| I. SPECIES | *Eriodictyon trichocalyx* A. Heller |
|---|---|
| **NRCS CODE: ERTR7**  juvenile plant, August 2010 | Family: **Boraginaceae** **(formerly placed in Hydrophyllaceae)** Order: **Solanales** Subclass: **Asteridae** Class: **Magnoliopsida**  A. Montalvo , 2010, San Bernardino Co. *E. t.* var. *trichocalyx*  |
| **A. Subspecific taxa** **ERTRT4** **ERTRL2** | 1. *E. trichocalyx* var. *trichocalyx* 2. *E. trichocalyx* var. *lanatum* (Brand) Jeps. |
| **B. Synonyms** | 1. *E. angustifolium* var. *pubens* Gray; *E. californicum* var. *pubens* Brand (Abrams & Smiley 1915) 2. *E. lanatum* (Brand) Abrams; *E. trichocalyx* A. Heller ssp. *lanatum* (Brand) Munz; *E. californicum.* Greene var. *lanatum* Brand; *E. californicum* subsp. *australe* var. *lanatum* Brand (Abrams & Smiley 1915) |
| **C. Common name** | 1. hairy yerba santa (Roberts et al. 2004; USDA Plants; Jepson eFlora 2015); shiny-leaf yerba santa (Rebman & Simpson 2006); 2. San Diego yerba santa (McMinn 1939, Jepson eFlora 2015); hairy yerba santa (Rebman & Simpson 2006) |
| **D. Taxonomic relationships** | Plants are in the subfamily Hydrophylloideae of the Boraginaceae along with the genera *Phacelia, Hydrophyllum, Nemophila, Nama, Emmenanthe,* and *Eucrypta,* all of which are herbaceous and occur in the western US and California. The genus *Nama* has been identified as a close relative to *Eriodictyon* (Ferguson 1999). *Eriodictyon, Nama,* and *Turricula,* have recently been placed in the new family Namaceae (Luebert et al. 2016). |
| **E. Related taxa in region** | Hannan (2013) recognizes 10 species of *Eriodictyon* in California, six of which have subspecific taxa. All but two taxa have occurrences in southern California. Of the southern California taxa, the most closely related taxon based on DNA sequence data is *E. crassifolium* (Ferguson 1999). There are no morphologically similar species that overlap in distribution with *E. trichocalyx.* The most similar taxon vegetatively is the primarily glabrous, also glutinous-leaved (leaves having a gluey exudation) *E. californicum,* but that species has much larger, essentially glabrous lavender flowers and its distribution does not overlap with the hairy yerba santa. |
| **F. Taxonomic issues** | Many taxonomists recognize Hydrophyllaceae as separate from the Boraginaceae (e.g., Hofmann et al. 2016), while others recognize the Namaceae (see I. D.). |
| **G. Other** | This and other species of *Eriodictyon* are important plants of alluvial scrub and chaparral habitats in southern California. Responsible use of the plants in restoration plant palettes requires knowledge of their native range and growth. *Eriodictyon trichocalyx* has been seeded on roadcuts adjacent to wildlands outside its native range along the base of the Santa Ana Mountains where the related *E. crassifolium* is native and would have been the appropriate choice (A. Montalvo pers. obs.). This plant required a longer time to ignite in flammability tests of moist and dry leaf material of several chaparral shrubs and may be beneficial along roadsides within its native range (Montgomery & Cheo 1969). However, planting close to homes should be considered carefully because the plants spread rapidly by rhizomes and can dominate a site. |

## II. ECOLOGICAL & EVOLUTIONARY CONSIDERATIONS FOR RESTORATION

**A. Attribute summary list (based on referenced responses in full table)**

Taxonomic stability - medium
Longevity - long-lived
Parity - polycarpic
Flowering age - 3+ yr
Stress tolerance - moderate to high
Environmental tolerance - moderate
Reproduction after fire - facultative seeder
Fragmentation history - historical and recent
Habitat fragmentation - high at low elevations
Distribution - intermediate, alluvial and slopes

Seeds - dormant, long lived
Seed dispersal distance - short
Pollen dispersal - intermediate to far
Breeding system - outcrossed
Population structure - unknown
Adaptive trait variation - unknown
Chromosome number - stable
Genetic marker polymorphism - unknown
Average total heterozygosity - unknown
Hybridization potential - low

1. *E. t* var. *trichocalyx*
SDM projected midcentury suitable habitat - 27–91 % stable
SDM projected midcentury habitat gain - gain > loss for 3 of 5 models (assuming unlimited dispersal)

2. *E. t.* var. *lanatum*
SDM projected midcentury suitable habitat - 0–64 % stable
SDM projected midcentury habitat gain - loss >> gain for all 5 models (assuming unlimited dispersal)

**B. Implications for seed transfer (summary)**

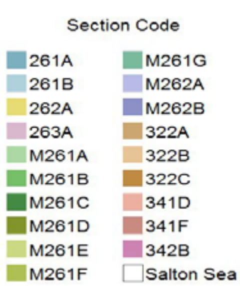
In California, *E. t.* var. *trichocalyx* is geographically separated from *E. t.* var. *lanatum*, except in southern San Diego County and species distribution modeling (SDM) of the southern California portion of taxon ranges indicates substantial differences between varieties in habitat suitability and projected future gain vs. loss in suitability (see Section V), suggesting it would be best to use varieties within their own home ranges. The need to move plants outside baseline predicted suitable habitat of var. *trichocalyx* to mitigate for climate change is not supported by SDM projections. Migration corridors for self-dispersal may be especially important because the large variation in SDM results for var. *lanatum* makes the direction of such mitigation highly uncertain. The ability of plants to form long-lived seed banks and to spread vegetatively may buffer them from rapid changes. The clonal structure suggests that seeds for restoration must be collected from multiple stands in the same geographic area to ensure genetically diverse seed lots for restoration.

## III. GENERAL

**A. Geographic range**

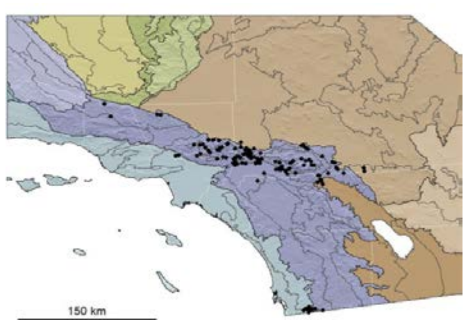
1. Southwestern California from Ventura County and Baja California; primarily near and through the San Gabriel and San Bernardino Mountains (Transverse Ranges) (Munz 1974, Hannan 2013).
2. Southwestern California from southern Riverside Co., south into Baja California; primarily along the western edge of the Sonoran Desert from the Santa Rosa Mts (Peninsular Ranges) to Baja Californa (Munz 1974, Hannan 2013).

**B. Distribution in California; ecological section and subsection**
(sensu Goudey & Smith 1994; Cleland et al. 2007)

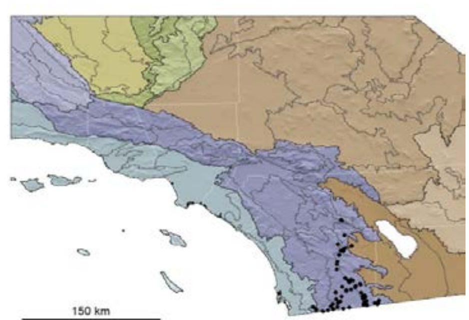



Map includes validated herbarium records (CCH 2016) as well as occurrence data from CalFlora (2016) and field surveys (Riordan et al. 2018).

*E. t.* var. *trichocalyx*




*E. t.* var. *lanatum*




1. *Eriodictyon trichocalyx* var. *trichocalyx*
Ecological Section/Subsection:
Southern California Coast 261B: g,i
Southern California Mountains and Valleys M262B: b,d,e,g-j,n
Mojave Desert 322A: g,p (bordering M262B)
Colorado Desert 322C: a (bordering M262B)

2. *Eriodictyon trichocalyx* var. *lanatum*
Ecological Section/Subsection:
Southern California Coast 261B: i
Southern California Mountains and Valleys M26B: m-p
Colorado Desert 322C: b (bordering M262B)

**C. Life history, life form**

Polycarpic, woody shrub with evergreen leaves; sometimes suffrutescent.

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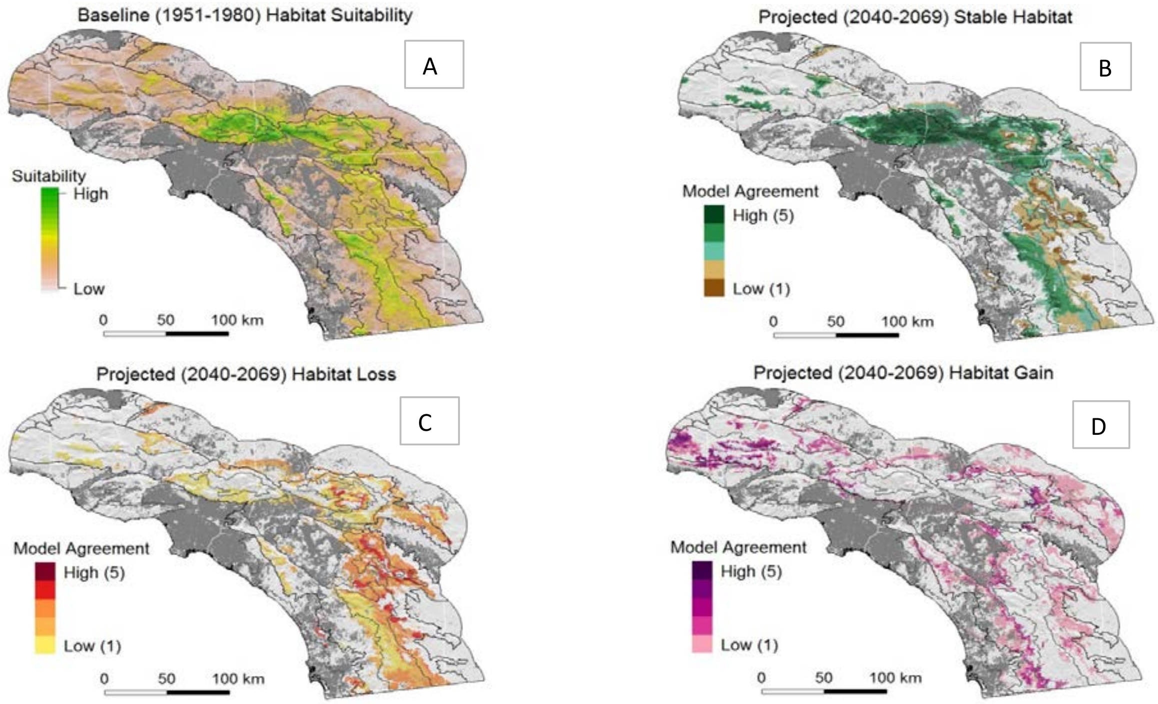
| **D. Distinguishing traits** | 1. *E. t.* var. *trichocalyx.* Erect shrubs 0.5 to 2 m tall with 5 to 15 cm long, lanceolate to oblanceolate, petiolate leaves that are dark green and somewhat glutinous above, with margins rolled under, and only sparsely hairy below between prominent yellow-green net-veins, with all the veins obvious. Coiled, branched inflorescences are produced at the tips of branches and bear 6-8 mm long, white to lavender, funnel-shaped flowers with spreading limbs that are covered with long, dense hairs on the outer surface of both the corolla and calyx (Munz 1974, Hannan 2013).<br>2. *E. t.* var. *lanatum.* Essentially as above but the lower surface of the leaves is densely white-tomentose such that only the midvein and secondary veins are obvious (McMinn 1939, Munz 1974). |
| **E. Root system, rhizomes, stolons, etc.** | Extensive spreading rhizomes (see photos in V. G. Flooding or high water tolerance). |
| **F. Rooting depth** | Shallow roots (less than 2 feet deep) extend from shallow, spreading rhizomes (A. Montalvo pers. obs.; see photo in IV. G. Flooding or high water tolerance). |

## IV. HABITAT

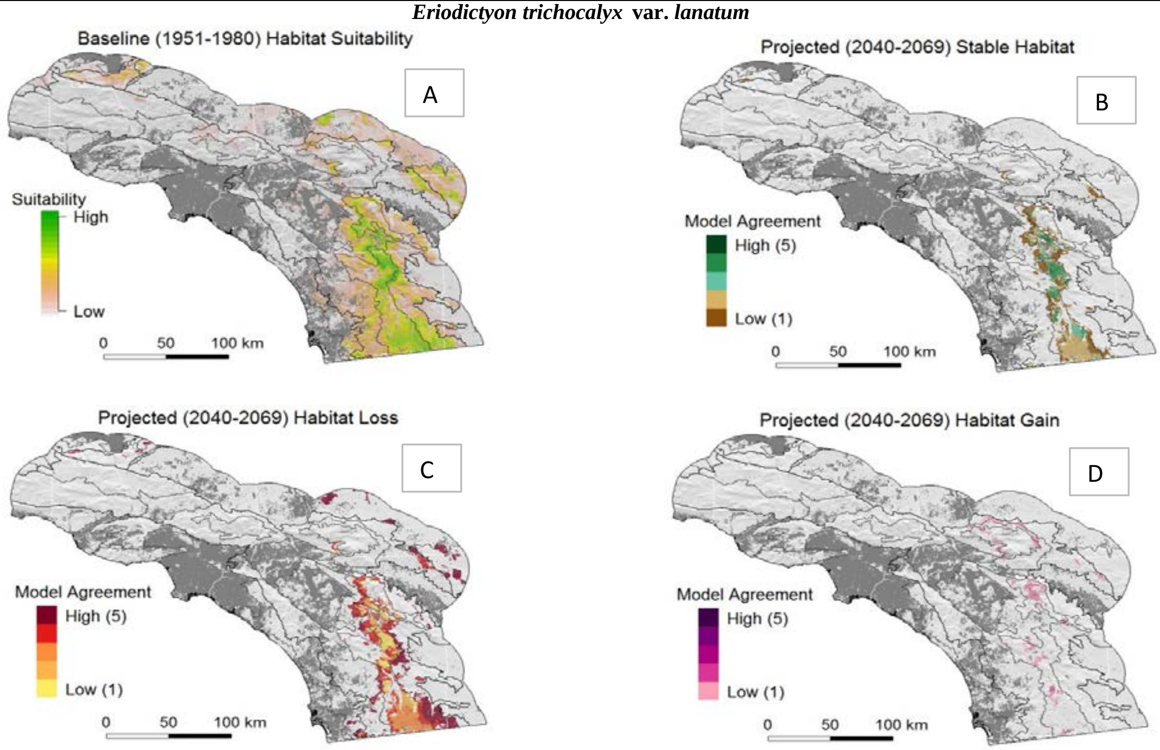
| | |
|---|---|
| **A. Vegetation alliances, associations** | Plants occur in chaparral, alluvial scrub, Joshua tree woodland vegetation, and open pine forest (Buck-Diaz et al. 2011, Hannan 2013). Plants often co-occur with *Lepidospartum squamatum, Eriogonum fasciculatum,* and *Hesperoyucca whipplei* along large washes. |
| **B. Habitat affinity and breadth of habitat** | 1. Alluvial deposits and sandy plains along washes and inland valleys. In the channels of washes and on alluvial terraces above perennial streams. Also found along roadsides, slopes, and other areas with frequent disturbance.<br>2. Primarily in chaparral on dry slopes and ridges of desert mountains (McMinn 1939, Munz 1974). |
| **C. Elevation range** | 1. From near sea level to 2600 m. (Hannan 2013)<br>2. 300- 2200 m. (Hannan 2013) |
| **D. Soil: texture, chemicals, depth** | 1. In dry rocky soil, sandy soils, and in well-drained alluvial deposits with a high proportion of sand and gravel (Munz 1974, A. Montalvo pers. obs.).<br>2. In dry rocky soils (Munz 1974). |
| **E. Precipitation** | Occurs primarily in Mediterranean climate zone with cool to cold moist winters and warm to hot dry summers. Plants typically grow in areas with 10 to 40 in precipitation. For ecological sections occupied by *E. trichocalyx*, annual normal precipitation ranges from 10 to 25 in (250 to 640 mm) in the Southern California Coast (261B) and from 10 to 40 in (250 to 1020 mm) in the Southern California Mountains and Valleys (M262B). In the Mojave Desert (322A) and Colorado Desert (322C) at the eastern margin of the species range, annual normals range from 3 to 10 in (80 to 250 mm) and 2 to 6 in (50 to 150 mm), respectively. |
| **F. Drought tolerance** | Drought tolerant. Plants grow on dry, droughty slopes and soils (McMinn 1939, Munz 1974). |
| **G. Flooding or high water tolerance** | Tolerates flood, scour, and sediment deposition but not long-standing water. Plants are adapted to well-drained alluvial areas that receive flood waters along waterways, but where the water vacates quickly.<br> <br>Rhizome with shoots exposed after flood event in San Bernardino Co. 1/23/11 A. Montalvo |
| **H. Wetland indicator status for California** | None. |
| **I. Shade tolerance** | Full sun. |

# V. CLIMATE CHANGE AND PROJECTED FUTURE SUITABLE HABITAT

***Eriodictyon trichocalyx* var. *trichocalyx***




***Eriodictyon trichocalyx* var. *lanatum***




**A. Species Distribution Models (SDM forecasts from Riordan et al. 2018) Map descriptions**

Modeled habitat suitability under (A) baseline (1951–1980) and (B–D) projected midcentury (2040–2069) climate conditions. Projected future habitat suitability maps show agreement across five different climate model scenarios: (B) stable = suitable under both baseline and future conditions; (C) loss = suitable under baseline but unsuitable under future conditions; (D) gain = unsuitable under baseline and becoming suitable under future conditions. In all maps, land area that has already been converted to urban and agriculture land uses is masked in dark gray (FRAP 2015 Assessment; https://map.dfg.ca.gov/metadata/ds1327.html).

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| **B. SDM summary** | Species distribution modeling suggests that projected climate change could affect the two varieties of *E. trichocalyx* very differently. Assuming a future of continued high greenhouse gas emissions, Riordan et al. (2017) predicted 0–64 % of baseline habitat for *E. t.* var. *lanatum* would remain suitable (stable) under mid-century conditions across future climate scenarios from five different general circulation models (GCMs) (V. A. Fig. B). Predicted loss (36–100 %) in suitable habitat exceeded gain (0–21 %) for variety *lanatum* across all five climate scenarios (V. A. Figs. C-D) with greatest loss under the wettest climate scenario. In contrast, *E. t.* var. *trichocalyx* had less severe, though still variable, predicted loss in suitable habitat with 27–92 % stable suitable habitat mid-century. Gain in suitable habitat was for variety trichocalyx was variable (10–181 %) and exceeded loss under three climate scenarios. The greatest loss in suitable habitat was predicted under the driest climate scenario. Overall, Riordan et al. (2018) predicted greater climate exposure and lower habitat stability for variety *lanatum* compared to variety *trichocalyx*. The climate scenario with the greatest predicted loss in suitable habitat also differed between the varieties.<br>The combined effects of land use, climate change, and altered fire regimes could negatively affect the species. In southern California, human activity is the primary driver of fire (Keeley & Syphard 2016) with fire ignitions and fire frequency increasing with human population growth and the proximity of developed lands (Syphard et al. 2009). *Eriodictyon. trichocalyx* is able to regenerate from resprouting rhizomes or seed after fire (see VI. D. Regeneration after fire or other disturbance), but too-frequent fire can be detrimental to many shrubs and is known to cause conversion of chaparral to annual grasses (Haidinger & Kelley 1993, Zedler et al. 1983). However, this species may be able to tolerate shorter fire-return intervals relative to other chaparral shrubs owing to its fast growth and ability to invade grasslands. The high level of habitat conversion and fragmentation in lower elevations of the species' range may pose a considerable barrier to dispersal and gene flow that could negatively affect the adaptive capacity and ability of the species to respond to changing conditions. Riordan and Rundel (2014) caution that land use may compound projected climate-driven losses in habitat suitability for southern California shrublands. |
| **C. SDM caveat (concerns)** | The five general circulation models used to predict future habitat suitability assume a 'business-as-usual' scenario of high greenhouse gas emissions that tracks our current trajectory (Intergovernmental Panel on Climate Change, IPCC scenario RCP 8.5). They show how climate may change in southern California and highlight some of the uncertainty in these changes. The true conditions at mid-21st century, however, may not be encompassed in these five models. Predictions of current and future habitat suitability should be interpreted with caution and are best applied in concert with knowledge about the biology, ecology, and population dynamics/demographics of the species. They are best interpreted as estimates of exposure to projected climate change. Our models characterize habitat suitability with respect to climate and parent geology but do not include other factors, such as biotic interactions or disturbance regimes, that may also influence species distributions. Additionally, they do not include the adaptive capacity of a species, which will impact its sensitivity to changes in climate. See Riordan et al. (2018) for more information on SDM caveats. |

## VI. GROWTH, REPRODUCTION, AND DISPERSAL

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|---|---|
| **A. Seedling emergence relevant to general ecology** | The tiny seedlings emerge in open areas during the winter to spring rainy season, especially following fire. In spring surveys at many sites, Keeley et al. (2006) observed most seedlings in the first two years after wildfire. |
| **B. Growth pattern (phenology)** | Vegetative growth of both varieties is primarily during the cool rainy season with flowering late spring to early summer. Higher elevation populations flower later than lower elevation populations and flowering in Baja California is likely to differ from plants in southern California habitats.<br><br>1. *E. t.* var. *trichocalyx.* Flowering occurs primarily from April through July depending on location and elevation (CCH 2016).<br>2. *E. t.* var. *lanatum.* Flowering occurs primarily from April to June (CCH 2016). |
| **C. Vegetative propagation** | Plants produce shoots readily from spreading rhizomes and can occur in clonal patches (Montalvo pers. obs.). Scouring flood waters may break apart rhizomes and allow colonization as pieces become buried by moist sediments. Owing to the potential for large clones, seeds will need to be collected from well-spaced groups of plants to ensure genetic diversity in the seed accessions. |

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| **D. Regeneration after fire or other disturbance**<br><br>Leaves on resprouts after fire can be large. | <br>Resprouts of *E. t.* var. t*richocalyx* eight months after fire in the foothills of the San Gabriel Mountains. Photos, A. Montalvo<br><br>Plants recolonize sites from seed or from sprouting rhizomes after fire or other disturbance. Keeley et al. (2006) classify this often suffrutescent plant as a "facultative seeder", plants that recruit from both seedlings and sprouts after fire. In their study, a mean of 87% of plants resprouted and most seed germination occurred within the first two years following fire (data grouped for *E. trichocalyx* and *E. crassifolium* ). Resprouting after moderate to low intensity fire is also know from the similar species *E. californicum* (Howard 1992).<br>Shoots also emerge from rhizomes after flood and sedimentation disturbance (see IV. G) as in *E. californicum* (Howard 1992). |
| **E. Pollination** | Moldenke (1976) stated that flowers in the genus *Eriodictyon* are pollinated primarily by bees in the genera *Bombus, Nomadopsis, Chelostoma, Anthophora* , and *Osmia* . Messinger & Griswold (2002) found that the related *E. tomentosum* attracted over50 species of pollen collecting bees. Kremen et al. (2002) found 35 species of bees on *E. californicum* , including species important to pollination of crops. Based on the similarity of flower form and floral displays, *E. tricocalyx* is likely to be attractive to a similar diversity of pollinators.<br>The larger bees, such as *Bombus* and honey bees are known to forage over substantial distances of over 1,000 to 10,000 km, and several species of Osmia were found to forage over hundreds of meters (Zurbuchen et al. 2010). Declines in native bee and honey bee populations are of great concern (Murray et al. 2009). Habitat fragmentation from agriculture and urbanization have resulted in declines in pollinator populations and decreases in pollination services (e.g., Kremen et al 2002). In San Diego coastal sage scrub, Hung et al. (2015) found that nearby habitat fragments (each 5−80 ha and surrounded by urbanization) supported 14% fewer species of native bees than the larger reserve habitats (each > 500 ha). Habitat corridors are used by bees and are needed to help maintain bee and plant populations (Townsend & Levey 2005). |
| **F. Seed dispersal** | Seeds are primarily gravity dispersed (Hofmann et al. 2016). Capsules are held about 1.5 m above the ground on branched infrutescences (fruiting inflorescences) and seeds shake out of capsules and fall to the ground when disturbed by wind or animals (A. Montalvo pers. obs.). The branches are springy, so when disturbed by large animals or strong winds, seeds may travel several meters. In areas that receive sheet flows or stream flows, seeds may be secondarily dispersed by water or foraging animals. |
| **G. Breeding system, mating system** | The rare, clonal, *Eriodictyon capitatum* is self-incompatible (Elam 1994), requiring cross pollination for successful seed production. Self-incompatibility is expected in perennial species of *Eriodictyon,* but flowers in the Hydrophyllaceae are often self-compatible (Hofmann et al. 2016). However, they generally have anthers that mature before stigmas become receptive (Hofmann et al. 2016), a mechanism that promotes cross-pollination. *Eriodictyon tricocalyx* needs study to confirm its breeding system. |
| **H. Hybridization potential** | No reference found. Many of the generalist species of bees that visit *E. californica, E. tomentosa,* and *Eriodictyon* in general, are likely to visit more than one species of *Eriodictyon* . If populations overlap in flowering time and are in close proximity, cross-pollination is likely; however, no observations of hybrids have been found. |
| **I. Inbreeding and outbreeding effects** | No information found. However, if plants are self-incompatible, cross pollination among clones would be important to seed production. |

## VII. BIOLOGICAL INTERACTIONS

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|---|---|
| **A. Competitiveness** | Plants are likely to be good competitors and are noted to establish within areas type-converted to non-native grasses (see X. B. Habitat restoration). Once they are mature and capable of lateral growth, they can become a dominant plant on the lower to middle alluvial terraces along major streams, and on slopes. The similar *E. californicum* which haslow palatability increases rapidly at sites where surrounding more palatable plants are heavily grazed or browsed (Howard 1992). |
| **B. Herbivory, seed predation, disease** | Larvae and adults of the Chrysomelid beetle, *Trirhabda eriodictyonis* , feeds on the leaves of *E. crassifolium* and *E. trichocalyx* (Gould 2014) . In the similar *E. californicum* , the resin and nitrogen content of the leaves was highest in young leaves and decreased from February to June (Johnson et al 1984). Older leaves had the highest levels of herbivore damage. |

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| **C. Palatability, attractiveness to animals, response to grazing** | Bohm & Constant (1990) examined the leaf surface chemistry of *E. trichocalyx* var. *trichocalyx* collected from the Devil's Punchbowl area of the San Gabriel Mountains. Extracts of the leaf resin contained a number of flavinoid compounds, including naringenin, eriodictyol, eriodictyol 3'-methyl ether, apigenin, luteolin, chrysoeriol, and isorhamnetin, similar to compounds found in *E. californicum, E. angustifolium,* and *E. tomentosum*. The leaf surface chemistry has been implicated in defense against herbivory.<br>Foliage is not likely to be palatable to many wildlife species, but if it is browsed, it can recover by resprouting from rhizomes. Of the genus, *E. californicum* is considered by Sampson & Jesperson (1963) to be the most important for browse; however, spring growth may provide fair to poor browse for deer but the plants are considered useless to livestock. |
| **D. Mycorrhizal? Nitrogen fixing nodules?** | No studies found for any species of *Eriodictyon*. In a review of mycorrhizal associations, Brundrett (2009) stated that most taxa studied in the family Hydrophyllaceae have been non-mycorrhizal. In a review by Wang & Qiu (2006), most taxa of Boraginaceae (excluding plants that may be classified as Hydrophyllaceae) have been reported as having arbuscular mycorrhizae. |
| **VIII. ECOLOGICAL GENETICS** | |
| **A. Ploidy** | Haploid count of n = 14 (JepsonOnline 2nd Ed, Munz 1974) |
| **B. Plasticity** | In the similar *E. californicum*, two types of leaves are produced over the growing season (Johnson et al. 1984). The first leaves grow from February to April and then dehisce. A second set of more drought tolerant leaves then grow and persist during the summer season. These two types of leaves also have differences in resin content, with summer leaves having a higher resin content. |
| **C. Geographic variation (morphological and physiological traits)** | No data found. |
| **D. Genetic variation and population structure** | No data found. The species forms large clones. Sampling for genetic variation will need to allow for adequate spacing among clumps of plants (likley > 10 m) so that genotypes of single individuals are not resampled. |
| **E. Phenotypic or genotypic variation in interactions with other organisms** | No data found. |
| **F. Local adaptation** | No data found. |
| **G. Translocation risks** | No data found. The taxa have geographically restricted ranges that suggest differences in adaptation to home regions. When establishing new populations, it will be important to use seeds from multiple clones to reduce inbreeding and ensure genetic diversity in incompatibility alleles in this presumably self-incompatible species (see VI. G, I). |
| **IX. SEEDS** | Rancho Santa Ana Botanic Garden Seed Program: view image of seeds of *E. t.* var. *trichocalyx* at http://www.hazmac.biz/161205/161205EriodictyonTrichocalyxTrichocalyx.html<br><br><br>Seed image by John Mcdonald, RSA<br>1 mm |
| **A. General** | Four to eight, approximately 1 mm long seeds in hard, dehiscent capsule. Seeds dark brown to black, with rows of shallow, transverse ridges (A. Montalvo, pers. obs.). Pure live seed (PLS) is likely to vary considerably among seed lots.<br>S&S Seeds (2017): average is 91,200 live seeds/bulk lb; 650,000 seeds per PLS lb.<br>Stover Seed Company (2015): report 20% purity and 40% germination and 3,000,000 seeds/lb (gives 240,000 PLS/lb). |

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| **B. Seed longevity** | Expected to be long given type of seed dormancy. Seeds of many species of Hydrophyllaceae are long-lived in soil seed banks (Gamboa-de Buen & Orozco-Segovia 2008). |
| **C. Seed dormancy** | Seeds of species that have been classified within the Hydrophyllaceae often have linear embryos that are underdeveloped at seed dispersal stage, complex cycles of dormancy and non-dormancy, and heterogeneity in germination response. Burial in soil may help to prime seeds for germination and those that follow fire tend to have seed coats that become permeable and able to germinate after exposure to smoke (Gamboa-deBuen & Orozco 2008). Seeds of *E. angustifolium* are linear and fully developed, but seeds are considered dwarf (Martin 1946 in Baskin & Baskin 1998). Such seeds often have morphological or morphophysiological dormancy (Baskin & Baskin 1998). In addition to smoke, light, heat, and charate may also influence germination in *Eriodictyon*. In light, *E. crassifolium* was found to increase germination after treatment with heat at 120$^{o}$C for 5 min, after heating to 100$^{o}$C for 5 min followed by treatment with liquid prepared from charred wood (charate), or by treating with charate (75%, 82%, 60%, respectively); few seeds germinated in the dark, but heat partially overcame the need for light (48%, 28%, 6%, respectively (Keeley 1987). Went et al. (1952) found that a 5 min. heat shock at 90 ºC stimulated germination in both *E. crassifolium.* and *E. trichocalyx*. |
| **D. Seed maturation** | Seeds are ripe in July-August, depending on elevation and rainfall patterns. The capsules sit inside the dry calyx and are straw-colored to brownish when ready to collect. Seeds are dark brown to black when ripe. |
| **E. Seed collecting and harvesting** | Collect whole, dry, fruiting inflorescences into open container, paper bags, or small mesh sacks for later extraction of seeds. Seeds have traditionally been wildland collected. |
| **F. Seed processing** | The tiny seeds need to be extracted from the hard, thick-walled capsules similar to the way described by Wall & Mcdonald (2009) for *E. crassifolium*. This can be done by hand for small collections by threshing (rubbing) the floral material with capsules on a metal screen or sieve so that they break apart and release the seeds into a container below. The captured material is then winnowed or sieved through a series of smaller meshed screens; #20 and #45 sieves work well. Blower speed: start at low speed (speed varies with machine), resieve through #18 sieve several times. |
| **G. Seed storage** | Store under cool, dry conditions. Cool, dry storage is expected to extend seed longevity. |
| **H. Seed germination** | Seeds germinate in the cool winter, rainy season. Seeds at colder, winter elevations are expected to emerge later in the season than at lowest elevations. In southern CA, Keeley et al. (2006) detected seedlings of *E. crassifolium* and *E. trichocalyx* in post-fire monitoring plots at chaparral and coastal sage scrub sites during spring monitoring visits (the two species were lumped for analysis). Most seedlings emerged in the first two years following fall fires; 52% of seedlings were found in the first year, but 24%, 10%, 12% and 2% were found in the 2nd, 3rd, 4th, and 5th years, respectively. |
| **I. Seeds/lb** | 91,000 average live seeds per bulk pound and 650,000 seeds per PLS lb (S&S Seeds 2017). |
| **J. Planting** | Seeds should be planted in the fall to take advantage of cool winter temperatures and rainfall. |
| **K. Seed increase activities or potential** | None known. This is an unlikely candidate for planting in agricultural fields because each plant can spread vegetatively many feet from where it is planted. Plant sends up sprouts from long, spreading root systems and resulting clones can be large in extent (see III. C, D.). Farming multiple genotypes would take up much space and clones would intermingle over time. Seeds are best collected from wild populations. |
| **X. USES** | |
| **A. Revegetation and erosion control** | This is an appropriate candidate species to use within alluvial habitats disturbed by construction or by flooding events thorough communities within the range of the species. It grows fast and can be planted as seed or from container plants propagated from seeds or rhizome cuttings. It is slower to ignite than a number of other shrub species, including *Adenostoma fasciculata* and *Salvia mellifera* with which it can co-occur, and may be especially appropriate for road banks and fire breaks (Montgomery & Cheo 1969). The plant recovers rapidly from disturbance. Newton & Claassen (2003) list the related *E. californica* as a species seeded for erosion control within its range. It is possible that *E. trichocalyx* has been seeded along roadsides in the Transverse Ranges; it has been mis-specified and seeded outside its range in Riverside Co., CA at the base of the Santa Ana Mountains (see I. G. Other). |
| **B. Habitat restoration** | Within its home range, this is an appropriate candidate species to use for restoration of alluvial scrub habitat that has been disturbed by construction or by mechanical removal of sediments after flooding events through communities. It grows fast from seed to maturity and can be planted from container stock or direct seeded. Plants successfully colonized deliberately type-converted watershed habitat within the San Dimas Experimental Forest in the San Gabriel Mountains, indicating good competitive ability when confronted with non-native grasses and other ruderal species (J. Beyers pers. obs.). |

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| **C. Horticulture or agriculture** | As with other related species of *Eriodictyon*, the spreading rhizomes and highly clonal nature of this plant make it inappropriate for farming seeds with adequate genetic diversity. Container plants can be propagated from seeds or root cuttings. The plants are highly clonal so care needs to be taken to ensure adequate genetic diveristy of propagation material, especially if using cuttings.<br>The related *E. californicum* has shown great promise as a hedgerow plant because it attracts many species of bees important to pollination of crops (Kremen et al. 2002). However, a buffer between crops and hedgerows of the more extensively spreading species of *Eriodictyon* may be needed to control invasion into fields. *Eriodictyon* species are good for bee and butterfly gardens (Calscape 2017). |
| **D. Wildlife value** | *Eriodictyon trichocalyx* provides cover for wildlife and the flowers are a valuable food resource for a wide variety of bees, wasps, and butterflies (Calscape, VI. E. Pollination). Use of both varieties by browsers is likely to be similar to the related species, *E. californicum*, which also has glutinous, aromatic leaves. *E. californicum* has been rated as fair to poor for deer and poor to useless for sheep, goats, and horses, and none of the other species in the genus are known to be important browse plants (Sampson & Jesperson 1963, Howard 1992). In one location in Madera County, in the first year after fire over 75% of the new growth of seedlings and resprouts were browsed by deer, but only about 30% was eaten in the second year; newly flushed leaves in mature stands were used much less (Sampson & Jesperson 1963). Range managers in the past have treated poor browse species such as *E. californicum* with herbicide to make room for desirable browse, a treatment that is contrary to habitat conservation. |
| **E. Plant material releases by NRCS and cooperators** | None. |
| **F. Ethnobotanical** | The common name of the genus *Eriodictyon*, yerba santa, is Spanish for holy herb owing to the plant's' medicinal value (Timbrook 2007). Garcia & Adams (2009) report the Chumash used that both *E. tricocalyx* and *E. crassifolium* to treat lung problems (asthma, tuberculosis, and bacterial pneumonia); to ease pain, roots were chewed or rubbed on skin. Leaves can quickly stop bleeding and chewing on leaves helps to keep the mouth moist. Plants contain many flavonoids (Bohm & Constant 1990); among them, eriodictyol might have antibacterial, anti-inflammatory, and expectorant properties. Antibacterial properties were found for the flavenoid eriodin extracted from *E. californicum* (Salle et al. 1951). Many other medicinal uses are listed (NAE 2016). |
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| **XII. CITATION** | Montalvo, A. M., E. C. Riordan, and J. L. Beyers. 2017. Plant Profile for *Eriodictyon trichocalyx.* 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: https://www.rcrcd.org/plant-profiles |
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## XIII. LINKS TO REVIEWED DATABASES & PLANT PROFILES

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| **Calflora** | https://www.calflora.org/ |
| **Calscape** | https://calscape.org/Eriodictyon-trichocalyx-() |
| **Fire Effects Information System (FEIS)** | Only *E. californicum* is treated: https://www.feis-crs.org/feis/ |
| **Jepson Flora, Herbarium (Jepson Interchange)** | https://ucjeps.berkeley.edu/cgi-bin/get_cpn.pl?24674 |
| **Jepson eFlora (JepsonOnline, 2nd ed.)** | https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=24674 |
| **USDA PLANTS** | https://plants.usda.gov/core/profile?symbol=ERTR7 |
| **Native Seed Network (NSN)** | https://nativeseednetwork.org/ |
| **GRIN (provides links to many resources)** | https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch.aspx |
| **GRIN as above, second link-** | https://npgsweb.ars-grin.gov/gringlobal/taxonomydetail.aspx?id=455785 |

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| **Native American Ethnobotany Database (NAE)** | http://naeb.brit.org/uses/search/?string=Eriodictyon+trichocalyx |
| **Rancho Santa Ana Botanic Garden Seed Program, seed photos** | http://www.hazmac.biz/161205/161205EriodictyonTrichocalyxTrichocalyx.html |
| **XIV. IMAGES** |  |

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