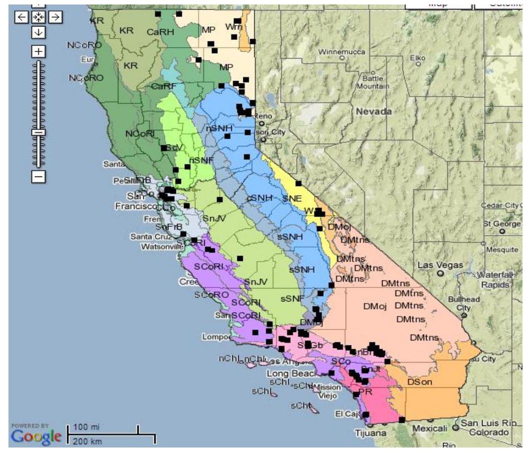
SPECIES	*Iva axillaris* Pursh ssp. *robustior* (Hook.) Bassett
NRCS CODE: IVAXR	Family: **Asteraceae** Order: **Asterales** Subclass: **Asteridae** Tribe: **Helenieae** Subtribe: **Ambrosiinae** Class: **Magnoliopsida**  A. Montalvo, w. Riverside Co.
Subspecific taxa	California plants have been treated as a subspecific taxon of *I. axillaris* Pursh.
Synonyms	*I. axillaris* Pursh var. *pubescens* Gray
Common name	povertyweed, deathweed, devil's-weed, poverty sumpweed, bozzleweed, salt sage, marsh elder, small-flowered marsh elder (DiTomaso & Healy 2007, Painter 2009). There are many more common names.
Taxonomic relationships	Species in the genus *Iva* are related to *Ambrosia* and *Artemisia* in southern California. Seven *Iva* species are currently recognized in North America (FNA), but nine species were assessed for phylogenetic relationships using cpDNA (Miao et al. 1995).
Related taxa in region	*Iva hayesiana* A. Gray (rare, native subshrub found mostly in sw San Diego County) is the closest relative in the region. The species differ in chromosome number, stature, size and habitat; *I. hayesiana* has n=17 chromosomes, is a coastal (Miao et al. 1995), and also differs in having flower heads with separate phyllaries (Munz 1974, DiTomaso & Healy 2007). Ragweeds are in the same section of the Asteraceae. Some (e.g., *Ambrosia psilostachya*) are found in similar areas and have a similar growth habit, but unlike *Iva*, they have incised or lobed leaf margins (DiTomaso & Healy 2007). Outside focus area: *Iva nevadensis* Jones is an annual herb found in sagebrush scrub and pinyon-juniper woodlands of CA (Munz 1974); *Iva acerosa* (Nutt.) Jackson is a perennial found on alkali sinks and desert areas of CA (Munz 1974).
Taxonomic issues	Munz (1974), Hickman (1993) and JepsonOnline (1st edition, 2010) consider southern CA forms to be *I. axillaris* ssp. *robustior.* However, the JepsonOnline 2nd Ed (2010) may dismiss the varietal status. Subspecies *robustior* and *axillaris* can be separated, in part, by the degree of fusion of the outer phyllaries, leaf shape, and color of glands after drying (Best 1975). In ours, the fused phyllaries form a distinct cup. FNA (2010) and USDA PLANTS (2010) do not recognize subspecific taxa.
Other	In some species, such as *Phragmites australis* (Saltonstall 2002, Vasquez et al. 2005), there are invasive and non-invasive genotypes; non-native aggressive genotypes from Eurasia have higher salt tolerance and have invaded North American wetlands, displacing many species over sometimes large areas. Such examples underline the value of using native non-invasive genotypes of taxa that are known to be invasive in other areas. Studies are needed to determine if there are differences in invasive potential within *I. axillaris,* especially between southwestern and northern subtaxa. This species is listed as a California Noxious Weed (with respect to agriculture), category CW (USDA PLANTS 2010, GRIN); however, its weediness is more of a problem in Canada and outside California (Munz & Keck 1968). The ssp. *robustior* is native to CA, the western US and western Canada and is not on the US Federal noxious weed list. However, the species is considered a noxious weed and serious pest in the prairies of Canada (Best 1975) and where it has been introduced in Australia (Parsons & Cuthbertson 1992). To avoid invasiveness issues, do not use around sensitive plant species or agricultural fields. Avoid introducing genotypes from areas where the plant has been introduced and is invasive and avoid placing seed increase plots in seed dispersal distance of other crops. Local seed laws may limit the sale and distribution of this species. Plants are somewhat resistant to 2-4-D at rates normally used for crops (Best 1975) and can be difficult to eradicate from agricultural fields.

GENERAL	
Map	Data provided by the participants of the Consortium of California Herbaria represent 144 records with coordinate data out of 330 records retrieved; data accessed 9/18/10. See Berkeley Mapper: http://ucjeps.berkeley.edu/consortium 
Geographic range	*I. a.* ssp. *robustior:* Widespread: CA, British Columbia, MT, Central US, TX, and west of the Continental Divide (Bassett et al. 1962, Hickman 1993). *I. a.* ssp. *axillaris* is widespread east of the Continental Divide in the northern US and Canada (Bassett et al. 1962).
Distribution in California; Ecological section and subsection	Common, but scattered throughout state (Munz & Keck 1968, Hickman 1993). Many ecological sections (http://www.fs.fed.us/r5/projects/ecoregions/ca_sections.htm), including: Modoc Plateau (M261G), Great Valley (262A), Central California Coast (261A), Sierra Nevada and Sierra Nevada Foothills (M261E,F), Mono and Southeastern Great Basin (341D,F), w Mojave Desert (322A), Southern California Mountains and Valleys (M262B), Southern California Coast (261B) .
Life history, life form	Long-lived perennial herb, capable of long periods of dormancy (Best 1975).
Distinguishing traits	Mat-forming perennial from vigorous creeping roots 0.2 to 0.6 dm tall; produces small nodding green flower heads from axils of leaves have outer phyllaries united into a cup; plants have simple, generally entire, pubescent, alternate leaves (1.5-2.5 cm long) and an unpleasant aromatic scent (Munz 1974, DiTomaso & Healy 2007, FNA 2010). Plants can be slightly woody at base and leaves have glandular dots (Munz 1974).
Root system, rhizomes, stolons, etc.	Creeping, woody, highly branched root system (DiTomaso & Healy 2007). Can spread vigorously from root system, potentially forming large clones (Best 1975).
Rooting depth	To 2.5 m depth (Best 1975, DiTomaso & Healy 2007).
HABITAT	
Plant association groups	Coastal salt marsh and alkali plains communities (DiTomaso & Healy 2007)
Habitat affinity and breadth of habitat	Weedy plant found from deserts to coastal areas in alkaline plains, depressions, or edges of saline marshes (Munz 1974); especially found in agricultural areas, pastures, rangeland, roadsides, and other disturbed areas (DiTomaso & Healy 2007).
Elevation range	Sea level to 2500 m (Hickman 1993).
Soil texture, chemicals, depth	Found growing on poorly drained alkaline and saline soils, but also found on more favorable neutral, well draining soils (DiTomaso & Healy 2007); in one study (primarily Canada) plants were found in soils with pH ranging from 6.59-8.77 and sodium content from 2.83 to 6.10 (Best 1975).
Drought tolerance	Plants typically grow in seasonally moist depressions, washes, along riparian edges and near streams or irrigation ditches. Plants can be found on dry slopes above riparian areas in Riverside Co., but it is possible that the deep root systems had contacted capillary water (A. Montalvo, pers obs).
Precipitation	Occurs under a broad range of precipitation normals, but in low precipitation regions, tends to occurs in areas that are seasonably wet (JepsonOnline 2010).
Flooding or high water tolerance	Occurs in seasonally wet, saline or alkaline areas (FNA 2010) and in areas that flood occasionally.
Wetland indicator status for California	Facultative (USDA PLANTS 2010).
Shade tolerance	

GROWTH AND REPRODUCTION	
Seedling emergence relevant to general ecology	Best (1957) reported that in natural ecosystems, there is generally very little seed germination, as most seeds are not viable due to seed predation. Most studies have been in Canada and the northern US.
Growth pattern, phenology	Flowers May-Sept. in California (Hickman 1993); foliage will die back in winter but roots remain alive (DiTomaso & Healy 2007). In North America, flowers May to October (FNA 2009).
Vegetative propagation	Clonal reproduction from creeping roots (DiTomaso & Healy 2007). Root pieces will lead to propagation and spread of plant (Best 1975, Parsons & Cuthbertson 1992).
Regeneration after fire or other disturbance	Investigation is needed to see if plants resprout after wildfire. Plants withstand mowing and other mechanical disturbance (DiTomaso & Healy 2007).
Pollination	Wind pollinated (Colin & Jones 1980, DiTomaso & Healy 2007).
Primary seed dispersal	The achenes are small and light, but they have no specialized dispersal structures. The seeds are also buoyant enough to be carried by water after they drop to the ground (Bruns & Rasmussen 1953).
Breeding system, mating system	Large clones can be expected to self-pollinate, but self-pollination resulted in underdeveloped embryos for five populations tested, including both subspecies (Bassett et al. 1962). This can be caused by self-incompatibility or severe inbreeding depression. This suggests seeds are produced by outcrossing and that multiple genotypes are necessary for seed production.
Hybridization potential	Potential for cross pollination of plants from different populations or varieties is high in this wind pollinated plant. In Colorado and Wyoming, ssp. *axillaris* and ssp. *robustior* overlap in distribution. Plants intermediate in form betweeen have been observed, suggesting hybridization (Best 1975).
Inbreeding and outbreeding effects	Self-pollination resulted in underdeveloped embryos (Bassett et al. 1962). This may be an expression of inbreeding depression that occurs very early in embryo development. Self-incompatibility is also likely.
BIOLOGICAL INTERACTIONS	
Competitiveness	In agricultural areas, *I. axillaris* can significantly reduce crop yields in the U.S. and Canada (Best 1975, DiTomaso & Healy 2007). Extracts from leaves reduce germination and growth of roots and shoots in wheat, grasses, and legumes (Parsons & Cuthbertson 1992).
Herbivory, seed predation, disease	Seeds are eaten by larvae of the beetle *Smicronyx utilis* Buchanan (Best 1975). Another beetle, *Zygospila conjuncta conjuncta,* as well as other insects including *Rhophalus viridicatus, Psylliodes punctulata, Systena blada, Monoxia angularis, Collop vittatus,* and *Hippodamia parenthesis* are known to feed on different parts of the plant (Best 1975). *Ophaella communa* LaSage feeds on *Iva axillaris* in CA, and *I. frutescensin* in eastern NA (Futuyma et al. 1993). In addition, researchers found that there was genetic variation in the insect with respect to larval survival on host plants within chemically similar plants in the Asteraceae. The greatest variation was with *I. frutescens* .
Palatability, attractiveness to animals, response to grazing	A weed database by the California Department of Food and Agriculture reports that plants are not palatable and are seldom eaten by livestock (http://www.cdfa.ca.gov/phpps/ipc/weedinfo/iva-axillaris.htm); however, Hanley & Hanley (1982) reported that *I. axillaris* was grazed in the Great Basin by sheep. The plants have been reported to absorb selenium from the soil and accumulate sufficient quantities to be poisonous to some animals (Best 1975).
Mycorrhizal?	Found to be colonized with vesicular-arbuscular mycorrhizal fungi in disturbed areas of UT (Pendleton & Smith 1983).
ECOLOGICAL GENETICS	
Ploidy	2n=36, 54 (Hickman 1993). No correlates between variation in ploidy and morphology have been found (Best 1975). Miao et al. (1995) found *I. axillaris* to be the most primitive member of the genus based on cpDNA, chromosome number, and flower head structure. Primitive number of the tribe is n=18, and *Iva axillaris* ssp. *robustior* n=18 (Payne et al. 1964).
Plasticity	No information.
Geographic variation (morphological and physiological traits)	There is some morphological differentiation of populations classified as different subspecies, but no studies have been found that document the genetic basis of the variation.

Genetic variation and population structure	No studies found. Wind pollinated, self-incompatible plants typically have high rates of gene dispersal and low levels of population structure. Seed dispersal by water can also add to higher gene dispersal and low structure, but seeds dispersed by gravity could result in localized family structure. The clonal spread of these plants is likely to result in large patches of single genotypes.
Phenotypic or genotypic variation in interactions with other organisms	
Local adaptation	
Translocation risks	As mentioned above, the eastern genotypes may be more invasive than forms that occur in California. Care should be taken to avoid plants that are too aggressive.
SEEDS	For RSABG seed image see: http://www.hazmac.biz/USDA/USDAIvaAxillaris.html
General	Seeds (achenes) are about 2 mm long and turnip-shaped (DiTomasso & Healy 2007).
Seed longevity	Seeds may be relatively short-lived both in the wild and in storage based on a review by Best (1975).
Seed dormancy	"Newly matured seed can be dormant" (DiTomaso & Healy 2007).
Seed maturation	
Seed collecting	This species may be similar to *Ambrosia* or *Artemisia* for which seeds can be hand-stripped or beaten into a hopper or open container (e.g., Stevens et al. 1996).
Seed processing	Wall and MacDonald (2009) recommend rubbing the flower material of similar *Artemisia* and *Ambrosia* over a sieve or medium screen, and then using a blower (with an Oregon Seed Blower unit) to remove the chaff.
Seed storage	Seeds may be relatively short-lived in dry storage. Seeds did not germinate when tested at any time during 22 and 60 months of dry storage (Bruns & Rasmussen 1953, 1957). However when stored submerged inside lumite screen bags in a Washington Canal, seeds germinated after prolonged storage (Bruns & Rasmussen 1953). There was no germination before 2 months, 43% germination after 7 months, < 3% germination after 10 months, increased to 38% after 14 months, then dropped again after 18 months. Germination cycled and increased with a decrease in water temperature. In another study, submerged seeds slowly germinated or disintegrated for 60 months, but 86% were no longer sound after 30 months (Bruns & Rasmussen 1957).
Seed germination	Scarification is not effective in promoting germination (Best 1975); seeds submerged outdoors in a canal in Washington had their highest germination at between months 6 to 8 months and again at 14 to 18 months when water temperatures were between 32 and 50 ºF. Few seeds germinated when water temperatures were between 50 and 72 ºF (Bruns & Rasmussen 1953). This suggests most seedling emergence will be in the cool season. Studies are needed to determine if cold stratification could aid germination of seeds from southern California plants.
Seeds/lb	161,997 (Stevens 1932).
Planting	
Seed increase activities or potential?	
USES	
Revegetation and erosion control	Promising for use on slopes of water quality basins and bioswales where alkalinity is expected. The root system of this species should be good for stabilizing salty or alkaline soils around water quality basins and seasonally wet bioswales.
Habitat restoration	Use cautiously and consider if too competitive for natural site.
Horticulture or agriculture	No information was found about how to grow plants. We only found information about how to get rid of *I. axillaris* from agricultural fields.
Wildlife value	In the mid-1900's in Oregon *I. axillaris* was found to make up more than 1% of the diet of antelopes (Mason 1952). There was also a low level of grazing in August by bison in Colorado (Peden 1976).
Plant material releases by NRCS and cooperators	None.

Ethnobotanical	Many uses by Native Americans have been reported in the ethnobotanical database (http://herb.umd.umich.edu/herb/search.pl?searchstring=Iva+axillaris). For example, plants were used for contraception, as an abortifacient, gastrointestinal aid, and leaves were used as a plaster or in an infusion to treat sores or skin irritations. Pollen and hairs on leaves may cause an allergic reaction in sensitive individuals (DiTomaso & Healy 2007).
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CITATION	Montalvo, A. M., L. K. Goode, and J. L. Beyers. 2010. Plant Profile for *Iva axillaris.* Native Plant Recommendations for Southern California Ecoregions. Riverside-Corona Resource Conservation District and U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, Riverside, CA. Online: http://www.rcrcd.com/index.php?option=com_content&view=article&id=88&Itemid=190.

LINKS TO REVIEWED DATABASES & PLANT PROFILES

(last accessed September 2010)

Fire Effects Information System (FEIS)	No matches: http://www.fs.fed.us/database/feis/
Jepson Flora, Herbarium (JepsonOnline)	http://ucjeps.berkeley.edu/cgi-bin/get_cpn.pl?IVAX
Jepson Flora, Herbarium, 2nd edition review (JepsonOnline 2nd Ed.)	http://ucjeps.berkeley.edu/tjm2/review/treatments/compositae.html#3654
USDA PLANTS	http://plants.usda.gov/java/profile?symbol=IVAX
Native Plant Network Propagation Protocol Database (NPNPP)	no matches: http://nativeplants.for.uidaho.edu/network/
Native Seed Network	No matches
GRIN	http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?20534
Flora of North America (FNA) (online version)	http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250067018
Native American Ethnobotany Database (NAE)	http://herb.umd.umich.edu/
Calflora	http://www.calflora.org/
Rancho Santa Ana Botanic Garden Seed Program, RSABG seed photos	http://www.hazmac.biz/rsabghome.html

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