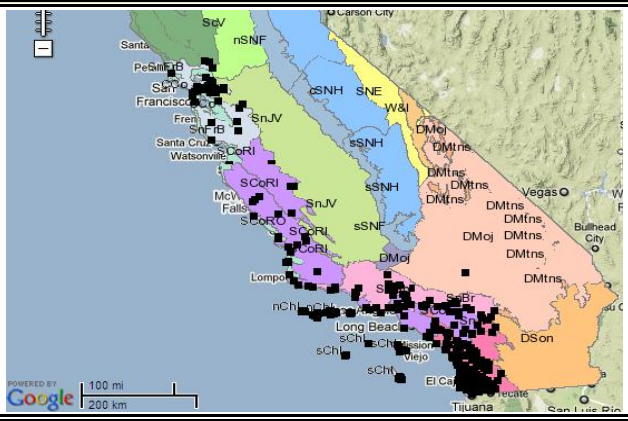
SPECIES	*Artemisia californica* Less.
NRCS CODE: ARCA11 **FEIS CODE: ARCAL**	Subtribe: **Artemisiinae** Tribe: **Anthemideae** Family: **Asteraceae** Order: **Asterales** Subclass: **Asteridae** Class: **Magnoliopsida**  spring growth, 2003  juvenile plant  flowering plant, November 2005  mature plant with flower buds August 2010 photos from Riverside Co., A. Montalvo  seedling, March 2009
Subspecific taxa	None. *Artemisia californica* Less. var. *insularis* (Rydb.) Munz is now recognized as *Artemisia nesiotica* P.H. Raven
Synonyms	*Artemisia abrotanoides* Nuttall; *A. fischeriana* Besser; *A. foliosa* Nuttall; *Crossostephium californicum* (Lessing) Rydberg (FNA 2010).
Common name	California sagebrush. The common name refers to its strong, sage-like aroma and being endemic to California and Baja California. Other names include: coastal sage, coast sage, coast sagebrush (Painter 2009).
Taxonomic relationships	There are 30 native taxa of *Artemisia* in California (JepsonOnline 2010). The FNA (2010) places this species in subgenus *Artemisia*. The molecular phylogeny of the genus has improved the understanding of relationships among the many species of *Artemisia* and has, at times, placed the species in subgenus *Tridentadae;* morphology of the inflorescences and flowers alone does not place this species with its closest relatives (Watson et al. 2002). The detailed phylogeny is not completely resolved (Hayat et al. 2009).
Related taxa in region	There are 15 taxa of *Artemisia* in southern California, all of which differ clearly from *A. californica* in habitat affinity, structure, or both (JepsonOnline 2010, Munz 1974). Within subgenus *Artemisia* (as per FNA), *A. nesiotica* from the Channel Islands is the most similar and was once considered part of *A. californica;* it can be told apart by its wider leaves with flat leaf margins (not rolled under). *A ludoviciana* Nutt. overlaps in southern California, but plants are rhizomatous perennials that grow primarily further inland and in the great Basin. *A. dracunculus* L. overlaps with *A. californica* in floodplain habitats and alluvial scrub. Plants can easily be distinguished from *A. californica* by their perennial, non-woody habit, often tarragon odor, and glabrous to subglabrous stems and leaves. The shrub *A. tridentata* overlaps in southern California but has short, broad, wedge-shaped leaves with three teeth toward the top end and is generally separated by its interior distribution and occurrence at higher elevation.
Taxonomic issues	None at the species level.
Other	One of the most important and widespread plants of coastal sage scrub vegetation. It is an indicator species frequently used in restoration. Seed transfer guidelines have been developed for the much more widespread species of sagebrush, *A. tridentata* (Mahalovich & McArthur 2004).

GENERAL	
Map	Data provided by the participants of the Consortium of California Herbaria represent 369 and 791 records with coordinate data ; Berkeley Mapper, accessed 8/6/2010: http://ucjeps.berkeley.edu/consortium 
Geographic range	Central western and southwestern California, from Contra Costa Co. south into Baja California, including the Channel Islands.
Distribution in California; Ecological section and subsection	Jepson general areas of CA: Widespread in Central Western and Southwestern California Bioregions. Ecological Section/subsection map: http://www.fs.fed.us/r5/projects/ecoregions/ca_sections.htm: Central California Coast (261Ae-l), Central California Coast Ranges (M262Aa-f, Ah, Aj), Northern California Coast (263Ak-l), Southern California Coast (261B), and Southern California Mountains and Valleys (M262Ba-d, Bf, Bj-l, Bn)(e.g., in Sawyer et al. 2009). Historically, it was the dominant shrub on north-facing slopes in coastal sage scrub but has declined to about a third of its past abundance in many areas of southern California, especially inland on north-facing slopes where it is being replaced by exotic annual grasses (Minnich & Dezzani 1998).
Life history, life form	Subshrub, drought deciduous, generally lives for 5 to 25 years (Sawyer et al. 2009).
Distinguishing traits	Aromatic, sage-smelling subshrub usually 0.6 to 1.5 tall but sometimes reaching 2.5 m. Plants tend to be wider than tall with many branches from the base (Munz & Keck 1968, Hickman 1993). Upper branches are somewhat unbranched and the stems are whitish with appressed hairs, long, slender, leafy, and flexible. The somewhat hairy gray-green leaves are soft, entire to divided into narrow linear segments, giving the entire shrub a wispy appearance. Early and late season leaves differ in morphology, and shrubs become more brown in hue during the dry summer to fall. Early season leaves tend to be longer and more divided than late season leaves. The many small bisexual flower heads are less than 5 mm wide and nodding at maturity, arranged in many small, branched clusters along the stem (appears like a long narrow panicle), and have 15 to 30 disk florets per flower head. (modified from Montalvo & Koehler 2004)
Root system, rhizomes, stolons, etc.	Branched taproot becomes fibrous. The shallow, branched roots (Harrison et al. 1971) allow for rapid water absorption and growth response to shallow rains (Gray 1982).
Rooting depth	Shallow root system (Gordon & White 1994).
HABITAT	
Plant association groups	Present as a canopy dominant to scattered in lowland shrub communities such as coastal sage scrub, chaparral, and alluvial scrub. Occurs as co-dominant in *Artemisia californica- Salvia mellifera* and *Artemisia californica-Eriogonum fasciculatum* shrubland alliances (Sawyer et al. 2009).
Habitat affinity & breadth of habitat	California sagebrush is common in sage scrub and coastal strand on dry slopes and fans (Munz & Keck 1968, Hickman 1993). It is an indicator species of coastal sage scrub (Kirkpatrick & Hutchinson 1977). In southern California, plants tend to grow equally on flats and gentle to steep slopes (Kirkpatrick & Hutchinson 1980). Although shrubs tend to be taller and broader when growing on north-facing slopes than on south facing ones, seed production is higher on south-facing slopes (DeSimone & Zedler 2001).
Elevation Range	Generally below 800 m (Munz & Keck 1968, Hickman 1993). Some records and authors report to about 1200 m (Sawyer et al. 2009).
Soil texture, chemicals, depth	Plants occur on virtually all soil types except serpentine (Westman 1981a), and on a variety of soil textures including loams, clayey loams, sandy loams, and loamy sands (FEIS: Scott 2006). Common on granite, unconsolidated soils and "other" soils (Kirkpatrick & Hutchinson 1980).
Drought tolerance	Drought tolerant. Plants drops their larger, early season leaves during the summer drought and shift to small leaf production and maintenance.

Precipitation	Plants typically occur in Mediterranean climate regions of California that are typically dry in summer, wet in the cool winter, becoming dry mid to late spring, depending on location. Total annual precipitation ranges from about 10 to 25 in, but can be higher in northern coastal locations.
Flooding or high water tolerance	Upland species but also grows in infrequently inundated and well-drained areas of flood plains along streams and on alluvial fans in alluvial scrub vegetation (FEIS: Scott 2006, Burk et al. 2007).
Wetland indicator status for California	None.
Shade tolerance	Shade intolerant. Requires full sun or nearly full sun.

GROWTH AND REPRODUCTION

Seedling emergence relevant to general ecology	Seeds germinate after fire, in canopy openings, or in small grassland clearings generated by gophers (*Thomomys* spp.), but seedlings suffer high mortality from gopher activity (Eliason & Allen 1997, DeSimone & Zedler 1999, 2001).
Growth pattern (phenology)	Seedlings emerge in winter during the rainy season, and most growth occurs by May (DeSimone & Zedler 2001). In California, shoot and new leaf production begins with the winter rains, usually in December, and continues throughout winter and spring. Flower buds are produced in summer, but flowering occurs after the first rains. Flowering of California sagebrush tends to peak in late fall, but in Baja California summer rains may trigger flowering during summer (Minnich 1985). Seeds mature October to January, depending on location and rainfall patterns. The thin leaf cuticle and numerous stomata allow a high photosynthetic rate in response to water availability (Poole & Miller 1975, Gray 1983). Leaves are drought-deciduous and seasonally dimorphic (Westman 1981b, Gray 1982). Leaf drop and production of smaller leaves occurs during the summer drought (Westman 1981b).
Vegetative propagation	Resprouts from base of plant. Buried stems can sometimes develop roots (FEIS: Scott 2006).
Regeneration after fire or other disturbance	Facultative seeder (Keeley 1998, Keeley et al. 2006). Seedling emergence after fire is variable and low (Zedler et al. 1983, Keeley 1998). In a large study in southern California, California sagebrush resprouted after fire about 20 percent of the time within inland areas and 18 percent of the time in coastal areas (Keeley et al. 2006). Over a five year period after fire, about 83% of seedlings emerged in the first two years after fire, falling to 13% in year 3. Resprouting appears to be lower in burns through dense vegetation, where plants are older, or if fire intensity is high (Malanson & O'Leary 1982, Keeley 1998, Minnich & Dezzani 1998). Seedlings sometimes appear the second year from seeds of resprouts or seeds blown in from adjacent areas. Under high fire intensities or frequency, California sagebrush will likely be extirpated because of its poor resprouting ability and poor competitive ability of seedlings (Malanson & O'Leary 1982, Malanson & Westman 1991).
Pollination	Primarily wind pollinated. The reduced flowers are typical of other wind-pollinated species of *Artemisia* . Most of the genus is wind-pollinated (Hyat et al. 2009).
Seed dispersal	The tiny seeds are thought to be wind dispersed. DeSimone & Zedler (2001) used see traps to determine dispersal distances away from parent plants. The longest distances recorded were 5 m.
Breeding system, mating system	Flowers are said to be self-incompatible (Moldenke & Neff 1974), but evidence is lacking. Some species of *Artemisia* have been shown to be self-compatible (Hayat et al. 2009), while others are self-incompatible (Garnock-Jones 1986).
Hybridization potential	No information on *A. californica* . Hybridization among distantly related populations in mixed plantings is probable if flowering overlaps. There is evidence for hybridization and introgression between subspecies of *Artemisia tridentata* in the Great Basin (Wang et al. 1997).
Inbreeding and outbreeding effects	No studies found. Effects of outbreeding among subspecies from adjacent habitats was examined in *A. tridentata* and reported in Rogers & Montalvo (2004). *A. tridentata* plants were tested in hybrid zone and parental environments of different subspecies. of *A. tridentata.* The first generation hybrids were most fit in the ecotone between the two subspecies studied; parents most fit at contrasting home sites (Graham et al. 1995, Wang et al. 1997).

BIOLOGICAL INTERACTIONS

Competitiveness	Competition with invasive species for light and resources appears to limit establishment of *A. californica* . Seedlings can be virtually absent in grasslands adjacent to stands of shrubs (Freudenberger et al. 1987), and seedlings are notably less abundant in annual grasslands than in gaps and small clearings of non-grassland vegetation (DeSimone & Zedler 1999). Seed germination and seedling establishment and survival are poor in light limited conditions under grass thatch or amidst even low densities of standing grass (Schultz 1996, Eliason & Allen 1997, Storms 1999), a problem likely exacerbated by much earlier germination and growth of grasses than of sagebrush. Attempts to use annual legumes as nurse plants in revegetation projects can result in reduced seedling growth and survival (Marquez & Allen 1996), but seedling survival may be unaffected when sown with other native species at low density (Montalvo et al. 2002). Clearing weeds before planting is critical. California sagebrush can return vigorously to areas where all vegetation has first been removed, even when sown with a variety of other species. Solarization of soil and prescribed burning to kill seeds of non-native grasses at a site in the coastal Santa Monica Mountains signficantly improved establishment from seeds and plugs compared to control plots (Moyes et al. 2005). However, *Brassica nigra* was prolific in the burned plots.
Herbivory, seed predation, disease	High rates of infection by larvae of wood-boring beetle (*Perarthrus vittatus*) have been observed, although it is not known if infection results in death (Tyson 1981). *Artemisia californica* has also been found to host larvae of the scarab beetle *Phobetus comatus* (La Rue 1992). Spittle bugs (Cercopidae) are commonly found on *Artemisa* during summer months, but are not known to harm plants significantly (Jutta Burger pers. com.).
Palatability, attractiveness to animals, response to grazing	Grazing appears to prevent shrub establishment, as seen by differential reinvasion of shrubs into ungrazed and grazed areas (see Freudenberger et al. 1987, Callaway & Davis 1993). Although some grazers may choose to eat young grasses or forbs over fresh shoots of *A. californica* during the growing season, shrubs are vulnerable to grazing by vertebrate herbivores during the summer and fall, when they may be preferentially eaten (Genin & Badan-Dangon 1991, Genin & Pijoan 1993). Plants continually produce basal sprouts during a single shrub's lifetime, and young shrubs can resprout if clipped at the base (Malanson & Westman 1985).
Mycorrhizal? **Nitrogen fixing nodules?**	Roots form associations with arbuscular mycorrhizal (AM) fungi (Harney et al. 1997), but the beneficial nature of the interaction may be facultative and is potentially affected adversely by human-influenced nitrogen deposition (Sigüenza 2000; Yoshida & Allen 2001, 2004). In a study of root colonization along a nitrogen deposition gradient, colonization of roots of *A. californica* by AM fungi was found to be lowest in areas of high nitrogen deposition (Sigüenza et al. 2006b). In addition, in greenhouse studies, plants that received higher amounts of nitrogen fertilizer had lower growth when inoculated with soil containing AM fungi compared to uninoculated controls (Sigüenzaet al. 2006a). Furthermore, inoculums collected from high N-deposition sites resulted in the greatest depression in growth. Together, such data suggest that N-deposition is one of the causes of the sharp decline in the abundance of *A. californica* .
Other	It has been suggested that *Artemisia* and other shrubs of coastal sage scrub produce allelopathic substances that inhibit growth or germination of other plant species (Muller et al. 1964). Studies on chemistry of leaves, litter, and soil below shrubs documented the presence of both soluble compounds and volatile monoterpenes and sesquiterpenes that inhibit germination or growth of some plants (Halligan 1973, 1975, 1976). Small mammalian herbivores and seed eaters often restrict foraging to beneath shrub canopies and to within a short distance of protective cover (Halligan 1973, 1974) and may contribute to the conspicuous bare zones on the edge of shrub stands and under canopies.

ECOLOGICAL GENETICS

Ploidy	Diploid with n = 9 chromosomes (Hickman 1993).
Plasticity	There is plasticity in flowering time and seed maturation time evident from among year variation in phenology. Plants in southern California have been observed to be facultatively deciduous in prolonged drought.
Geographic variation (morphological and physiological traits)	Near the coast, plants vary in pubescence, color, chemistry, and physiology (O'Brien 1980). Shrubs vary between a green form with sparse hairs on the leaves to a form with dense hairs that give the plants a gray hue. Populations differ in the distinctness of forms and in their relative frequency. Seedlings raised together generally retain the grayness of their parents but can become grayer with age (O'Brien 1980). Differences in pubescence of shoots correspond to differences in water content, rate and timing of shoot elongation, leaf retention, and chemistry. The lower leaf-water content of gray plants negatively impacts larval growth and fecundity of the beetle, *Trirhabda sericotrachyla* (O'Brien 1980).
Genetic variation and population structure	No studies found. However, prostrate forms have been selected from coastal regions for use as groundcover in landscaping (Perry 2010). This implies that there is genetic variation among populations in stature.

Phenotypic or genotypic variation in interactions with bacteria, herbivores, pollinators, or fungi	No studies found. In *A. tridentata* , a reciprocal transplant study of seedlings and soil suggested that the microorganisms with which the plants interact may be adapted to native soil, and that the plants in turn, may be adapted to native microorganisms (Miglia et al. 2004).
Local adaptation	No studies found. Rogers & Montalvo (2004) outlined ample evidence for evidence of differences in adaptation among populations of the related, but more widespread, shrub *A.tridentata:* 1) Seedling growth of three subspecies from multiple sources grown in common greenhouse environment for 6 mo differed significantly (Booth et al. 1990); 2) in a common garden study with 15 source populations, there were habitat-correlated patterns in seed germination (mean January temperature) and effect of chilling (Meyer et al. 1990, Meyer & Monsen 1990, 1991, 1992); 3) subspecies were adapted to different site conditions, and intervarietal hybrids were adapted to the ecotone between parental habitats (Graham et al. 1995); and 4) subspecies and hybrids differed in absorption of elements, and there was local adaptation in uptake of several elements (Wang et al. 1997, 1999).
Translocation effects/risks	Not studied. This species grows across a range of temperature, elevation, and precipitation gradients that are likely to have influenced differences in adaptation within southern California, notably among Ecological Sections. For other *Artemisia* , seed transfer guidelines state that "when local data suggest moisture gradients and ranges of elevation in excess of 458 m (1500 ft), conservative guidelines could further restrict seed transfer up 153 m (500 ft) in elevation, or down 305 m (1000 ft) in elevation, from the origin collection area" (Mahalovich & McArthur 2004). *A. californica* shares similar reproductive traits and dispersal ability with these other species. It is likely to be highly outcrossed and wind-pollinated, which provides an ability to exchange genes among adjacent stands of plants. Studies are needed, but risk of translocation is likely to be on a scale of habitat zones such as between Ecological Sections M262B and 261B, for which temperature and precipitation can differ sharply (http://www.fs.fed.us/r5/projects/ecoregions/ca_sections.htm). Within zones, the plant grows on many different soil types, which should be noted and matched when possible.
SEEDS	For seed images: Rancho Santa Ana Botanic Garden Seed Program: http://www.hazmac.biz/seedphotoslistgenus.html http://www.hazmac.biz/090223/090223ArtemisiaCalifornica.html
General	The small achenes (dry, one-seeded fruits) are tiny (about 60 micrograms) and build up in the soil seed bank (DeSimone & Zedler 2001). They are about 1.2 mm long, obovate, yellowish brown with a thin, white, membranous fruit coat (Wall & Macdonald 2009). Low purity (5 to 15%) and 60% minimum germination are common standards (Jody Miller, S&S Seeds, pers. com., Stover Seed Company 2010).
Seed longevity	Other species of *Artemisia* do not form long-lived seed banks, but seeds are potentially viable for 5 years if stored dry at under 10 °C (Meyer 2008). See seed storage below.
Seed dormancy	Seeds have physiological dormancy. In tests on the combined effects of light and fire components on germination, 73% of seeds exposed to light germinated on soil, but seeds in the dark did not germinate (Keeley 1987). These results are consistent with field data that show germination may be limited by reduced light (Eliason & Allen 1997, Montalvo et al. 2002).
Seed maturation	The single-seeded fruits (achenes) ripen in December to January (sometimes as early as October), with variation among years and habitats (Eliason & Allen 1997, DeSimone & Zedler 1999).
Seed collecting, harvesting	Mature inflorescences with ripe seeds are brown to golden brown, and seeds fall easily from the small heads. Seeds and seed heads generally fall easily from the inflorescence when ripe and dry (A. Montalvo, pers. obs.). Meyer (2008) describes the following seed collecting methods for other species of *Artemisia* , and these methods work for *A. californica* (A. Montalvo pers. obs.). Seeds tend to be retained in heads when plants are wet. Heads should be dry and seeds brownish when collected. Gently shake, strip, or beat branches with a racket over an open tub, tarp, or hopper to collect ripe seeds.
Seed processing	It is not necessary to remove all the chaff from the seed heads for processing seeds for seeding projects. For bulk collections and cleaning up to 15% purity, material of *Artemisia* can be run through a debearder and screened to separate seeds and large chaff (Stevens et al. 1996). For high purity processing, dry material down and separate dehisced loose floral material from the bottom of the collection bin/bag through a #25 sieve to remove bulk of the chaff (Wall & Macdonald 2009). Wall & Macdonald (2009) then recommend gently rubbing the material over a #45 sieve or a rubber mat to separate the achenes from the flowers and then reprocessing material through the #25 sieve to separate seeds from most chaff. A blower can then be used at speed 19 followed by sieving the captured material through the #25 sieve to catch remaining small twigs and chaff.
Seed storage	Store seeds dry under cool conditions. Meyer (2008) warns that seeds of other *Artemisia* hold viability for only 2 to 3 years under warehouse conditions. She also notes that if seed quality is initially low, that viablity may decrease faster than high quality seed lots. In addition, if seeds are dried down to an optimal moisture content of 6 to 8% , storage at under 10 °C is likely to extend longevity.

Seed germination	Baskin & Baskin (1998) and NPNPP (2010) recommend 23°C in light and seeds germinate about 21 days after sowing (Young in NPNPP 2010). Montalvo & Koehler (2004) provides the following review of germination enhancements: Seeds will germinate when fresh, but stored seeds may need cold stratification to enhance germination (De Hart 1994). When one-year-old seed stored at room temperature, was tested at 19/26ºC on moist filter paper with 12h light, germination was less than 10% both with and without gibiberellic acid treatment (J. Burger, pers. com.). Certain components of fire influence germination. In light, treatment with leachate from charred wood (charate) alone or with heat increases germination by 5 to 14 percent, but germination is about a third lower when seeds are subjected to high temperatures (70 to 120 °C). In contrast, in darkness both heat and charate alone stimulate germination, although heat and charrate together generally decrease germination. Thus buried seeds may require some exposure to fire in order to germinate, but such exposure yields inferior germination compared to light alone (Keeley 1987).
Seeds/lb	5,500,000 seed/lb (S&S Seeds 2010 database). 6,000,000 seed/lb (Stover Seeds 2010 database).
Planting	For sowing containers, mix the tiny seeds with washed fine sand or potting soil to dilute seeds and sow on surface of potting soil (NPNPP 2010, A. Montalvo pers. obs.). For direct seeding, California sagebrush should be planted using shallow seeding methods such as hydroseeding or dry broadcasting followed by seed imprinting. Shallow methods are superior to planting with a range drill because the seeds need light for germination (Montalvo et al. 2002). As in Montalvo et al. (2002), the tiny seeds can be mixed with bran or other carrier to help distribute seeds at intended seeding rates. Meyer (2008) provides detailed information for seeding of *A. tridentata* that may be useful for *A. californica* . For example, she recommends that seeds be planted at or near the surface of a firm seed bed. Too much compaction can be a problem, and seed can get buried too deeply if drilled or broadcasting on too loose a seed bed. Bowler et al. (1994) had success salvaging seedlings from a nearby site and transplanting them into a restoration site in Orange Co. The transplants were watered about once a month the first year.
Seed increase activities or potential  Young plant in increase field. J.Burger	Yes. *A. californica* is being grown for seed increase in Orange County, CA by the Irvine Ranch Conservancy (J. Burger pers. com.), where it was planted at three foot spacing in drip-irrigated raised beds from 2 1/2 inch liners. Plants planted in November and provided with limited supplemental water produced 100% cover and had flower buds by September of the following year.  Planting liners of *A. californica* in raised beds . 18 Nov. 2009, J. Burger Seed increase has been done successfully with three subspecies of *A. tridentata* in Utah (Stevens et al. 1996). Generally, plants were placed 5 to 7 feet apart within rows that were also spaced 5 to 7 feet. For transplants, depending on subspecies, about 20 to 50% of seed crop was produced during the second growing season, increasing to 80 to 100% by the third year. Production was 1000 to 2000 lbs/acre at 15% purity and production stands last at least 15 years.
USES	
Revegetation and erosion control	California sagebrush is an important, fast growing shrub used extensively in roadside revegetation, erosion control, post-fire mitigation, and habitat restoration in coastal California and its inland valleys, especially in coastal sage scrub (Montalvo & Koehler 2004). Newton and Claassen (2003) recommend use of this plant for disturbed lands within the Central Western California and Southwestern California Regions. In about 2006, CalTrans decided the shrub was too flammable to use in revegetation of right of ways in Riverside County (Montalvo, pers. obs.). The shrub has a high flammability index due to its chemistry (particular volatile chemicals), dry deciduous leaves in summer, and fine branching structure (FEIS: Scott 2006). Studies are needed to see if roadside fires spread as efficiently through a closed canopy of mixed shrub species, including *A. californica*, than shrubs mixed with invasive annual grasses.

Habitat restoration	Used extensively in restoration of inland and coastal sage scrub vegetation. Recommended for use in the Central Western California and Southwestern California regions (Newton & Claassen 2003). Burger et al. (2003) found that although *A. californica* in restoration plots supported a higher arthropod abundance and richness than natural stands, their diversity was lower when corrected for number of arthropods sampled. Diversity and abundance may have differed because of the relatively young age of restored plants as compared to naturally-established ones. There are attempts to restore areas that have been type converted to non-native grassland, and this requires control of the grasses. Cox & Allen (2008) found that three years of exotic grass control (grass-specific herbicide, thatch removal, mowing combinations) significantly reduced grass cover over the short term. Continual control of grasses was necessary to prevent their reinvasion into plots seeded with *A. californica* and other native shrubs and herbs. In addition, non-native forbs, especially *Erodium cictarium*, were problematic.
Horticulture or agriculture	Agriculture: Spring rains or artificial late fall and spring irrigation may enhance survival of seedlings (Williams & Hobbs 1989, Eliason & Allen 1997, Padgett et al. 2000). However, in experiments by Padgett et al. (2000) where supplemental irrigation occurred in the first year, the increase in seedlings in irrigated plots was erased by the end of two years. Also, survival is not enhanced by late-season watering in wet years (DeSimone & Zedler 2001). Horticulture: California sagebrush can be compact if kept pruned and subjected to occasional pinching. These aromatic plants remain attractive in the dry season with occasional water (Schmidt 1980, Keator 1994). It prefers well-drained soils and low organic matter content (Wasowski & Wasowski 1995). Naturally occurring prostrate or low-mounding varieties are in cultivation (Browse 1987, Wasowski & Wasowski 1995, Perry 2010) and look good in dry borders or as a foreground to contrasting taller shrubs (Keator 1994). *Artemisia* 'Canyon Grey' was selected from San Miguel Island and has a prostrate growth habit; *A. c.* 'Montara' from coastal San Mateo Co. has a low spreading form (Perry 2010).
Wildlife value	As a dominant member of coastal sage scrub, *Artemisia californica* provides habitat for many plant and animal species and it is an important component of habitat for the rare California gnatcatcher (*Polioptila californica*). Gnatcatcher habitat consists primarily of *Eriogonum fasciculatum - Artemisia californica* and *Encelia californica - A. californica* shrub associations (Weaver 1998). Foraging may preferentially occur in *Artemisia* and *Eriogonum* shrubs (Beyers & Wirtz 1997), in part because they house a high number of arthropods (see Osborne 1998). An arthropod sampling study in sage scrub of southwestern Riverside County found that *A. californica* supports fewer species of arthropods than the co-dominant shrub *E. fasciculatum* (218 vs. 265, respectively) but higher abundances (266 vs. 147 individuals per plot, respectively); the relative abundance of the two shrub species does not alter the arthropod use patterns of the shrubs. Both are important to the maintenance of high arthropod species richness and abundance in coastal sage scrub (Osborne 1998) and thus to the overall health of the community.
Plant material releases by NRCS and cooperators	None.
Ethnobotanical	Leaves of California sagebrush have been used by Native Americans for smoking, in sweat-houses, and various other purposes (Bean & Saubel 1972). The Cahuilla used the plant to ensure proper maturation of girls into women. It is said to stimulate the uterine mucosa, ensuring rapid childbirth and, if regularly consumed as a decoction prior to the onset of each menstruation, to prevent menstrual cramps and alleviate menopausal trauma. Fresh or dried leaves were chewed to alleviate colds (Bean & Saubel 1972). Costanoan Indians applied leaves to wounds or aching teeth for pain reduction, used a decoction to bathe patients with colds, coughs and rheumatism, or consumed leaves and used them as a poultice for treatment of asthma (Bocek 1984).

ACKNOWLEDGMENTS	Partial funding for production of this plant profile was provided by the U.S. Department of Agriculture, Forest Service, Pacific Southwest Region Native Plant Materials Program. Jutta Burger, Irvine Ranch Conservancy, provided comments that improved this document.
CITATION	Montalvo, A. M., C. E. Koehler, and J. L. Beyers. 2010. Plant Profile for *Artemisia californica.* 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. Available online: http://www.rcrcd.com/index.php?option=com_content&view=article&id=88&Itemid=190.

LINKS: REVIEWED DATABASES & PLANT PROFILES

(last accessed September 17, 2010)

Fire Effects Information System (FEIS)	http://www.fs.fed.us/database/feis/plants/shrub/artcal/all.html
Jepson Flora, Herbarium (JepsonOnline)	http://ucjeps.berkeley.edu/cgi-bin/get_cpn.pl?1171&expand=1
Jepson Flora, Herbarium, Second Edition Review (JepsonOnline, 2nd Ed)	http://ucjeps.berkeley.edu/tjm2/review/treatments/compositae.html#1171

USDA PLANTS	http://plants.usda.gov/java/profile?symbol=ARCA11
Native Plant Network Propagation Protocol Database (NPNPP)	http://www.nativeplantnetwork.org/network/ViewProtocols.aspx?ProtocolID=555,2058
Native Seed Network (NSN)	http://www.nativeseednetwork.org/
GRIN (provides links to many resources)	http://www.ars-grin.gov/cgi-bin/npgs/html/taxgenform.pl
Wildand Shrubs	http://www.fs.fed.us/global/iitf/pdf/shrubs/Artemisia%20californica.pdf
Flora of North America (FNA) (online version)	http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250066144
Ethnobotanical	Moerman's Native American Ethnobotany Database From GRIN http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?408997
Calflora	http://www.calflora.org/
Rancho Santa Ana Botanic Garden Seed Program, seed photos	http://www.hazmac.biz/rsabghome.html

Bibliography for *Artemisia californica*

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