-1
7.08	Propagules dispersed by other animals (internally)	?	
8.01	Prolific seed production	y	1
8.02	Evidence that a persistent propagule bank is formed (>1 yr)	y	1
8.03	Well controlled by herbicides	y	-1
8.04	Tolerates, or benefits from, mutilation or cultivation		
8.05	Effective natural enemies present in U.S.		
	Total Score	**6**	
	Implemented Pacific Second Screening	**Yes**	
	Risk Assessment Results	**Low risk**	

Pacific second screening: decision rules for species with WRA scores between 1 and 6

(from Daehler *et al*. 2004)



Vines must pass both tests

Completed: September 2013

	Reference	Source data
1.01	1.a-b. Jamboonsri, W. et al. 2012. Extending the range of an ancient crop, *Salvia hispanica* L.—a new x3 source. *Genetic Resources and Crop Evolution* , 59(2): 171-178.	1.a. Although not specifically domesticated to prevent weediness, there is evidence of selection for nonshattering; calyxes remain closed at seed maturity effectively eliminating natural dispersal and confining domesticated varieties to human cultivation (Cahill 2005). 1.b. Early Mesoamerican breeders produced lines with well developed agronomic characteristics including good, uniform seed yield and retention. Seed retention in particular is disadvantageous for survival in the wild.
1.02	1.a-b. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1.a. Of the 42 species of *Salvia* found in Colombia three are relatively recent introductions which occur as escapes from cultivation in a few isolated localities (*S. hispanica* from Mexico). 1.b. Found as an introduced weed in Colombia and Ecuador.
1.03		
2.01	1. PERAL NAPPFAST Global Plant Hardiness (http://www.nappfast.org/Plant_hardiness/NAPPFAST%20Global%20zones/10-year%20climate/PLANT_HARDINESS_10YR%20lgnd.tif) & USDA Plant Hardiness Zone Map, 2012. Agricultural Research Service, U.S. Department of Agriculture. Accessed from http://planthardiness.ars.usda.gov. 2. USDA/ARS-GRIN [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxgenform.pl?language=en (18 Sept 2013). 3. Jamboonsri, W. et al. 2012. Extending the range of an ancient crop, *Salvia hispanica* L.—a new x3 source. *Genetic Resources and Crop Evolution* , 59(2): 171-178.	**No computer analysis was performed**. 1. Global plant hardiness zones (8-?)9-12 (-13?); equivalent to USDA Hardiness zones 8a-11b (north, central, & south zones of Florida). 2. Native to Mesoamerica, specifically Guatamala and Mexico. 3. Pre-Columbian cultivation in southern Honduras and Nicaragua.
2.02		**No computer analysis was performed**. 1. Native range is well known; refer to 2.01 source data.
2.03	1. Köppen-Geiger climate map (http://www.hydrol-earth-syst-sci.net/11/1633/2007/hess-11-1633-2007.pdf).	1. Native distribution appears to be in more than three climatic groups (Af, Am, Aw, BSk, Cwa, Cwb), possibly other climatic groups (BSh, Cfa, Cfb).
2.04	1. The World Bank. http://data.worldbank.org/indicator/AG.LND.PRCP.MM. Accessed 06 Sept 2013.	1. 700 mm-3000 mm (29.5"-118").

2.05	1. Accessed through GBIF data. www.portal data.gbif.org/welcome.htm. Accessed: 18 Sept 2013 (specific references upon request). 2. Jamboonsri, W. et al. 2012. Extending the range of an ancient crop, *Salvia hispanica* L.—a new x3 source. *Genetic Resources and Crop Evolution* , 59(2): 171-178. 3. Perkins, K. 2004. University of Florida Herbarium Collections Catalog. (http://www.flmnh.ufl.edu/natsci/herbarium/cat/). Accessed 18 September 2013. 4. Robert K. Godfrey Herbarium, Florida State University. http://herbarium.bio.fsu.edu/. Accessed 18 September 2013. 5. USDA, NRCS. 2013. The PLANTS Database (http://plants.usda.gov, 22 September 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.	1. Herbarium specimens from Austria, Canada, Colombia, Costa Rica, Ecuador, El Salvador, France, Germany, Hungary, Italy, Spain, United States. 2. Reportedly cultivated in Southeast Asia. 3. Recorded from Alachua County, Gainesville, Florida in 1938 as a weed in a yard. 4. Recorded from Leon County, Florida, 2011, in Elinor Klapp-Phipps Park in sandy loam amongst *Bidens alba* at water stalls on S side of Florida Field and in sandy loam of disturbed sites on grassy meadow. 5. Introduced to Florida, New York, Texas.
3.01	1.a-b. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1.a. Of the 42 species of *Salvia* found in Colombia three are relatively recent introductions which occur as escapes from cultivation in a few isolated localities (*S. hispanica* from Mexico). 1.b. Found as an introduced weed in Colombia and Ecuador.
3.02	1. Perkins, K. 2004. University of Florida Herbarium Collections Catalog. (http://www.flmnh.ufl.edu/natsci/herbarium/cat/). Accessed 18 September 2013. 2. Robert K. Godfrey Herbarium, Florida State University. http://herbarium.bio.fsu.edu/. Accessed 18 September 2013. 3. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	Unknown because there is no evidence that the species has negative impacts or is subject to control. 1. Recorded from Alachua County, Gainesville, Florida in 1938 as a weed in a yard. 2. Recorded from Leon County, Florida, 2011, in Elinor Klapp-Phipps Park in sandy loam amongst *Bidens alba* at water stalls on S side of Florida Field and in sandy loam of disturbed sites on grassy meadow. 3. Found as an introduced weed in Colombia and Ecuador.
3.03		No evidence
3.04		No evidence
3.05	1. Center for Invasive Plant Management. Invasive plant information - western states and provinces weed lists. http://www.weedcenter.org/inv_plant_info/worst-M-Z.html#mediterranean. Accessed 25 September 2013.	1. *Salvia aethiopis* is classified as a noxious weed in several states in the United States.
4.01		No evidence for these morphological features.

4.02	1. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. Preliminary experiments with aqueous root leachates of the morphologically advanced domesticates of *Salvia hispanica* applied to *Echinochloa* and *Amaranthus* seeds show statistically significant inhibition of germination of *Echinochloa* seeds, but not for wild or any of the other domesticated varieties tested (see Table 3). Further experimentation is needed, both in isolating chemical compounds involved and identifying common weeds associated with *Salvia hispanica* monocrop systems in Mexico.
4.03	1. USDA, NRCS. 2013. The PLANTS Database (http://plants.usda.gov, 22 September 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.	1. *Lamiaceae* family is not known as a parasitic taxon.
4.04		
4.05	1. Wilson, RF, and DF Hildebrand. *Engineering Status, Challenges and Advantages of Oil Crops Advances in Genetically Modified Oil Trait Technology in New or Underdeveloped Oilseed Crops* , Ch. 8. In: *Biotechmology in Agriculture and Forestry: Plant Biotechnology for Sustainable Production of Energy and Coproducts* Vol. 66. Eds. PN Mascia, J Scheffran, JM Widholm. Heidelberg: Springer, 2010. E-book.	1. Chia and chia oil is used as animal feed.
4.06		No evidence.
4.07	1. Wilson, RF, and DF Hildebrand. *Engineering Status, Challenges and Advantages of Oil Crops Advances in Genetically Modified Oil Trait Technology in New or Underdeveloped Oilseed Crops* , Ch. 8. In: *Biotechmology in Agriculture and Forestry: Plant Biotechnology for Sustainable Production of Energy and Coproducts* Vol. 66. Eds. PN Mascia, J Scheffran, JM Widholm. Heidelberg: Springer, 2010. E-book. 2. Jamboonsri, W. et al. 2012. Extending the range of an ancient crop, *Salvia hispanica* L.—a new x3 source. G*enetic Resources and Crop Evolution* , 59(2): 171-178.	1. Chia and chia oil is used as human food and as an ingredient in cosmetics. 2. Was widely used in pre-Columbian for food, medicine and oil.
4.08		
4.09	1. Plants for a Future. http://www.pfaf.org/user/Plant.aspx?LatinName=Salvia+hispanica. Accessed 26 September 2013.	1. *Salvia hispanica* cannot grow in the shade.

4.10	1. Wilson, RF, and DF Hildebrand. *Engineering Status, Challenges and Advantages of Oil Crops Advances in Genetically Modified Oil Trait Technology in New or Underdeveloped Oilseed Crops* , Ch. 8. In: *Biotechmology in Agriculture and Forestry: Plant Biotechnology for Sustainable Production of Energy and Coproducts* Vol. 66. Eds. PN Mascia, J Scheffran, JM Widholm. Heidelberg: Springer, 2010. E-book.	1. Chia seeds require wet soil to germinate, but once the seedlings are established, chia grows well with limited water. Chia grows well on soils containing widely varying levels of nutrients.
4.11	1. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1. Annual herb 20-40(-100) cm (= 7.9"-15.7" [-39"]).
4.12	1. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1. Annual herb 20-40(-100) cm (= 7.9"-15.7" [-39"]).
5.01	1. USDA, NRCS. 2013. The PLANTS Database (http://plants.usda.gov, 22 September 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA. 2. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1. Family: *Lamiaceae* . 2. Annual herb 20-40(-100) cm (= 7.9"-15.7" [-39"])
5.02	1. USDA, NRCS. 2013. The PLANTS Database (http://plants.usda.gov, 22 September 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA. 2. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1. Family: *Lamiaceae* . 2. Annual herb 20-40(-100) cm (= 7.9"-15.7" [-39"])
5.03	1. USDA, NRCS. 2013. The PLANTS Database (http://plants.usda.gov, 22 September 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA. 2. Wood, JRI, & RM Harley. 1989. The Genus *Salvia* (*Labiatae*) in Colombia. *Kew Bulletin* , 44(2): 211-278.	1. Family: *Lamiaceae* . 2. Annual herb 20-40(-100) cm (= 7.9"-15.7" [-39"])
5.04		No evidence of tubers, corms, or bulbs.
6.01	1. Gomez, JAH & SM Colin. 2008. Characterizacion morfologica de chia (*Salvia hispanica*). *Rev. Fitotec. Mex.* , 31(2): 105-113.	1. The genetic variability of chia (*Salvia hispanica* L.) has been decreasing.
6.02	1. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. When asked if the seeds were planted, the response was an emphatic no, and informants went on to explain that seedlings just appeared in the same place year after year.
6.03	1. Hernandez-Gomez, JA et al. 2008. Cruzamiento natural de chia (Salvia hispanica L.). Rev. Chapingo Ser. Hortic, 14(3): 331-337. Translation located at http://www.salviahispanica.com/natural-chia-outcrossing/. Accessed 25 September 2013. 2. Cahill, JP. 2004. Genetic diversity among varieties of Chia (*Salvia hispanica* L.). *Genetic Resources and Crop Ecolution* , 51(7): 773-781.	1. Cahill (2004) reported 0.24% of natural cross between a wild and a domesticated population of *S. hispanica* and although intraspecific hybridization in the wild is rare, controlled crosses between wild and domesticated produce fully fertile offspring. 2. While intraspecific hybridization may be exceedingly rare or non-existent in the wild, controlled crosses between all wild and domesticated accessions of *S. hispanica* resulted in fully fertile progeny.

6.04	1. Ali, NM, et al. 2012. The Promising Future of Chia, *Salvia hispanica* L. *Journal of Biomedicine and Biotechnology* , vol. 2012, Article ID 171956, 9 pages, 2012. doi:10.1155/2012/171956. 2. Hernandez-Gomez, JA et al. 2008. Cruzamiento natural de chia (*Salvia hispanica* L.). *Rev. Chapingo Ser. Hortic* , 14(3): 331-337. Translation located at http://www.salviahispanica.com/natural-chia-outcrossing/. Accessed 25 September 2013. 3. Haque, MS & KK Ghoshal. 1991. Floral biology and breeding system in the genus *Salvia* L. *Proceedings of the Indian National Science Academy. Part B. Biological sciences* , 47(5): 716-724.	1. Chia flowers are small (3-4 mm) with small corollas and fused flower parts that contribute to a high self-pollination rate (wild-type or domesticated was not specified in this paper). 2. Haque and Goshal (1981) indicate that *S. hispanica* is self-compatible and that selfing is due to that the flowers are very small and homostílicas (homostylic?). 3. *S. hispanica* flowers are very minute and supposedly self-pollinated; seed setting by open pollination was extremely high, almost all the flowers produced seeds. Because the flowers are minute, bagging and artificial selfing was not possible. However, one plant was kept isolated from others and then percentage of seed setting was recorded. In this condition also, almost cent per cent (i.e., 100%) of the flowers produced seeds. This indicates that probbly self-pollination is probably the rule in *S. hispanica* .
6.05	1. Haque, MS & KK Ghoshal. 1991. Floral biology and breeding system in the genus *Salvia* L. *Proceedings of the Indian National Science Academy. Part B. Biological sciences* , 47(5): 716-724.	No evidence. 1. Flowers are very minute and likely self-pollinated.
6.06		
6.07	1. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. Short annual life cycle.
7.01		
7.02	1. Jamboonsri, W. et al. 2012. Extending the range of an ancient crop, *Salvia hispanica* L.—a new x3 source. *Genetic Resources and Crop Evolution* , 59(2): 171-178. 2. USDA/ARS-GRIN [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. http://www.ars-grin.gov/cgi-bin/npgs/html/taxgenform.pl?language=en (18 Sept 2013). 3. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. It was widely used in pre-Columbian Mesoamerica as a major commodity and its seeds were valued for food, medicine and oil. 2. Used as food additives (flavoring, oil, etc.), human food (beverage base), and medicine. 3. Seed is collected by shaking a small quantity of seed out of the calyxes. If the plant is white-seeded the seeds are dropped to the ground. This shaking and dropping assists dispersal, spreading seeds further from the parent plant.
7.03		
7.04		No morphological features to assist in wind dispersal.
7.05		
7.06		1. Modest natural selection may occur in wild populations as white seeds contrast with the dark soil, making white seeds more susceptible to predation. The white-seeded phenotype is rare in wild populations, with no other reported white-seeded plants from wild populations other than Mesa de Nayar.

7.07		No morphological features that would suggest that it could attach itself externally to animals.
7.08	1. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. Modest natural selection may occur in wild populations as white seeds contrast with the dark soil, making white seeds more susceptible to predation. The white-seeded phenotype is rare in wild populations, with no other reported white-seeded plants from wild populations other than Mesa de Nayar.
8.01	1. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. Each mature plant is capable of producing more than 1,000 seeds.
8.02	1. Cahill, JP. 2005. Human selection and domestication of Chia. *Journal of Ethnobiology* , 25(2): 155-174.	1. Plants of *S. hispanica* were left standing to mature while all other species had been cleared. When asked if the seeds were planted, the response was an emphatic no, and informants went on to explain that seedlings just appeared in the same place year after year and were intentionally spared when weeding.
8.03	1. Kummer, C & T Phillips. 2012. Chia. University of Kentucky Cooperative Extension Service. Crop Diversification and Biofuel Research Education Center. http://www.uky.edu/Ag/CDBREC/introsheets/chia.pdf. Accessed 25 September 2013.	1. Most commonly used herbicides tested against chia have succeeded in killing it.
8.04		
8.05		