Family: ***Asteraceae***

Taxon: ***Gutierrezia sarothrae***

Synonym: *Gutierrezia diversifolia Greene*
Solidago sarothrae Pursh (basionym)
Xanthocephalum sarothrae (Pursh) Shinners

Common Name: broom snakeweed
kindlingweed
matchbrush
matchweed
snakeweed

Questionaire : current 20090513 **Assessor:** Chuck Chimera **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Chuck Chimera **WRA Score 15**

101	**Is the species highly domesticated?**	**y=-3, n=0**	**n**
102	**Has the species become naturalized where grown?**	**y=1, n=-1**	
103	**Does the species have weedy races?**	**y=1, n=-1**	
201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
202	**Quality of climate match data**	**(0-low; 1-intermediate; 2-high) (See Appendix 2)**	**High**
203	**Broad climate suitability (environmental versatility)**	**y=1, n=0**	**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**	**n**
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)**	
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)**	
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**	
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**
406	**Host for recognized pests and pathogens**	**y=1, n=0**	
407	**Causes allergies or is otherwise toxic to humans**	**y=1, n=0**	
408	**Creates a fire hazard in natural ecosystems**	**y=1, n=0**	**y**
409	**Is a shade tolerant plant at some stage of its life cycle**	**y=1, n=0**	

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**	
604	**Self-compatible or apomictic**	**y=1, n=-1**	
605	**Requires specialist pollinators**	**y=-1, n=0**	**n**
606	**Reproduction by vegetative fragmentation**	**y=1, n=-1**	**n**
607	**Minimum generative time (years)**	**1 year = 1, 2 or 3 years = 0, 4+ years = -1**	**2**
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y=1, n=-1**	
702	**Propagules dispersed intentionally by people**	**y=1, n=-1**	**y**
703	**Propagules likely to disperse as a produce contaminant**	**y=1, n=-1**	**n**
704	**Propagules adapted to wind dispersal**	**y=1, n=-1**	**y**
705	**Propagules water dispersed**	**y=1, n=-1**	**n**
706	**Propagules bird dispersed**	**y=1, n=-1**	**n**
707	**Propagules dispersed by other animals (externally)**	**y=1, n=-1**	
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**	**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)**	**y=-1, n=1**	

Designation: H(HPWRA) **WRA Score** **15**

Supporting Data:

101	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Is the species highly domesticated?? No] "Gutierrezia sarothrae is an extremely weedy and widely distributed species that is known to have diploid, tetraploid, and octoploid populations (Lane 1980b, 1982b, and unpubl.)." [No evidence]
102	2011. WRA Specialist. Personal Communication.	NA
103	2011. WRA Specialist. Personal Communication.	NA
201	1997. Sterling, T.M./Hou, Y.. Genetic Diversity of Broom Snakeweed (Gutierrezia sarothrae) and Threadleaf Snakeweed (G.microcephala) Populations. Weed Science. 45(5): 674-680.	[Species suited to tropical or subtropical climate(s) 2-high] "Broom snakeweed is the most widely distributed, growing from cold-temperate climates in southern British Columbia and Saskatchewan, Canada to subtropical areas in Nuevo Leon and Sinola, Mexico (Lane 1985; Solbrig 1960)."
202	1997. Sterling, T.M./Hou, Y.. Genetic Diversity of Broom Snakeweed (Gutierrezia sarothrae) and Threadleaf Snakeweed (G.microcephala) Populations. Weed Science. 45(5): 674-680.	[Quality of climate match data 2-high] "Broom snakeweed is the most widely distributed, growing from cold-temperate climates in southern British Columbia and Saskatchewan, Canada to subtropical areas in Nuevo Leon and Sinola, Mexico (Lane 1985; Solbrig 1960)."
203	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Broad climate suitability (environmental versatility)? Yes] "Distribution and habitat: Throughout W United States, south into central Mexico and north to W Canada (fig. 5); 50-2900 m. Grass- lands, Larrea-Yucca deserts, arroyos, slopes; soils varied." [Elevation range exceeds 1000 m]
203	2000. Sterling, T.M./Murray, L.W./Hou, Y.. Morphological Variation among Gutierrezia sarothrae Populations. Weed Science. 48(3): 356-365.	[Broad climate suitability (environmental versatility)? Yes] "Gutierrezia sarothrae and Gutierrezia microcephala are multibranched shrubs of the Asteraceae family common to western United States rangeland ecosystems (Sterling et al. 1999). They are shallow-rooted, low growing, often short-lived perennial shrubs growing on a wide variety of soils and landscape positions and across a broad spectrum of climates and vegetation types...Over these large areas, G. sarothrae populations show great adaptation to soil types, a broad spectrum of climates, elevations, and other vegetation species (Lane 1985; Nadabo et al. 1980). Gutierrezia sarothrae habitats range from 700 to 2,900 m in elevation on welldrained high montane slopes, mesic or semiarid grasslands, and deserts (Lane 1980, 1985)."
204	1997. Sterling, T.M./Hou, Y.. Genetic Diversity of Broom Snakeweed (Gutierrezia sarothrae) and Threadleaf Snakeweed (G.microcephala) Populations. Weed Science. 45(5): 674-680.	[Native or naturalized in regions with tropical or subtropical climates? Yes] "Broom snakeweed is the most widely distributed, growing from cold-temperate climates in southern British Columbia and Saskatchewan, Canada to subtropical areas in Nuevo Leon and Sinola, Mexico (Lane 1985; Solbrig 1960)."
205	1999. Wiersema, J.H./León, B.. World Economic Plants: A Standard Reference. CRC Press, Boca Raton, FL	[Does the species have a history of repeated introductions outside its natural range? No] No evidence
301	2006. Nesom, G.L.. Flora of North America Vol. 20 - Gutierrezia sarothrae. Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250066828	[Naturalized beyond native range? Yes] "Gutierrezia sarothrae is often abundant in overgrazed pastures; it is naturalized in New York."
301	2011. Starr, F./Starr, K.. Plants of Hawaii - Gutierrezia sarothrae. http://www.hear.org/starr/images/search/?q=Gutierrezia+sarothrae&o=plants	[Naturalized beyond native range? Found growing on summit of Haleakala, Maui. Presumably controlled] "Gutierrezia sarothrae Broom snakeweed Flowers Science City, Maui August 17, 2011"
302	2009. Ralphs, M.H.. Response of Broom Snakeweed (Gutierrezia sarothrae) and Cool-Season Grasses to Defoliation. Invasive Plant Science and Management. 2(1): 28-35.	[Garden/amenity/disturbance weed? A disturbance adapted weed that impacts ranching. See 3.03] "Broom snakeweed is one of the most widespread range weeds in western North America. Although a native plant, it increases with disturbance such as overgrazing, fire, and drought, and can dominate sites."
303	1992. Sterling, T.M./Lownds, N.K.. Picloram Absorption by Broom Snakeweed (Gutierrezia sarothrae) Leaf Tissue. Weed Science. 40(3): 390-394.	[Agricultural/forestry/horticultural weed? Yes] "Broom snakeweed is a suffrutescent shrub widely distributed in the Western United States from Canada to northern Mexico (6). This weed is a problem in rangeland because it interferes with forage growth and production(11) and is potentially poisonous to livestock(12). An estimated 60% of New Mexico rangeland is infested by broom snakeweed resulting in significant economic losses (21)."
303	2000. Sterling, T.M./Murray, L.W./Hou, Y.. Morphological Variation among Gutierrezia sarothrae Populations. Weed Science. 48(3): 356-365.	[Agricultural/forestry/horticultural weed? Yes] "Gutierrezia sarothrae has been considered detrimental to rangeland for a century (Wooten 1915) due to its toxicity to livestock and its ability to reduce forage production via competition with desirable species (McDaniel and Sosebee 1988; Ueckert 1979)."

304	2011. Ralphs, M.H./McDaniel, K.C.. Broom Snakeweed (Gutierrezia sarothrae): Toxicology, Ecology, Control, and Management. Invasive Plant Science and Management. 4(1): 125-132.	[Environmental weed? A native plant that is primarily considered a rangeland weed. May have ecological impacts, generally as the result of overgrazing] "Broom snakeweed is a native plant that can increase in density when other more desirable plants are reduced or removed by disturbance, such as overgrazing, fire, or drought. It can dominate many of the plant communities on western rangelands, including: salt desert shrub, sagebrush, and pinyon–juniper plant communities of the Intermountain region; short- and mixed grass prairies of the plains; and mesquite, creosotebush, and desert grassland communities of the southwestern deserts (U.S. Forest Service 1937). In addition to its invasive nature, it contains toxins that can cause abortions in livestock (Dollahite and Anthony 1957). Platt (1959) ranked it one of the most undesirable plants on western rangelands."
305	2002. McDaniel, K.C./Ross, T.T.. Snakeweed: Poisonous Properties, Livestock Losses, and Management Considerations. Journal of Range Management. 55(3): 277-284.	[Congeneric weed? Yes. G. microcephala] "Snakeweeds (broom, Gutierrezia sarothrae (Pursh) Britt & Rusby); and threadleaf, G. microcephala (DC.) Gray) fall into that class of poisonous weeds that seldom cause direct livestock losses because they are highly unpalatable and animals rarely consume large quantities of plant material. However, when snakeweed becomes dominant on rangeland and retards growth of desirable forage, then indirectly it becomes a serious hazard to animal health."
401	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Produces spines, thorns or burrs? No] "Shrubs 10 cm or more high, scraggly to up- right or globose; tap root woody, vertical or spreading laterally; stems suffrutescent, brownish below, tan, green, or, occasionally, yellowish or reddish above; leaves greyish- green to green, single and lanceolate to linear or appearing fascicled and then filiform, 4-55 mm long, 0.3-5 mm wide, usually diminishing in size above (if filiform and fascicled below, then occasionally larger above), 1-nervate"
402	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Allelopathic? Possibly] "Plants are reportedly allelopathic [61]."
403	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Parasitic? No] "Shrubs 10 cm or more high, scraggly to up- right or globose; tap root woody" [Asteraceae; no evidence of parasitism]
404	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Unpalatable to grazing animals? Yes] "Broom snakeweed browse is relatively unpalatable to most big game species and to domestic livestock. However, results of a Utah study indicate that it is preferred by pronghorn during spring and summer [90]. Broom snakeweed is described as "at least moderately palatable" to domestic sheep in Idaho [72]. Seeds are palatable to a variety of small birds and mammals."
404	2002. McDaniel, K.C./Ross, T.T.. Snakeweed: Poisonous Properties, Livestock Losses, and Management Considerations. Journal of Range Management. 55(3): 277-284.	[Unpalatable to grazing animals? Yes] "Snakeweeds (broom, Gutierrezia sarothrae (Pursh) Britt & Rusby); and threadleaf, G. microcephala (DC.) Gray) fall into that class of poisonous weeds that seldom cause direct livestock losses because they are highly unpalatable and animals rarely consume large quantities of plant material."
405	1986. Fuller, T.C./McClintock, E.M.. Poisonous plants of California: Issue 53 of California natural history guides. University of California Press, Berkeley and Los Angeles, CA	[Toxic to animals? Yes] "Symptoms: Abortion in cattle, less common in sheep and goats. Listlessness and loss of appetite resulting in weight loss, bloody urine, nasal and vaginal discharges, and mucus in the feces. Plants are most toxic during early stages of growth and when grown in sandy soils."
405	2000. Sterling, T.M./Murray, L.W./Hou, Y.. Morphological Variation among Gutierrezia sarothrae Populations. Weed Science. 48(3): 356-365.	[Toxic to animals? Yes] "Gutierrezia sarothrae has been considered detrimental to rangeland for a century (Wooten 1915) due to its toxicity to livestock and its ability to reduce forage production via competition with desirable species (McDaniel and Sosebee 1988; Ueckert 1979)."

405	2002. McDaniel, K.C./Ross, T.T.. Snakeweed: Poisonous Properties, Livestock Losses, and Management Considerations. Journal of Range Management. 55(3): 277-284.	[Toxic to animals? Yes] "Snakeweeds (broom, Gutierrezia sarothrae (Pursh) Britt & Rusby); and threadleaf, G. microcephala (DC.) Gray) fall into that class of poisonous weeds that seldom cause direct livestock losses because they are highly unpalatable and animals rarely consume large quantities of plant material. However, when snakeweed becomes dominant on rangeland and retards growth of desirable forage, then indirectly it becomes a serious hazard to animal health. Confined and rangeland feeding trials conducted at New Mexico State University with cattle and sheep have failed to elicit reproductive failure with elevated snakeweed dosages. Snakeweed was shown to impair certain reproductive functions such as pituitary responsiveness to luteinizing hormone, and caused mild hepato renal toxicity. Under rangeland conditions, livestock grazing in areas dominated by snakeweed reportedly have more serious problems, such as abortion. A commonality between confined feeding trials and rangeland grazing trials is that in the presence of snakeweed, animals typically display symptoms associated with a low-plane of nutrition such as lack of gain, emaciation, and occasional death...Snakeweeds contain a rich mixture of alkaloids, flavonoids, saponins, terpenes, and other compounds that are often causal agents in various plants that poison rangeland livestock. These substances also render snakeweed highly unpalatable so that when given a choice animals usually will not eat the foliage. Bite into a snakeweed leaf and you'll quickly appreciate from the harsh burning taste why other common names, such as fireweed and turpentinew eed are so appropriate"
406	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Host for recognized pests and pathogens? Unknown] "Broom snakeweed is susceptible to severe damage by the round-headed borer (Crossidius pulchellus) and mealybugs (Chorizococcus spp.). These insects were believed to be the major factor causing a broom snakeweed die-off in Texas and New Mexico during a particularly dry summer. Eighty-two percent of the mortality was attributed to insects, while the other 18% was thought to be drought-induced [100]."
407	1986. Fuller, T.C./McClintock, E.M.. Poisonous plants of California: Issue 53 of California natural history guides. University of California Press, Berkeley and Los Angeles, CA	[Causes allergies or is otherwise toxic to humans? Possibly] "Symptoms: Abortion in cattle, less common in sheep and goats. Listlessness and loss of appetite resulting in weight loss, bloody urine, nasal and vaginal discharges, and mucus in the feces. Plants are most toxic during early stages of growth and when grown in sandy soils." [Toxicity usually the result of accidental or intentional ingestion by animals. Unlikely that humans would accidentally ingest this species]
408	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Creates a fire hazard in natural ecosystems? Potentially] "Broom snakeweed is highly combustible when ignited [65]. In the spring, numerous dried flowers and supporting branches from the previous year are readily consumed by fire if there is sufficient fine fuel to move the fire from plant to plant [64]."
409	2011. Lady Bird Johnson Wildflower Center. Native Plant Database - Gutierrezia sarothrae. http://www.wildflower.org/plants/result.php?id_plant=GUSA2	[Is a shade tolerant plant at some stage of its life cycle? Potentially] "Light Requirement: Part Shade"
409	2011. Plants For A Future Database. Gutierrezia sarothrae. http://www.pfaf.org/user/Plant.aspx?LatinName=Gutierrezia+sarothrae	[Is a shade tolerant plant at some stage of its life cycle? Possibly No] "It cannot grow in the shade"
410	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Tolerates a wide range of soil conditions? Yes] "Broom snakeweed occurs on a wide range of soil types including dry, well-drained, sandy, gravelly, or clayey loams and heavy clays. Growth is reportedly best on moderately rich limestone, clay loams of broad alluvial slopes, and shallow, rocky, or sandy soil. Growth is generally poor on saline or alkaline soils [97]."
410	2000. Sterling, T.M./Murray, L.W./Hou, Y.. Morphological Variation among Gutierrezia sarothrae Populations. Weed Science. 48(3): 356-365.	[Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)? Yes] "Gutierrezia sarothrae and Gutierrezia microcephala are multibranched shrubs of the Asteraceae family common to western United States rangeland ecosystems (Sterling et al. 1999). They are shallow-rooted, low growing, often short-lived perennial shrubs growing on a wide variety of soils and landscape positions and across a broad spectrum of climates and vegetation types."
411	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Climbing or smothering growth habit? No] "Shrubs 10 cm or more high, scraggly to up- right or globose;"

412	1997. Sterling, T.M./Hou, Y.. Genetic Diversity of Broom Snakeweed (Gutierrezia sarothrae) and Threadleaf Snakeweed (G.microcephala) Populations. Weed Science. 45(5): 674-680.	[Forms dense thickets? Yes] "At least 3.5 million ha in Texas and New Mexico are so densely covered with snakeweed that forage production is greatly suppressed (Torell et al. 1988). Grass production can be decreased by an estimated 90% in dense snakeweed stands (McDaniel et al. 1982)."
412	2001. Knight, A.P./Walter, R.G.. A guide to plant poisoning of animals in North America. Teton NewMedia, Jackson, WY	[Forms dense thickets? Yes] "Snakeweed is commonly found in the dry plains and hills at 4000 to 10,000 feet (1219 to 3048 meters) of altitude, where it can form dense stands over thousands of acres. The predominance of snakeweed in rangelands is generally indicative of overgrazing and poor range management."
412	2011. Ralphs, M.H./McDaniel, K.C.. Broom Snakeweed (Gutierrezia sarothrae): Toxicology, Ecology, Control, and Management. Invasive Plant Science and Management. 4(1): 125-132.	[Forms dense thickets? Yes] "Broom snakeweed is a native weed widely distributed on rangelands of western North America. It often increases to near monocultures following disturbance from overgrazing, fire, or drought."
501	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Aquatic? No] "Shrubs 10 cm or more high, scraggly to up- right or globose;" [Terrestrial]
502	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Grass? No] Asteraceae
503	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Nitrogen fixing woody plant? No] Asteraceae
504	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Shrubs 10 cm or more high, scraggly to up- right or globose; tap root woody" [Not a true geophyte, but may be able to resprout from taproot]
601	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Evidence of substantial reproductive failure in native habitat? No] No evidence
602	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Produces viable seed? Yes] "Broom snakeweed is a short-lived perennial that propagates by seed in years when optimal environmental conditions occur, then subsequently dies from 1 or more factors, including drought (McDaniel 1989), insect infestation (Wangberg 1982), and old age Jameson 1970)."
603	1985. Lane, M.A.. Taxonomy of Gutierrezia (Compositae: Astereae) in North America. Systematic Botany. 10(1): 7-28.	[Hybridizes naturally? Unknown] "I prefer to accept G. sarothrae as a broadly defined species, encompassing numerous morphotypes. In contrast, I am recognizing G. californica s.lat. because the morphological differences between it and G. sarothrae are correlated with ploidy level and geographic distribution; further, the combination is well established in the literature. However, where the ranges overlap, there is significant morphological intergradation. Whether this is a result of hybridization or of ongoing adaptive radiation and incomplete speciation, as noted by Solbrig (1963) for Gutierrezia in South America, has yet to be determined although there is evidence to support each of these hypotheses."
603	1997. Sterling, T.M./Hou, Y.. Genetic Diversity of Broom Snakeweed (Gutierrezia sarothrae) and Threadleaf Snakeweed (G.microcephala) Populations. Weed Science. 45(5): 674-680.	[Hybridizes naturally? Unlikely] "Although both species outcross via insect pollination and reproduce by seeds, no hybrids have been identified."
604	1997. Sterling, T.M./Hou, Y.. Genetic Diversity of Broom Snakeweed (Gutierrezia sarothrae) and Threadleaf Snakeweed (G.microcephala) Populations. Weed Science. 45(5): 674-680.	[Self-compatible or apomictic? Possibly No] "Both broom and threadleaf snakeweed are predominantly outcrossers, although there is no genetic mechanism to prevent selfing (Solbrig 1960)."
605	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Requires specialist pollinators? No] "Flowers of broom snakeweed are pollinated by various insects [61]."
606	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Reproduction by vegetative fragmentation? No] "Plants may be transplanted or established through seed. Broom snakeweed is well adapted to planting in pinyon-juniper, big sagebrush, northern desert shrub, and southern desert shrub communities [82]."

607	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Minimum generative time (years)? 1-2] "Four main phenological stages occur in broom snakeweed: perennating bud stage in November and December, vegetative growth stage from late January through August, flower bud development in August and November, and flowering stage [34]. Annual growth of broom snakeweed begins in early spring as green herbaceous shoots sprout from the base of the plant. Elongation of the stems and new leaves may begin as early as late January to March [67]. Most vegetative development occurs during the spring and early summer when moisture availability peaks in many locations [91]. In New Mexico, new branches and leaves develop rapidly in July and August [65]. Lower temperatures may limit growth after mid-October in many parts of the Southwest [14]. In south Texas, mature vegetative phenological state generally extends from June to September when maximum canopy dimension is reached [29,65]. Plants generally become dormant after completion of the annual growth cycle, but in some parts of the southwest, plants can remain green if soil water is adequate during the winter [92]. During winter dormancy, stems remain but become brown and die back to near the base of the plant [97]. Carbohydrate storage typically increases during the fall after flowering [91]. Flowering is strongly influenced by available soil moisture, and may be delayed or prolonged during wet years [19]. During dry years both flowering and carbohydrate accumulation may begin earlier [91]. Mature plants may bloom for up to 2 months in wet years. In dry years, or when plants are older, flowering periods may be as short as 2 to 3 weeks [92]. In New Mexico flowering begins in late August with seed set in early November [65]. General flowering dates are as follows [26]:"
701	2011. Ralphs, M.H./McDaniel, K.C.. Broom Snakeweed (Gutierrezia sarothrae): Toxicology, Ecology, Control, and Management. Invasive Plant Science and Management. 4(1): 125-132.	[Propagules likely to be dispersed unintentionally? Unlikley, although possible] "Seeds held in dried flower heads gradually are dispersed over winter, mainly during high wind and snowfall events. They have no specialized structures such as wings to aid in long-range dispersal, thus they usually drop directly beneath or close to the parent plant."
701	2011. Starr, F./Starr, K.. Plants of Hawaii - Gutierrezia sarothrae. http://www.hear.org/starr/images/search/?q=Gutierrezia+sarothrae&o=plants	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Uncommon, but possible. Found growing on summit of Haleakala, Maui. Presumably controlled] "Gutierrezia sarothrae Broom snakeweed Flowers Science City, Maui August 17, 2011" [Seed presumably arrived via soil contamination or through inadvertent transport by people, or construction materials]
702	1994. Marinelli, J.. Going native: biodiversity in our own backyards. Brooklyn Botanic Garden, Brooklyn, NY	[Propagules dispersed intentionally by people? Yes] Landscape and ornamental uses in the mainland U.S.
702	1995. Morrow, B.H.. Best plants for New Mexico gardens and landscapes: keyed to cities and regions in New Mexico and adjacent areas. University of New Mexico Press, Albuquerque, NM	[Propagules dispersed intentionally by people? Yes] "A noxious pest in the countryside and a sign of a ruined range, snakeweed is nonetheless beautiful and a good landscape plant for low-maintenance gardens." [Continental U.S. ornamental]
703	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Propagules likely to disperse as a produce contaminant? No] "Regeneration of broom snakeweed, a cool season germinator, is primarily through light, wind-dispersed seed [60,111]. However, most ripe seeds fall beneath the parent plant, and seed dispersal is described as "inefficient." [No evidence to date]
704	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Propagules adapted to wind dispersal? Yes] "Broom snakeweed achene dispersal was monitored by placing surface-level traps outwards in the cardinal directions from 12 plants and collecting the achenes weekly or bi-weekly from September 1993 until seeds were no longer retained by the plants after 42 wk. About 50% of the achenes dispersed between October and December. Especially high numbers of achenes were dislodged during periods of intense winter winds and rains, with 78% of the seed placed into the east tray and 86% falling within 50 cm of the parent plant"
704	2009. Roth, G.A./Whitford, W.G./Steinberger, Y.. Small mammal herbivory: Feedbacks that help maintain desertified ecosystems. Journal of Arid Environments. 73: 62–65.	[Propagules adapted to wind dispersal? Yes] "Pruning and wastage of flowering heads of G. sarothrae contribute to the dispersal of snakeweed because the clipped flowering heads are easily moved by wind. About 50% of snakeweed achenes are dispersed between October and December and peak achene viability (82%) is during the winter months (Wood et al., 1997). Browsing, which includes cutting and releasing seed heads for wind dispersal, occurs at the same time as the peak in achene viability. Since the severed flowering heads of G. sarothrae have a large surface area to mass ratio, the achenes are wind dispersed even at low wind speeds (DeSoyza et al., 1997). Although browsing on snakeweed by rodents represents a small fraction of the total biomass lost to herbivory, rodent herbivory on G. sarothrae appears to provide positive feedback on desertification by enhancing the dispersal of G. sarothrae seeds."

705	2011. Ralphs, M.H./McDaniel, K.C.. Broom Snakeweed (Gutierrezia sarothrae): Toxicology, Ecology, Control, and Management. Invasive Plant Science and Management. 4(1): 125-132.	[Propagules water dispersed? No] "Seeds held in dried flower heads gradually are dispersed over winter, mainly during high wind and snowfall events. They have no specialized structures such as wings to aid in long-range dispersal, thus they usually drop directly beneath or close to the parent plant."
706	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Propagules bird dispersed? No] "This highly reduced pappus is unlike that found with most members of the tribe Astereae, which usually have a well-developed pappus for wind dispersal (Lane 1985). Thus, broom snakeweed seeds are absent of any specialized structures to facilitate long range dispersal, and most seeds fall close to the parent plant when dislodged (Osman et al. 1987). Good seed crops may occur every year on some sites, but climatic factors, plant age, and insects generally cause wide fluctuations in seed production from year to year (McDaniel 1989)."
707	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Propagules dispersed by other animals (externally)? Possibly] "We did not examine biological dispersal, but animals large enough to brush against a plant can feasibly affect dispersal either by causing stems to eject achenes by a whipping motion or by achene trichomes attaching to the animal's coat and possibly transporting the seed out of the area (Mayeux 1989)."
708	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Propagules survive passage through the gut? No] "Broom snakeweed seeds are readily eaten by a wide variety of small birds and mammals. Seeds of broom snakeweed are an important winter scaled quail food in parts of southeastern New Mexico [23]. Broom snakeweed seed forms part of the spring and summer diets of the lesser prairie chicken in eastern New Mexico [24]. The banner-tailed kangaroo rat, Ord's kangaroo rat and northern grasshopper mouse also eat broom snakeweed seed [7,70]." [When consumed, seeds tend to be depredated]
801	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Prolific seed production (>1000/m2)? Yes] "Individual broom snakeweed plants are capable of producing thousands of seeds (Ragsdale 1969), but there is considerable variation in seed production among plants, populations, and years (Pieper and McDaniel 1989). Of 12 plants randomly sampled for seed production near the beginning of dispersal in October 1993, the number of achenes counted ranged from 116 to 14,414 per plant and averaged 3 ,928 achenes per plant (± 1,146) (data not presented). A similar sample of 12 plants in October 1994 indicated a range from 25 to 8,921 achenes per plant and a mean of 2,036 (± 987)."
801	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Prolific seed production (>1000/m2)? Yes] "Studies indicate that a single plant is capable of producing more than 9,000 to 10,000 seeds annually. Most germination and seedling establishment takes place in winter and spring [92]."
802	1997. Wood, B.L./McDaniel, K.C./Clason, D.. Broom Snakeweed (Gutierrezia sarothrae) Dispersal, Viability, and Germination. Weed Science. 45(1): 77-84.	[Evidence that a persistent propagule bank is formed (>1 yr)? Possibly No. See Tirmenstein 1999] "These results indicate that the majority of broom snakeweed achenes are not long-lived and that only a small proportion of the original number of seeds persist into the next production year...A similar periodicity of viability was not observed for achenes stored in the laboratory for 2 yr, which agrees with Mayeux and Leotta (1981), who reported that viability of broom snakeweed achenes remain unchanged after 4 yr of laboratory storage." [Seed viability in field conditions shorter than in the lab]
802	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Evidence that a persistent propagule bank is formed (>1 yr)? Yes] "Under laboratory conditions seeds have remained viable for at least 2 years [61]. Osman and Pieper [75] report that seed can remain viable in the soil for "a considerable period of time." Seeds can remain viable in the soil for at least several years [65,85]. Broom snakeweed can mature and set seed within one to two years [77]."
802	2009. Ralphs, M.H.. Response of Broom Snakeweed (Gutierrezia sarothrae) and Cool-Season Grasses to Defoliation. Invasive Plant Science and Management. 2(1): 28-35.	[Evidence that a persistent propagule bank is formed (>1 yr)? Possibly] "It is easily controlled with herbicides (McDaniel and Duncan 1987) and fire (McDaniel et al. 1997), but its seed bank in soil enables it to come back in wet years."
802	2011. Ralphs, M.H./McDaniel, K.C.. Broom Snakeweed (Gutierrezia sarothrae): Toxicology, Ecology, Control, and Management. Invasive Plant Science and Management. 4(1): 125-132.	[Evidence that a persistent propagule bank is formed (>1 yr)? Apparently yes] "Buried seeds remain viable for several years and germinate when moved to the soil surface by disturbance (Mayeux 1989)."

803	1987. McDaniel, K.C./Duncan, K.W.. Broom Snakeweed (Gutierrezia sarothrae) Control with Picloram and Metsulfuron. Weed Science. 35(6): 837-841.	[Well controlled by herbicides? Yes] "Applications of picloram and metsulfuron in the fall more effectively controlled broom snakeweed than applications in the spring. Lower herbicide rates were necessary for 90% or greater control on a sandy loam than on a silty clay loam. Grass yield increased significantly the first, second, and third growing seasons when a majority of the broom snakeweed were killed by either herbicide, but was not different from untreated rangeland when less than 50% of the plants were killed. Reduction in broom snakeweed densities of 90% or greater following applications of picloram or metsulfuron resulted in 3- to 5-fold increases in the estimated carrying capacity of rangeland in east-central New Mexico."
803	1992. Sterling, T.M./Lownds, N.K.. Picloram Absorption by Broom Snakeweed (Gutierrezia sarothrae) Leaf Tissue. Weed Science. 40(3): 390-394.	[Well controlled by herbicides? Yes] "Control of broom snakeweed using herbicides has been more successful than using other control measures such as mowing or burning; however, control with herbicides can vary (10). Differences in efficacy may be related to differences in herbicide penetration"
803	2009. Ralphs, M.H.. Response of Broom Snakeweed (Gutierrezia sarothrae) and Cool-Season Grasses to Defoliation. Invasive Plant Science and Management. 2(1): 28-35.	[Well controlled by herbicides? Yes] "It is easily controlled with herbicides (McDaniel and Duncan 1987) and fire (McDaniel et al. 1997), but its seed bank in soil enables it to come back in wet years."
803	2011. Ralphs, M.H./McDaniel, K.C.. Broom Snakeweed (Gutierrezia sarothrae): Toxicology, Ecology, Control, and Management. Invasive Plant Science and Management. 4(1): 125-132.	[Well controlled by herbicides? Yes] "Herbicide control is recommended on dense snakeweed stands, particularly where fine fuels are not sufficient to carry a fire. Picloram at 0.28 kg ae ha21 (0.25 lb ac21) or metsulfuron at 0.03 kg ai ha21 (0.43 oz ac21) applied in the fall provided consistent control in New Mexico (McDaniel 1989b; McDaniel and Duncan 1987). Sosebee et al. (1982) suggested that fall applications were more effective than spring in the southwest because carbohydrate translocation was going down to the crown and roots, thus carrying the herbicide down to the perennating structures. Whitson and Freeburn (1989) recommended picloram at 0.56 kg ae ha21 and metsulfuron at 0.04 kg ai ha21 applied in the spring on shortgrass rangelands in Wyoming. In big sagebrush sites in Utah, the new herbicide aminopyralid at 0.12 kg ae ha21 was effective when applied during the flower stage in fall, as was metsulfuron 0.042 kg ai ha21 and picloram + 2,4-D 1.42 kg ae ha21 (Keyes et al. 2011). Picloram by itself at 0.56 kg ae ha21 was most effective and eliminated snakeweed when applied in either spring or fall. Residual control was obtained with tebuthiuron (80% wettable powder) at 1.1 to 1.7 kg ai ha21 on mixed grass prairies in west Texas (Sosebee et al. 1979)."
804	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Mechanical control is generally ineffective in controlling broom snakeweed [29]. Hoeing the plants just below the soil surface can be effective but is difficult or impractical in stony ground [94]. In Arizona, chaining resulted in increases in broom snakeweed and harrowing in central Arizona reduced populations by only 5 to 10% [34]...Although usually killed by fire, plants occasionally sprout [45]. If the entire crown is not consumed, plants may produce shoots from undamaged primordial buds located on lower stems [64]. Reestablishment generally proceeds rapidly through large numbers of light, wind-dispersed seed [69,111]."
805	1999. Tirmenstein, D.. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown] "Biological control agents may have potential for control of broom snakeweed [21,36]." [No evidence for Hawaii or Pacific]