

Plant Species Evaluation Form

Grimmia torenii Hastings

TOREN'S GRIMMIA

Family: Grimmiaceae
(CNPS 2017)

PLANTS Symbol: N/A
(USDA 2017)

Calif. Endemic: Yes
(CNPS 2017)

Synonyms/Other Names: There are no taxonomic synonyms for this species; however, prior to the official publication of this species, several misidentifications have been published in the California botanical literature. The first specimen, collected in 1972 by David Toren, was identified by Dan Norris as *Grimmia heterophylla* Kindb. ex Macoun & Kindb. The specimen kept this name for two decades and appeared in two publications as such (Toren and Sigal 1974; Toren 1977). This, and an additional collection, were re-identified as *Grimmia tergestina* Tomm. Ex Bruch & Schimp. and appeared as such in the Catalog of California Mosses (Norris and Shevock 2004). This entity was again re-identified as *Grimmia ovalis* (Hedwig) Lindberg and appeared in *Flora of North America North of Mexico* as such (Hastings and Greven 2007). It was described as a separate entity from these three species by Hastings in 2008.

Identification Issues: In general, *Grimmia* can be identified by their very dense, cushion growth, in which branching cannot be seen. They also tend to inhabit arid habitats, often several species co-occurring in these sites. Malcolm et al (2009) assert that the whitish perichaetial (at the base of the sporophyte) leaves are a good, if crude, field diagnostic for *G. torenii* in particular, giving the plant a whitish, fuzzy appearance.

Grimmia torenii has been misidentified in the past by experts as *G. ovalis* and *G. tergestina* because it looks superficially like a hybrid between these two species, being similar in its gametophyte features to the former and similar in its sporophyte features to the latter. It is clearly closely related to both; however, a recent analysis of specimens indicates that *G. tergestina* does not occur in North America (Hastings 2008). Related *Grimmia* species are widespread and plastic in the features used for identification, *G. torenii* is narrow in its habitat preference as well as in its morphological traits. It therefore may have some overlap in a particular trait with other *Grimmia* species, so multiple traits, plus habitat type, should be utilized for identification.

Hastings (2008) describes in detail several characters to focus on for identification: *G. torenii* differs from *G. tergestina* in having perichaetial leaves that are greatly inflated, broadly lingulate, filmy-hyaline throughout except for a small chlorophyllose area projecting into the awn, and with the apex abruptly narrowed to a long, subulate point. Its calyptra differs from that of *G. tergestina* in being small, barely covering the operculum. *Grimmia torenii* differs from *G. ovalis* in its mature capsules remaining immersed (tucked into the gametophyte leaves), with small, mitrate calytrae and straight, long-rostrate to subulate opercula. In fact, *G. torenii* is distinct from all other North American *Grimmia* species in several sporophyte characters: it has unusual, disarticulating peristome teeth, a sheathing operculum membrane that remains on the peristome teeth, and bulging cells beneath the rim of the operculum. It also has a distinctive

Grimmia torenii Hastings

gametophytic character—its leaves have mammillose-papillose cuticular leaf cells, giving a dull appearance to the surface of some leaves. This may be a xeric adaptation as this trait is more pronounced on the most exposed leaves. The awns of the leaves of *G. torenii* have dense and robust teeth, and this character can be used, with caution, to identify vegetative specimens from related species (e.g. *G. poecilostoma* awns have few, subtle teeth).

The ecological distinctions of *G. torenii* that are useful in identification are that it prefers metavolcanic pillow basalts (ophiolites) and some sandstones of the Franciscan Formation. This substrate preference is apparently strict, because, in years of collecting, *G. torenii* has yet to be found on similar, more widespread rock types where other *Grimmia* species are found. For instance, the apparently closely related *Grimmia ovalis* prefers acid or neutral substrates, although in two sites (Elk Mountain and Mt. Diablo) both species were collected. Members of the genus *Grimmia* in general favor mafic (heavy metal rich) substrates (Hastings 2008), but typically acidic ones. *Grimmia tergestina* is also a calciphile, but instead of limestone and basic sandstones, not on pillow basalts.

Taxonomy:

Species in Genus: 75-90 species worldwide. It is especially well-represented in California with several recently described species. It is perhaps California's most widespread petricolous genus throughout all bioregions in the state. Often a single rock outcrop will host multiple species of *Grimmia*. (Wilson 2017).

Etymology: The genus *Grimmia* is named for J. F. K. Grimm, 1737-1821, physician and botanist of Gotha, Germany (Hastings and Greven 2007). *Grimmia torenii* is named for David Toren, California bryologist, who collected the type material of the species and championed the recognition of this species as a distinct element of the flora (Wilson 2017).

Plants to 1.5 cm high, in hoary green to gray-green cushions, opaque-green to nearly black below. Leaves loosely imbricate when dry, loosely erect-spreading when moist, somewhat concave but not at all keeled, to 3 mm long with the awn constituting nearly 1/2 of that length, ovate-lanceolate from a loosely sheathing somewhat expanded base, 2.5–3.5: 1. Median leaf cells in regular longitudinal rows, unistratose in the expanded base but uniformly bistratose in the limb, smooth, to 7 µm wide, isodiametric with lumens irregular but without corner thickenings. Marginal cells not differentiated. Basal juxtacostal cells elliptical, to 3: 1, to 15 µm wide, with irregularly thickened lateral walls. Basal marginal cells transversely elongate, 0.5–0.7: 1, to 15 µm wide. Costa flared at the base and filling 1/3–1/4 of immediate leaf base, narrowed and obscure above, percurrent in the somewhat acuminate awn. Costa cross-section at leaf middle broad and flattened, less than 1.5 times as thick as the adjacent leaf, with a weak abaxial band of stereids or substereids and with a single layer of larger cells on the adaxial face. Margin of leaf limb plane to incurved, entire below. Awn strongly decurrent with its margin somewhat serrulate, and with its surface spinose-prorate. Axillary hairs to 100 µm long, with 6–8 nearly isodiametric and thick-walled cells, without a basal brown cell. Rhizoids red brown, to 15 µm wide at base, smooth. Stem cross-section rounded-triangular with a large and well-defined central strand, and with leptodermous, hyaline and large inner cortical cells, and with the 1–2

Grimmia torenii Hastings

cell-thick outer stereome composed of much smaller, thick-walled cells strongly pigment with yellow to yellow-brown.

Dioicous with male and female plants similar. Perichaetial leaves loosely sheathing base of seta, somewhat larger and with a relatively longer, less decurrent awn than the adjacent vegetative leaves. Seta to 2.5 mm long, yellow to pale brown, straight and smooth. Urn erect, symmetrical, smooth to lightly wrinkled when dry, to 1.2 mm long, 1.5–2: 1, not strumose. Operculum short rostrate, about 1/3 as long as urn. Annulus formed of 2–3 rows of relatively more thin-walled cells. Calyptra mitrate, covering about 1/2 of urn. Peristome red-brown, to 200 µm long, cribose along median line near the apex, papillose to vertically striate-papillose. Exothecial cells to 25 µm wide, not in regular vertical rows, quite irregular in size and shape, rectangular 2–4: 1, rather thick walled. Stomata phaneroporous, restricted to base of urn. Spores smooth, to 12 µm. (Norris 2017, Wilson 2017, adapted from Hastings 2008.)

Status:

Note: Federally recognized Endangered, Threatened, Proposed, or Candidate species under the Endangered Species Act are omitted as they do not meet the definition of a Species of Conservation Concern (FSH 1909.12 § 12.52).

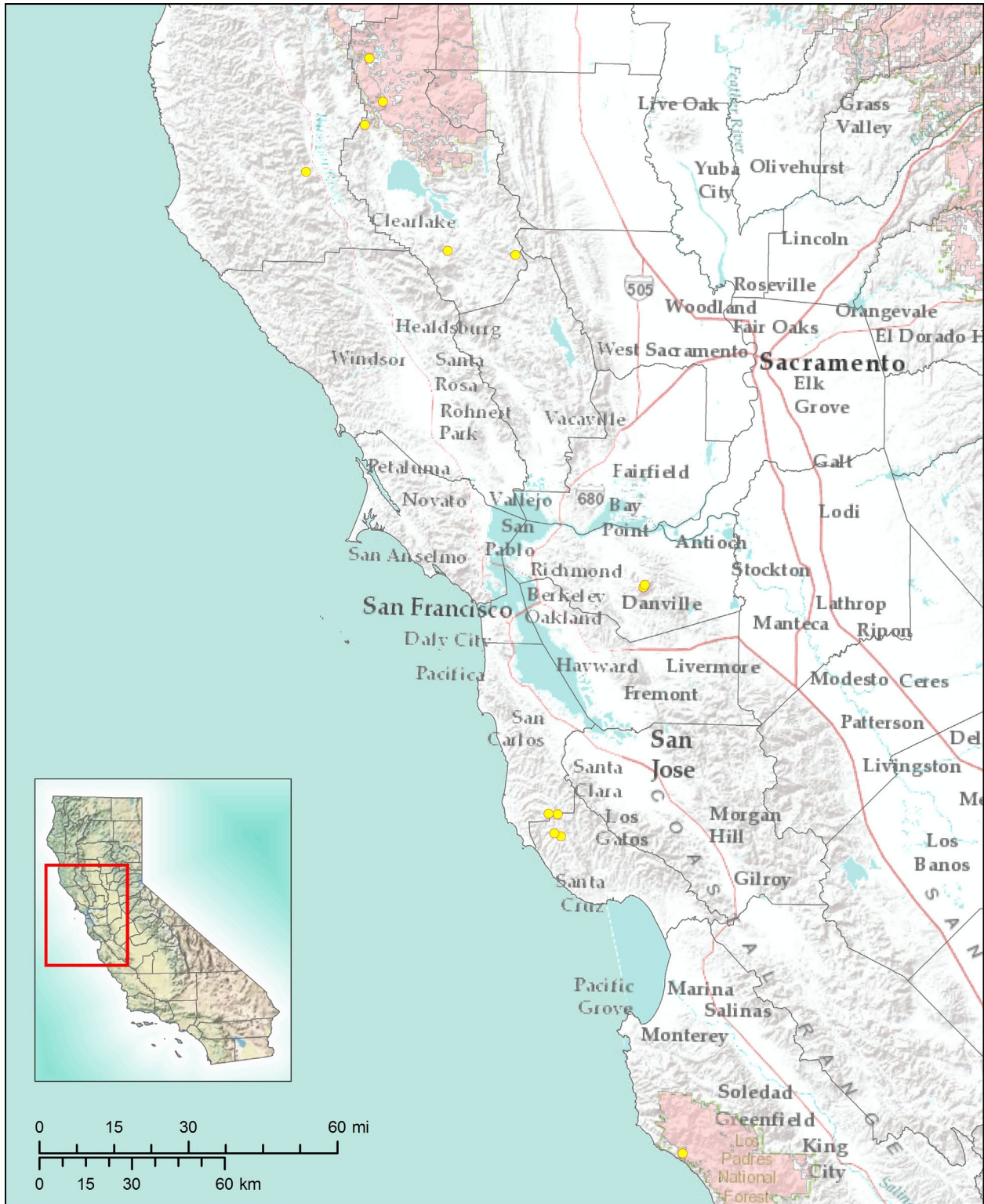
State Listing	G-rank	S-rank	CRPR	R5 FSS	NFP SM	CA BLM
CA: Not listed NV: Not listed OR: Not listed	G2	CA: S2 NV: Not listed OR: Not listed	1B.3	Not listed	Not listed	Not listed
SWAP: Not listed	NNHP: Not listed	NNPS: Not listed	ORBIC: Not listed	OCS: Not listed	IUCN: Not listed	

Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2017b), Nevada Division of Forestry Fully Protected Plant Species (NAC 527) (NDF 2012), Oregon Department of Agriculture Listed Plants (ODA 2014); G-rank=Global Conservation Status (CDFW 2017a; NatureServe 2017); S-rank=Subnational (state or province-level) Conservation Status (CDFW 2017a; NatureServe 2017; NNHP 2017; ORBIC 2016); CRPR=California Rare Plant Rank (CNPS 2017); R5 FSS=USDA Forest Service Region 5 Regional Forester Sensitive Plant Species List (USDA 2013); NFP SM=Forest Service and Bureau of Land Management Northwest Forest Plan Survey and Manage Species (USDA 2001); CA BLM=California Bureau of Land Management Designated Sensitive Species (BLM 2010); SWAP=California State Wildlife Action Plan Status (CDFW 2015); NNHP=Nevada Natural Heritage Program Status (NNHP 2017); NNPS=Nevada Native Plant Society Status (NNHP 2017); ORBIC=Oregon Biological Information Center Status (ORBIC 2016); OCS=Oregon Conservation Strategy Species (ODFW 2016); IUCN=International Union for Conservation of Nature Red List Status (IUCN 2017).

Distribution: This species is endemic to the coastal mountains of central California, and is currently known only from Lake, Mendocino, Contra Costa, San Mateo, Monterey, and Santa Cruz counties. Hastings (2008) states that the species required substrate rock types (metavolcanic pillow basalts, and pH basic sandstones) are of restricted distribution in California, occurring scattered from just north of San Luis Obispo north to the Klamath Ranges of southern Oregon and this species should be sought on these rock types within this area.

The trend for this species appears to be that dedicated searching by bryologists on the rock types known to harbor this species is steadily turning up additional occurrences. Although there are many of these outcrops not yet surveyed, they tend to be small, and often isolated from each other.

Grimmia torenii Hastings



Map Sources: *Layers:* USDA Forest Service, Pacific Southwest National Forests: CPAD 2016. California counties: CDF 2009. *Basemaps:* California inset map: © 2013 National Geographic Society, i-cubed (Esri 2017a). Main map: Esri, DeLorme, USGS, NPS (Esri 2012) and Esri, USGS, NOAA (Esri 2017b).

Grimmia torenii Hastings

Locations within California:

(Note: Record numbers indicate sites that contain an individual, population, or groups of populations located within ¼ mile of each other (per the California Natural Diversity Database (CNDDB) definition of Element Occurrences in California). Official Element Occurrence (EO) numbers for plants in California are determined solely by the CNDDB and are included within the Reference (Source) column for CNDDB data. Duplicate records from the same site are given the same record number and included in red. The Population Info column includes total number of individuals and total number and size of populations/sub-populations when provided. Elevations in meters from source were converted to feet. If not provided in original source, Land Manager information was obtained using the California Protected Areas Database (CPAD 2016) and Quad information was obtained using 24K Quads, SDE Feature Class (CDFG 2013). All other information is directly from the Reference (Source) column unless additional citation is given.)

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
1	S OF THE COAST RIDGE ROAD JUST E OF BM 2766, BETWEEN CASTRO CANYON AND GRIMES CANYON, SANTA LUCIA MTNS.	Monterey	Partington Ridge (3612126)	CNDDB, May 2017 (EO 1)	23-May-2009	SITE BASED ON A 2009 KELLMAN COLLECTION.		Los Padres NF	2690
2	EAGLE ROCK OFF OF ROAD TO ABANDONED FIRE LOOKOUT TOWER ADJACENT TO BIG BASIN REDWOODS STATE PARK BOUNDARY.	Santa Cruz	Big Basin (3712222)	CNDDB, May 2017 (EO 2)	26-Jul-2008	SITE BASED ON A 2008 SHEVOCK COLLECTION.		Unknown	2325

Grimmia torenii Hastings

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
3	ALONG BASIN TRAIL OFF OF CHINA GRADE ROAD ABOUT 1.5 MILES NNW OF HIGHWAY 236, BIG BASIN REDWOODS STATE PARK.	Santa Cruz	Big Basin (3712222)	CNDDDB, May 2017 (EO 3)	12-Jul-2008	SITE BASED ON A 2008 SHEVOCK COLLECTION AND A 2008 KELLMAN COLLECTION. ALSO OBSERVED AT THIS SITE IN 2001.		DPR-Big Basin Redwoods SP	2200
4	BELOW BUTANO FIRE ROAD JUST W OF THE SANTA CRUZ COUNTY LINE.	San Mateo	Big Basin (3712222)	CNDDDB, May 2017 (EO 4)	21-Mar-2009	SITE BASED ON A 2009 KELLMAN COLLECTION.		Unknown	2115
5	JUST NE OF LOOKOUT IN THE SUMMIT AREA OF MT DIABLO.	Contra Costa	Clayton (3712188)	CNDDDB, May 2017 (EO 5)	15-Oct-2006	SITE BASED ON A 2006 TOREN COLLECTION.		DPR-Mount Diablo SP	3805
6	ADJACENT TO ROAD BETWEEN PROSPECTORS GAP AND THE SUMMIT OF NORTH PEAK, MOUNT DIABLO STATE PARK.	Contra Costa	Clayton (3712188)	CNDDDB, May 2017 (EO 6)	25-Jan-2004	SITE BASED ON A 2004 SHEVOCK COLLECTION.		DPR-Mount Diablo SP	3025

Grimmia torenii Hastings

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
7	ALONG JERICHO CREEK, A TRIBUTARY OF HUNTING CREEK, JUST E OF ROUND MOUNTAIN, NW OF KNOXVILLE.	Lake	Jericho Valley (3812274)	CNDDDB, May 2017 (EO 7)	26-Apr-1998	SITE BASED ON A 1998 TOREN COLLECTION.		BLM	2200
8	BIG CANYON ROADS OF HOWARD SPRINGS.	Lake	Whispering Pines (3812276)	CNDDDB, May 2017 (EO 8)	20-Mar-2005	SITE BASED ON A 2005 TOREN COLLECTION.		Unknown	1640
9	HELLS PEAK, N END OF BACHELOR VALLEY ABOUT 5 AIR MILES NW OF UPPER LAKE.	Lake	Upper Lake (3912228)	CNDDDB, May 2017 (EO 9)	30-Nov-1997	SITE BASED ON 1972 AND 1997 TOREN COLLECTIONS.		Unknown	1900
10	BELOW SUMMIT OF ELK MOUNTAIN.	Lake	Elk Mountain (3912238)	CNDDDB, May 2017 (EO 10)	20-May-2006	SITE BASED ON 2001 AND 2006 TOREN COLLECTIONS.		Mendocino NF	3610
11	LAKE PILLSBURY AREA, EEL RIVER WATERSHED.	Lake	Lake Pillsbury (3912248)	CNDDDB, May 2017 (EO 11)	20-May-2006	TYPE LOCALITY. SITE BASED ON 1999, 2005, AND 2006 TOREN COLLECTIONS.		Mendocino NF	1920

Grimmia torenii Hastings

Rec. #	Locality	County	Quad	Reference (Source)	Date Last Observed	Population Info	Threats	Land Manager	Elev. (ft.)
12	S TRIBUTARY TO ROBINSON CREEK ALONG HIGHWAY 253, 3.4 MILES W OF HIGHWAY 101 AND ABOUT 5 MILES S OF UKIAH.	Mendocino	Elledge Peak (3912312)	CNDDB, May 2017 (EO 12)	11-Apr-2007	SITE BASED ON A 2007 TOREN COLLECTION.		Unknown	1065
13	PINE MOUNTAIN TRAIL, NE OF BUZZARDS ROOST, BIG BASIN REDWOODS STATE PARK.	Santa Cruz	Big Basin (3712222)	CNDDB, May 2017 (EO 13)	19-Jul-2002	SITE BASED ON A 2002 KELLMAN COLLECTION.		DPR-Big Basin Redwoods SP	1970

Grimmia torenii Hastings

Distribution on National Forest System (NFS) Lands:

(Please see Reference column of Locations table above for references pertaining to Record Numbers indicated on NFS lands.)

National Forest System (NFS) lands	Record #s (from Locations table above)	CNDDDB EOs	Non-CNDDDB Records	Recent (seen in past 20 yrs.)	Historic (not seen in past 20 yrs.)	Most Recent Obs.	EOs/ Recs. (5 mile buffer)	Total Records on NFS lands
Angeles:	-	-	-	-	-	-	-	0
Cleveland:	-	-	-	-	-	-	-	0
Eldorado:	-	-	-	-	-	-	-	0
Inyo:	-	-	-	-	-	-	-	0
Klamath:	-	-	-	-	-	-	-	0
Lake Tahoe Basin MU:	-	-	-	-	-	-	-	0
Lassen:	-	-	-	-	-	-	-	0
Los Padres:	1	1	-	1	-	23-May-2009	-	1
Mendocino:	10, 11	2	0	2	-	20-May-2006	1	2
Modoc:	-	-	-	-	-	-	-	0
Plumas:	-	-	-	-	-	-	-	0
San Bernardino:	-	-	-	-	-	-	-	0
Sequoia:	-	-	-	-	-	-	-	0
Shasta-Trinity:	-	-	-	-	-	-	-	0
Sierra:	-	-	-	-	-	-	-	0
Six Rivers:	-	-	-	-	-	-	-	0
Stanislaus:	-	-	-	-	-	-	-	0
Tahoe:	-	-	-	-	-	-	-	0
Totals:	N/A	3	0	3	0	N/A	1	3

Demographic and Population Trends: There are insufficient data to discuss whether populations are affected by human activity, or whether the species is increasing or decreasing in range.

Life History: The perennial structure of this moss is the haploid stage, which will persist year after year, forming dense tufts of closely-packed shoots. It is unknown how old the moss tufts can be. Diploid spore-bearing structures appear in early summer. This moss is extremely

Grimmia torenii Hastings

desiccation resistant and is an early colonizer of rock surfaces that few other organisms can thrive on.

Diversity: There have been no studies on the genetic or ecological diversity of this species. Hastings (2008) describes this species as stenotypic, meaning it has a narrow preferred habitat and lacks phenotypic plasticity. Variability in morphology and habitat preference increase as more locations are found, but the current data suggest this is a locally evolved habitat specialist and would not be expected to exhibit much diversity.

Habitat: The habitat of this species can be summarized as: sunny, rocky openings in forest, chaparral, and woodlands. Specimen records almost invariably mention sun, full sun, and especially the term “exposed”. The site information invariably includes a rock type descriptor, especially “outcrop”, but also: exposed cliff, boulders, rock-slab, and rocky ridge or rocky terraces.

According to Hastings (2008), this species has been collected only on metavolcanic pillow basalts (ophiolites) and some sandstones of the Franciscan Formation (basic pH substrates, origin of seafloor spreading), often where these are adjacent to serpentines. Collection records state metavolcanic substrate most frequently, but also mention sandstone, calcareous sandstone, and in one case marble.

The descriptor “dry” appears frequently, and this is underscored by description of surrounding vegetation, which is dominated by dry plant community species: chaparral, knobcone pine forest, manzanita, California juniper, canyon live oak, California buckeye, mixed conifer, Oregon oak, chamise, California lilac and California bay are all mentioned. When associated moss species are mentioned, they are also those that favor dry, sunny rocky areas: *Orthotrichum kellmanii*, *Grimmia ovalis*, *Bryerythrophyllum columbianum*, *G. montana*, and *G. laevigata* (CNDDDB 2017). It’s elevation range is from 325 to 1,160 meters.

Habitat Status or Trend: The 13 CNDDDB Element Occurrences (EOs) are all based on herbarium specimens collected from 1997 to 2009. Specimen labels from which EOs are produced did not contain information on habitat condition, trends, or population size, so none of these occurrences are ranked. All EOs have Presence listed as “Presumed Extant”.

Capacity for the Species to Disperse: This species of moss is dioicous, meaning that the gametophytes are either male or female. This means that a minimum of two individuals is required to establish a sexually reproducing population. Gemmae were not noted in the description of this species (Hastings 2008), so it is not known if this species can take advantage of this mode of asexual reproduction, although it is possible it does possess the ability, since it is documented in several other *Grimmia* species.

Dispersal for mosses is thought to be by wind events, or inadvertent movement by animals (since no fruit or seed reward is offered).

Grimmia torenii Hastings

The habitat of these plants is on rock substrates that are limited in distribution in California and uncommon where they do occur. Therefore, the populations of this species would likely be fairly isolated from each other.

Threats: CNDDDB Element Occurrences do not list any threats to this species. The limited area of the preferred habitat means that individual populations are at risk of being extirpated by localized events. The size of area needed to sustain a moss population is not well studied.

Since the preferred habitat, rock outcrops on pillow basalt and basic sandstone, is poor agricultural or timber land, these industries will unlikely be threats. In the southern portion of the range, the rocky outcrops with suitable substrate fall a highly populated region, so recreation could be a significant threat in this region. Seven (7) of thirteen (13) occurrences are known to be on public land (BLM, USFS, or state park), but land development may be a threat for the other six (6) occurrences. There is no reported commercial use of *Grimmia* moss in North America.

The habitat is reported to be mainly rock, and with sparse vegetation, if mentioned. The species listed in the area around the rock habitat are all fire-adapted species, so this moss occupies low fire risk microhabitat within a surrounding area of high fire risk. Rock outcrops are generally unlikely to be burned in a wildfire, although they may be subject to damage by fire-fighting activities (trampling, retardant drop, fireline cutting).

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Grimmia torenii Hastings

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Grimmia torenii Hastings

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Persons Contacted:

None.

Author(s) and Date:

Alison Colwell, Assistant Rare Plant Botanist, California Native Plant Society, (916) 447-2677 x219, acolwell@cnps.org

Aaron E. Sims, Rare Plant Botanist, California Native Plant Society, (916) 324-3816, asims@cnps.org

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Grimmia torenii Hastings

Reviewer(s) and Date:

David Magney, Rare Plant Program Manager, California Native Plant Society, (916) 447-2677 ext. 205, dmagney@cnps.org. January 26, 2018.

Formatting: Form is set up as 508 compliant. Please use the “styles” if further formatting is necessary.

Purpose: This is to maintain the best available science on a species that could be used by the Forest Service in a variety of functions. Specifically, there would be additional steps and evaluations to determine whether or not this species would be considered a Species of Conservation Concern under the 2012 Planning Rule or a Sensitive Species under the 1982 Planning Rule.

Additional Considerations at the Forest Level: Habitat amount and juxtaposition of both the species and habitat locations.