

BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

**PETITION TO LIST THE TEMBLOR LEGLESS LIZARD (*Anniella alexanderae*) AS AN
ENDANGERED OR THREATENED SPECIES UNDER THE CALIFORNIA
ENDANGERED SPECIES ACT (CESA)**



**CENTER FOR BIOLOGICAL DIVERSITY
NOVEMBER 18, 2021**



Notice of Petition

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Division 3, Chapter 1.5, Article 2 of the California Fish and Game Code (Sections 2070 *et seq.*) relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Species Name: Temblor legless lizard (*Anniella alexanderae*)

II. RECOMMENDED ACTION: Listing as Endangered or Threatened

The Center for Biological Diversity submits this petition to list the Temblor legless lizard (*Anniella alexanderae*) as Endangered or Threatened pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 *et seq.*, “CESA”).

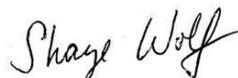
This petition demonstrates that the Temblor legless lizard is eligible for and warrants listing under CESA based on the factors specified in the statute and implementing regulations. Specifically, the Temblor legless lizard meets the definition of an “endangered species” since it is a “native species or subspecies of a ... reptile...which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease.” Cal. Fish & Game Code § 2062. Alternatively, we request that the California Fish and Game Commission consider listing of the Temblor legless lizard as a “threatened species” which is “a native species or subspecies of a ... reptile that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts” Cal. Fish & Game Code § 2067.

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I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature:



Date: November 18, 2021

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Executive Summary

The Center for Biological Diversity submits this petition to list the Temblor legless lizard (*Anniella alexanderae*) as Endangered or Threatened pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq., “CESA”).

Following Section 670.1, Title 14, California Code of Regulations, petitioners present scientific information regarding life history, population trend, range, distribution, abundance, kind of habitat necessary for survival, factors affecting the ability to survive and reproduce, degree and immediacy of threat, impact of existing management efforts, suggestions for future management, availability of sources and information, and a detailed distribution map.

First identified in 1852, the California legless lizard, genus *Anniella*, is found only in California and Baja California, Mexico. Originally considered to consist of two distinct species, *A. pulchra* and *A. geronimensis*, Papenfuss and Parham (2013) formally split *A. pulchra* into five distinct species in 2013 based on genetic and morphological differences, including the species *Anniella alexanderae*, the Temblor legless lizard.

The Temblor legless lizard is a unique and rare reptile that is only found in a few locations in the San Joaquin Valley in central California. It can be distinguished from a snake due to its eyelids and detachable tail which is used to escape predators. The lizard’s preferred habitat is sandy alkali desert scrub with plenty of loose soil and leaf litter for burrowing and hunting. Legless lizards are the only sand swimming specialists in California.

The Temblor legless lizard is restricted to an exceedingly small range estimated at only 1,720 square kilometers along the east side of the Temblor Mountains, from the western edge of Kern County north to western Fresno County. It is currently known to exist at only four sites, three of which are on private land.

The lizard is immediately threatened by extensive oil and gas development in its restricted range. Three of the four sites where the lizard has been detected are within oil field boundaries and surrounded by extensive oil and gas development. In total, 31 oil fields overlap the lizard’s range, and more than 98% of its range is already open or potentially available to oil and gas development. The International Union for Conservation of Nature (IUCN) recently concluded that oil and gas development could propel the Temblor legless lizard to Critically Endangered status or extinction in the near future.

Oil and gas development threatens the Temblor legless lizard by destroying and fragmenting its habitat; compacting soil, altering soil moisture, and removing native plants; spilling oil and produced water; noise and light pollution; and worsening climate change. Oil and produced water spills are rampant in the Temblor legless lizard’s restricted range, including at least 20 “surface expression” spills since 2019, two of which are currently active.

State and local agencies continue to approve thousands of new oil and gas permits each year in California, a substantial portion of which are in the 31 oil fields overlapping the species’ habitat. Kern County, where the majority of remaining Temblor legless lizard habitat is located, is attempting to streamline oil and gas permitting to make future approvals for projects faster and

hidden from public scrutiny. In 2019 the Bureau of Land Management (BLM) opened up oil and gas drilling and fracking on more than one million acres of public lands and mineral estate in Central California, including a significant portion of the Temblor legless lizard's restricted range. In 2020, the BLM approved the first oil and gas lease sales of federal public lands in California in eight years, covering 4,000 acres in Kern County, including one large parcel at the southern end of the Temblor legless lizard's range.

The Temblor legless lizard is also threatened by urban development, industrial solar development, invasive grasses and non-native wild pigs, and rising temperatures and changes in moisture caused by climate change. No existing regulatory mechanism are currently in place at the national, state or local levels that adequately address the threats facing *A. alexanderae*.

The Temblor legless lizard is currently listed as Species of Special Concern in California. It is designated as vulnerable by the IUCN, and as a G1 and S1 critically imperiled species at the global and state level by NatureServe. In 2019 experts on the species recommended listing the Temblor legless lizard under the California and federal Endangered Species Act.

This petition demonstrates that the Temblor legless lizard is eligible for and warrants listing under CESA based on the factors specified in the statute and implementing regulations. Under CESA, a "threatened species" is "a native species or subspecies... that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts..." Cal. Fish & Game Code § 2067. An "endangered species" is "in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." Cal. Fish & Game § 2062.

The Temblor legless lizard faces serious and immediate threats, particularly from oil and gas development, that jeopardize its continued existence in all or a significant portion of its range in California. It consequently meets the definition of an endangered species.

The Temblor Legless Lizard Warrants Listing as Endangered or Threatened under the California Endangered Species Act (CESA)

I. Introduction

This petition summarizes the available scientific information regarding the taxonomy and natural history of the Temblor legless lizard (*Anniella alexanderae*), its range, distribution, abundance, and population trends in California, threats affecting its ability to survive and reproduce, and discusses the limitations of existing management measures in protecting the species. As demonstrated below, the Temblor legless lizard meets the criteria for protection as “endangered” or “threatened” under the California Endangered Species Act (CESA) and would benefit greatly from such protection.

II. Life History

A. Taxonomy

The Temblor legless lizard *Anniella alexanderae* is recognized as its own species. The Temblor legless lizard is in the genus *Anniella* which consists of six fossorial, wormlike lizard species endemic to California and Baja California Norte, Mexico (Papenfuss and Parham 2013, p. 1; Parham et al. 2019, p. 5, Figure 1). *Anniella* was discovered to science in 1852 by Dr. J.A. Gray (Miller 1944, p. 273) and originally described as two species: one that ranges throughout most of California (*A. pulchra*) and another that occurs in Baja California (*A. geronimensis*). The California legless lizard *Anniella pulchra* was already listed as a Species of Special Concern in California (Jennings and Hayes 1994, p. 111) when it was split into five distinct species in 2013 based on genetic and morphological data: *Anniella alexanderae* (Temblor legless lizard), *Anniella campi* (Southern Sierra legless lizard), *Anniella grinnelli* (Bakersfield legless lizard), *Anniella pulchra* (Northern California legless lizard), and *Anniella stebbinsi* (Southern California legless lizard) (Papenfuss and Parham 2013, p. 2). *Anniella alexanderae* was named in honor of naturalist Annie Alexander (1867-1950) who made critical contributions to the study of California’s vertebrate biodiversity (Papenfuss and Parham 2013, pp. 9-10).

The California Natural Resources Agency’s October 2021 Special Animals List recognizes *Anniella alexanderae* as a distinct species (CNDDDB 2021a, pp. 43, 86). In reference to *Anniella alexanderae* (Temblor legless lizard), the Special Animals list explains that “[I]egless lizards (*Anniella* spp.) in California were traditionally considered one species, but are now considered five species (Papenfuss and Parham, 2013)” (CNDDDB 2021a, p. 86). The Special Animals List further clarifies that *Anniella alexanderae* retains the California Species of Special Concern (SSC) status (CNDDDB 2021a, p. 86).

B. Genetic Differentiation

A range-wide genetic survey of *Anniella* by Parham and Papenfuss (2009) revealed five major genetic lineages of *A. pulchra*, recognized as distinct genetic clades using both mitochondrial and nuclear DNA markers. The level of genetic divergence among these clades corresponds to species level differences found in other lizard genera (Papenfuss and Parham 2013, p. 3). Parham and Papenfuss (2009, p. 174) estimated that lineage B (corresponding to *A. alexanderae*)

diverged from other *Anniella* between 3 and 7 million years ago, at a time when a marine embayment would have separated many of the San Joaquin *Anniella* populations.

Papenfuss and Parham (2013) split *A. pulchra* into five distinct species, including *A. alexanderae*, corresponding to the five genetic clades detected by Parham and Papenfuss (2009), where *A. alexanderae* represents Lineage B. Importantly these species can be distinguished by their distinct morphological characteristics, including coloration and vertebral counts (Papenfuss and Parham 2013, p. 3).

Parham et al. (2019) expanded upon the genetic analysis of Parham and Papenfuss (2009) by more than tripling the number of samples for mitochondrial and nuclear DNA analysis and expanding the number of nuclear markers from one to six. Both mitochondrial and nuclear DNA analyses support the classification of *A. alexanderae* as a distinct species (Parham et al. 2019, pp. 17-19).

C. Species Description

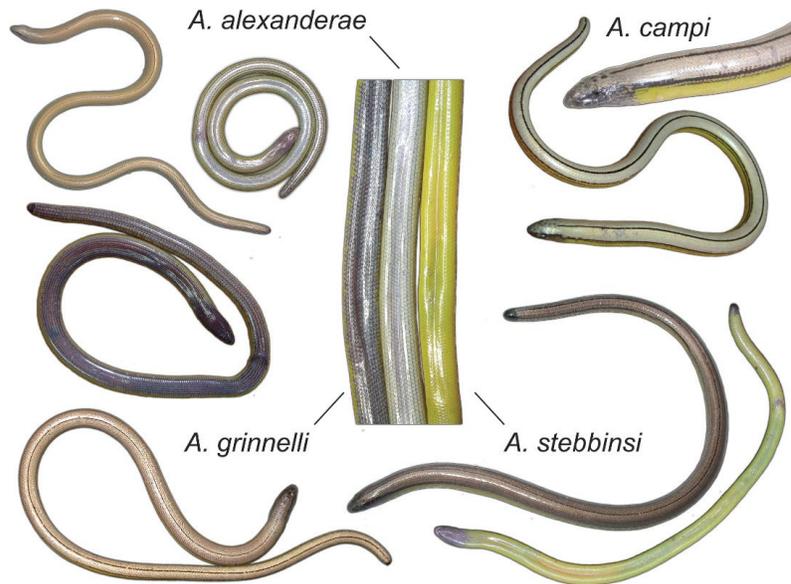
Anniella alexanderae is a small, slender lizard with no legs, a shovel-shaped snout, smooth shiny scales, and a blunt tail (Miller 1944, pp. 276-280). *A. alexanderae* is differentiated physically from snakes by the presence of eyelids and a detachable tail used to foil predators (Miller 1944, p. 277; California Herps 2021). The lizard has no external ear openings and senses vibrations through the sand (Thomson et al. 2016, p. 186). It is approximately 4 to 7 inches long from snout to vent, excluding the tail (Jennings and Hayes 1994, p. 108). Legless lizards are the only sand swimming specialists in California (Evelyn and Sweet 2018, p. 6).

A. alexanderae can be identified by its unique morphological characteristics (Parham et al. 2019, p. 23). While there are limited differences in scalation among *Anniella* species (Papenfuss and Parham 2013, p. 3), *A. alexanderae* can be differentiated from others by ventral and dorsum coloration, vertebral counts, and scale counts (Parham et al. 2019, p. 23). *A. alexanderae* has a higher dorsal scale and vertebral count (see Table 1 and Figure 1) and a unique light grey ventral coloring from the lower jaw to the end of the tail (Papenfuss and Parham 2013, p. 7-8). The dorsum is a pale olive with orange sides. There is a mid-dorsal black stripe present from the parietals to the tip of the tail, and lateral black stripes from the eye to the top of the tail (Papenfuss and Parham 2013, pp. 5, 7).

Table 1. Dorsal scale and trunk vertebral count (based on x-ray images) for the *Anniella pulchra* complex. Summary of data from *Hunt 1984 are from clearly designated groups in that study that do not include more than one species. Source: Papenfuss and Parham 2013, based on tables from pp. 5, 8.

<i>Anniella</i> spp	Dorsal Scale Count	Trunk Vertebral Count
<i>A. pulchra</i>	198 – 250*	74 – 78
<i>A. stebbinsi</i>	188 – 249*	
<i>A. alexanderae</i>	257	81 – 83
<i>A. campi</i>	244	75 – 78
<i>A. grinnelli</i>	239	79 – 83
<i>A. stebbinsi</i>	215	73 – 77

Figure 1. Four new species of *Anniella* and their diagnostic characteristics. Source: Papenfuss and Parham 2013, p. 6.



D. Biology

Since the taxonomic identification of *A. alexanderae* is relatively new, the available biological information primarily refers to what was originally known as *A. pulchra*.

Reproduction, Growth and Lifespan

California legless lizards are live-bearing species that breed from early spring through July and have anywhere between one and four fully developed live-born young between September and November (Miller 1944, pp. 274, 276, 288), after a gestation period of approximately four months (Jennings and Hayes 1994, p. 110). Female lizards may not produce new young every year, but more research is needed to determine how frequently or infrequently this occurs (Jennings and Hayes 1994, p. 110). Males reach sexual maturity around two years old and 90 mm snout-to-vent length, and females reach sexual maturity at three years old and 121 mm snout-to-vent length (Jennings and Hayes 1994, p. 110).

Anniella species, like most reptiles, shed their skin periodically. Under laboratory conditions this lizard sheds every three to five weeks, from February to November, with little to no shedding during the winter months depending on the activity of the lizard (Miller 1944, p. 277). The shedding process can take just a couple of days but is dependent on the moisture level in the substrate (Miller 1944, p. 277).

Due to the Temblor legless lizard's burrowing nature, it is difficult to study lifespan in the wild, although sexually mature adults have been kept alive in a lab for almost six years (Jennings and Hayes 1994, p. 110).

Burrowing Behavior and Movement

Temblor legless lizards are fossorial lizards that build burrows in soil with a high proportion of sand (Jennings and Hayes 1994, p. 108). They "swim" through dry, loose sand with lateral undulations (Stebbins and McGinnis 2012, p. 333). They are rarely active on the surface although they use the soil/litter interface for feeding and mating (Thomson et al. 2016, p. 188). They are sensitive to noise and light pollution (Miller 1944, p. 285) which can affect their hunting (Thomson et al. 2016, pp. 189, 190). The legless lizard's body surface is covered with smooth, highly polished scales which reduce friction with the surface, and smooth fine sand is needed for undulatory body movements (Miller 1944, p. 278). These lizards have been found at varying soil depths, from a few centimeters to 50 centimeters (Thomson et al. 2016, p. 188), but they usually reside in depths from one to four inches (Miller 1944, p. 289).

They are not known to move or emigrate far and have a high site fidelity, so populations are localized (Miller 1944, p. 288; Jennings and Hayes 1994, p. 110). As noted by Parham and Papenfuss (2009, p. 170), "[b]ecause of its habitat specificity and overall lack of motility, [the California legless lizard] is not apt to disperse and the isolation of populations should be a common phenomenon."

Temperature Requirements

Temperature regulates the key aspects of reptile life history such as sex determination and incubation (Mitchell and Janzen 2010, p. 129-140). Legless lizards prefer temperatures between 59 to 77°F (15 to 25°C), do not bask in direct light, are rarely found above ground, and lie just beneath the surface of the substrate for feeding and mating (Miller 1944, p. 284, 288). They are most active during the morning and evening (Miller 1944, p. 284). If the substrate temperatures remain above 70°F (21°C) for extended periods, they may also be observed on the surface at night (Jennings and Hayes 1994, p. 110). Their ability to withstand cooler temperatures while staying active is consistent with fossorial lizards that do not bask directly in the sun (Jennings and Hayes 1994, p. 110). They are inactive at temperatures below 55°F (13°C), and temperatures in a laboratory setting above 104°F (40°C) are lethal to *Anniella* species (Miller 1944, pp. 284, 288). The Temblor legless lizard is thought to hibernate during the winter months when the weather is cooler (Jennings and Hayes 1994, p. 110).

Diet and Foraging Behavior

The diet of the Temblor legless lizard consists of beetle larvae, termites, and spiders (Miller 1944, p. 274). The legless lizard will hide under leaf litter, loose sand, or at the base of shrubs to ambush their prey (Miller 1944, p. 288). While their eyes are functional, they appear to be nearsighted with a keen sense of mechanical disturbances and their olfactory senses are well developed (Miller 1944, p. 280). The lizard senses vibrations through the ground, using this sense to follow their prey from below and come up ahead to catch it (Miller 1944, p. 280). After capturing their prey, they go back down into their burrow to eat, swallowing sand along the way (Miller 1944, p. 274).

Predators

Documented predators of *A. alexanderae* and other legless lizards include ring-necked snakes, common kingsnakes, deer mice, long-tailed weasels, domestic cats, California thrashers, American robins, and loggerhead shrikes (Miller 1944, p. 277). Along with the ability to conceal itself in the substrate to attack prey and hide from predators, the legless lizard can also detach its tail as a defense mechanism; the tail will writhe on the ground for several minutes to distract a potential predator so the lizard can escape (California Herps 2021). Regrowth of the tail can take up to one year (Miller 1944, p. 277).

III. Habitat Necessary for Survival

The Temblor legless lizard is a microhabitat specialist due to its specific requirements for burrowing (Thomson et al. 2016, p. 188). Legless lizards are restricted to habitats that include loose soil or other substrate (e.g., sand or leaf litter), with moderate plant cover, that allow for their fossorial ecology (Jennings and Hayes 1994, pp. 110-111, Parham and Papenfuss 2009, p. 169). The Temblor legless lizard is limited to predominately sandy alkali desert scrub habitat along the base of the eastern side of the Temblor Mountain range, from northwestern Kern County to southwestern Fresno County, Central California (Parham et al. 2019, pp. 10, 12, 21). See Figure 2 for typical habitat.

Legless lizards have specific requirements for soil moisture and soil density that are essential to their survival (Miller 1944, pp. 288-289; Jennings and Hayes 1994, p. 111). Soil moisture is critical for conserving energy at high temperatures and allowing shedding to occur (Jennings and Hayes 1994, p. 111). If the sand is too dry, recently shed skin could stick to the new skin and the head may not shed at all, which makes the use of the eyes and feeding difficult, sometimes leading to starvation (Miller 1944, p. 277). If the soil has too much clay or adobe, the legless lizard cannot penetrate deep enough for survival (Miller 1944, p. 288) and the clay content can plug their nostrils, resulting in death due to suffocation (Evelyn and Sweet 2018, p. 6-7). Dry sand overlying damp sand provides optimal conditions where the lizards can move freely from one to the other (Miller 1944, p. 289). Loose, sandy soils also help in the construction of their burrows (Jennings and Hayes 1994, p. 108).

Anthropogenic activities that alter soil structure, soil moisture or plant composition can degrade the lizard's habitat and could cause local extinctions (Thomson et al. 2016, p. 189). The lizard cannot survive in developed or other areas where loose soil for burrowing has been removed or altered, such as by plowing or bulldozing (Jennings and Hayes 1994, p. 111). Oil and gas development, urbanization, conversion to cropland, large-scale industrial solar projects, and invasive species can alter soil moisture, friability, compaction, and plant cover in the lizard's habitat.

Figure 2. Habitat of *A. alexanderae*, Kern County. Photo by Theodore Papenfuss.



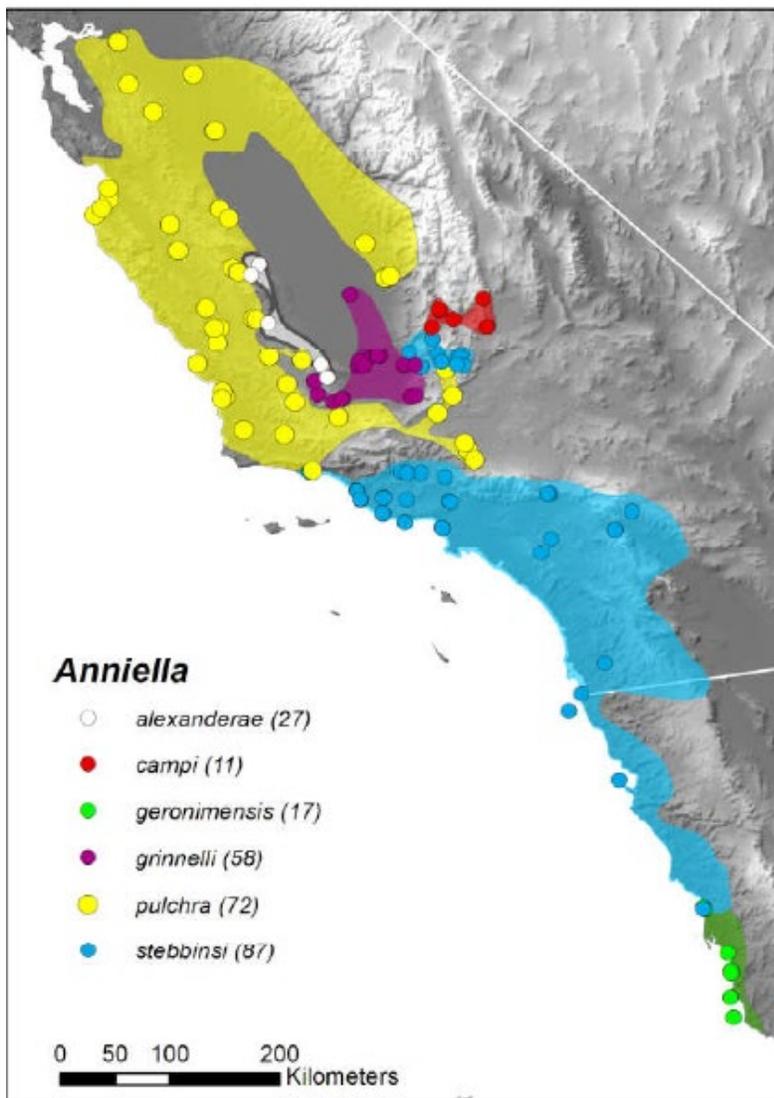
IV. Range

The known range of the Temblor legless lizard is a narrow strip less than 200 kilometers long on the east side of the Temblor Mountain Range from the western edge of Kern County to western

Fresno County, California, between the mountains and State Highway 33/Interstate Highway 5 (Parham et al. 2019, p. 10, Figure 2B). See Figure 3 for a range map. Parham et al. (2019, p. 14) estimated the total range of the species to be only 1,719.54 km². Parham et al. (2019, p. 14) noted that the Temblor legless lizard's elevation range is more limited than the majority of the other legless lizard species.

Ecological niche modeling predicted a larger swath of the northern San Joaquin Valley east of Highway 33 as suitable range for the Temblor legless lizard (Parham et al. 2019, p. 16), but detailed searches, including multi-year use of cover boards, have not found *Anniella* in this region east of Highway 33 (Papenfuss and Parham 2013, p. 8). Most of that land has now been developed and is highly modified (Parham et al. 2019, pp. 16, 21, 22).

Figure 3. Map showing current range for all six *Anniella* species in Southern California through Baja California, with survey sites represented by circles. The range for *A. alexanderae* is shown in white, with survey sites represented by white circles. Source: Parham et al. 2019, Figure 2.



V. Distribution

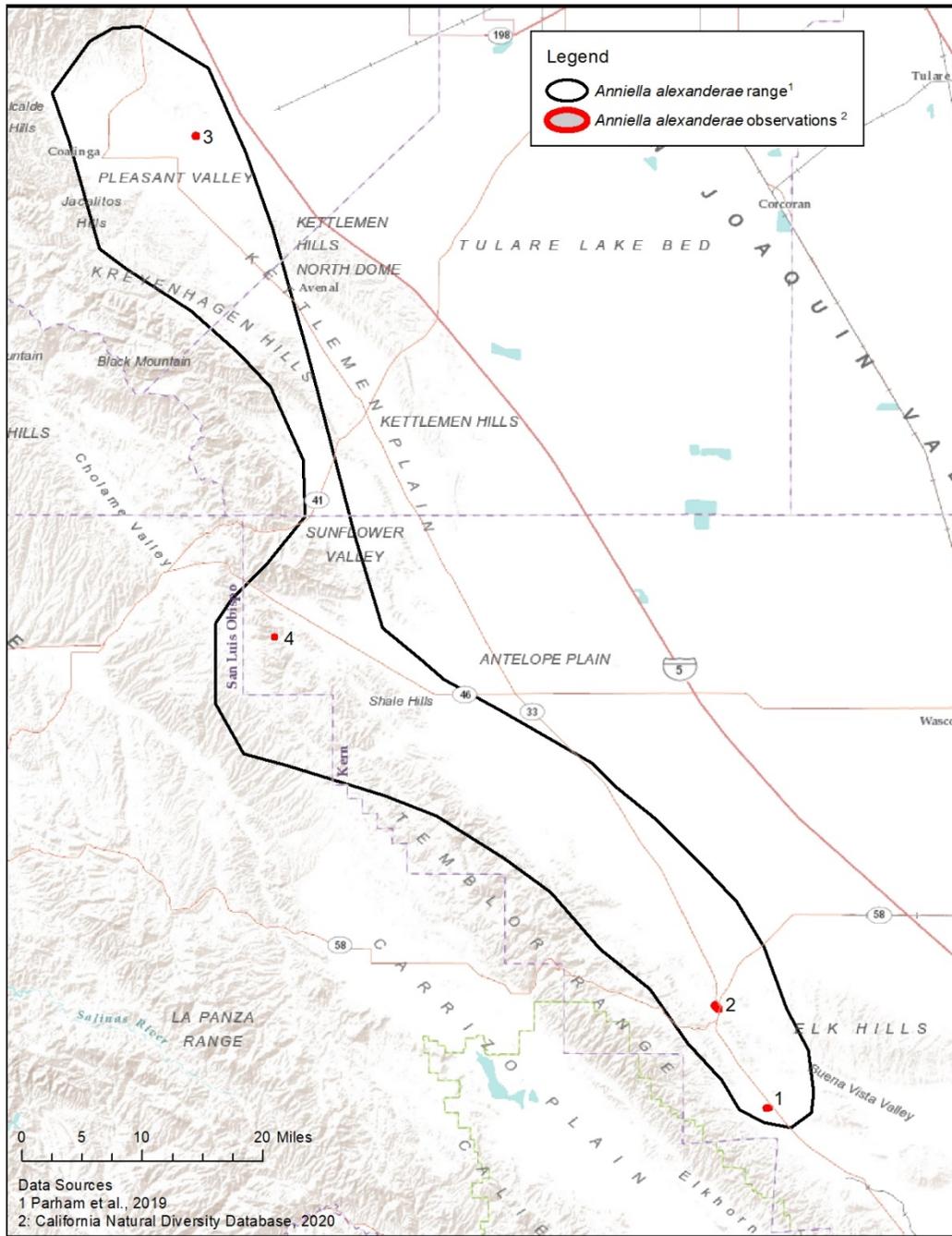
Information on Temblor legless lizard distribution comes largely from surveys based on placing cover boards made from cardboard or plywood on sandy soil (Papenfuss and Parham 2013, p. 8; Parham et al. 2019, p. 7). Cover boards are typically placed in the field in the summer or fall, covered with soil, and checked in the spring when *Anniella* are most active (Parham et al. 2019, p. 7). The boards are flipped over and the soil under the boards is lightly raked to check for lizards (Parham et al. 2019, p. 7). Importantly, researchers note that it often takes three to four years with a cover board in place before a legless lizard is detected (Theodore Papenfuss, personal communication).

As noted above, *A. alexanderae* was split into its own species in 2013 based on genetic and morphological data (Papenfuss and Parham 2013). Papenfuss and Parham (2013, p. 8) reported *A. alexanderae* from a single area at the southeast base of the Temblor Range between McKittrick and Taft west of Hwy 33, comprised of two sites separated by continuous suitable habitat.

Parham et al. (2019, p. 7, Appendix A, B) expanded the known range of *A. alexanderae* based on surveys conducted over four years, covering ~60 survey sites, where a site can have multiple separate locations with cover boards in place. Specifically, Parham et al. (2019, p. 14) reported Temblor legless lizards in four different sites in seven unique localities ranging in elevation from 168 to 466 meters. See Figure 4 for distribution map showing lizard detection sites. Lizard detection site 1 is northwest of the city of Taft, CA, with three localities within one kilometer of each other, within the Midway-Sunset oil field. Lizard detection site 2 is near the town of McKittrick within the McKittrick oil field boundary. Lizard detection site 3 is within the 1,200-acre California Department of Fish and Wildlife (CDFW)-managed Pleasant Valley Ecological Reserve (Parham et al. 2019, p. 22), east of Coalinga within the boundaries of the Pleasant Valley oil field. The Pleasant Valley Ecological Reserve was designated in 2000 to protect grasslands and saltbush scrub habitats for sensitive animal species and is surrounded by oil fields, cattle grazing, and agriculture (CDFW 2021a). Lizard detection site 4 is located within a 5-acre parcel on the Palo Prieto Conservation Bank, in the foothills of the Temblor Mountain Range (CNDDDB 2021b). The Palo Prieto Conservation Bank, an easement with five separate parcels of land totaling just over 5,000 acres, was established in 2006 to preserve San Joaquin kit fox habitat, as well as other sensitive species found in the area (PPCB 2020a). The conservation land is also used for cattle grazing.

Overall, three of the four detection sites (sites 1, 2, and 3) containing six of the seven localities are within oil field boundaries, with the exception of the Palo Prieto Conservation Bank. Three of the four detection sites (sites 1, 2, and 4) containing six of the seven localities are located on private land, with the exception of the Pleasant Valley Ecological Reserve.

Figure 4. Range of the Temblor legless lizard and the four sites where it has been found.



Importantly, the Temblor legless lizard is found in limited habitat patches at all the detection sites. For example, at site 3 in the 1,200-acre Pleasant Valley Ecological Reserve, suitable habitat for the legless lizard encompasses only about one acre in an upland area with sandy soil (Theodore Papenfuss, personal communication). The majority of reserve lands have hard-packed soils or are located in stream valleys subjected to periodic large floods which can drown lizards, and which are not suitable habitat (Theodore Papenfuss, personal communication). At site 4

within the Palo Prieto Conservation Bank, suitable habitat consists of approximately three to four acres (Theodore Papenfuss, personal communication). Most of the conservation bank land is rolling grassy hills without loose soil and does not provide suitable habitat (Theodore Papenfuss, personal communication).

Moreover, all known lizard detection sites are on private land with the exception of a single site on the CDFW Pleasant Valley Ecological Reserve. Parham et al. (2019, p. 22, Table 1) estimated that only 0.5% of the lizard's range (9 km², 18 parcels) is on CDFW lands, with another 5% of the range (91 km²) on BLM lands.

Temblor legless lizards have high-site fidelity, at least over the short term (Jennings and Hayes 1998, p. 110). Collection results via coverboards indicate localized populations, and in all probability the lizards are not distributed over their entire range (Miller 1944, p. 288).

VI. Abundance

The Temblor legless lizard is considered to be rare based on its limited range within which it has only been found at seven localities in four sites (Papenfuss et al. 2013, p. 14; Parham et al. 2019, pp. 11, 14). Due to its fossorial and cryptic nature, population size estimates are not readily available (Thomson et al. 2016, pp. 189-190).

VII. Population Trend

Trends in habitat availability serve as a proxy for population trends. Based on the extensive habitat loss and fragmentation within the lizard's range, the Temblor legless lizard population has almost certainly declined. As detailed below, the majority the species' habitat has been destroyed, fragmented and degraded by oil and gas development, urbanization, and other threats and is no longer suitable (Thomson et al. 2016, p. 189). Ecological niche modeling predicted that the lizard's range included a larger swath of the northern San Joaquin Valley, most of which has been developed (Parham et al. 2019, pp. 5, 16, 22). Detailed searches have yet to find the lizard in suitable habitat on the valley floor east of Highway 33 (Papenfuss and Parham 2013, p. 8). This indicates that extirpation from human development may be a cause of their limited range and populations (Parham et al. 2019, p. 22).

The Temblor legless lizard is currently listed as Species of Special Concern in California (Thomson et al. 2016, pp. 186-191). Experts on the species have recommended a California Endangered Species Act listing for *A. alexanderae* largely based on the loss of habitat that provides a proxy for population decline (Parham et al. 2019, p. 24). A key recommendation of the *2019 Conservation Assessment of the California Legless Lizard (Anniella)* prepared for the California Department of Fish and Wildlife is:

It would be prudent to consider the possibility of a Federal or State listing for *A. alexanderae*. The State of California already considers this species to be critically imperiled (G1 S1), but more protection may be warranted. The discovery of new sites for this species provide additional hope for its conservation, but currently all but one known site for this species is on private land (Parham et al. 2019, p. 24).

The Temblor legless lizard is further designated as vulnerable by the International Union for Conservation of Nature (IUCN) and is on the IUCN Red List due to its narrow range and imminent threats (Hammerson 2019, p. 1-3). The IUCN recently concluded that oil and gas development could propel the Temblor legless lizard to Critically Endangered status or extinction in the near future (Hammerson 2019, p. 2, 6). NatureServe classifies the Temblor legless lizard as a G1 and S1 critically imperiled global and state ranking status, respectively (NatureServe 2021). NatureServe defines its G1 and S1 categories as “critically imperiled – at very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors” and “factor(s) such as very steep declines making it especially vulnerable to extirpation from the state” (NatureServe 2021).

VIII. Factors Affecting Ability to Survive and Reproduce

Oil and gas development, urbanization, and associated habitat destruction, fragmentation, and degradation are the primary threats to the Temblor legless lizard (Thomson et al. 2016, pp. 188-189; Hammerson 2019, p. 6). The Temblor legless lizard is also threatened by industrial solar development, invasive grasses and non-native wild pigs, and rising temperatures and changes in moisture caused by climate change.

A. Oil and Gas Development

Oil and gas development is the primary threat to the Temblor legless lizard. Three of the four sites where the lizard has been detected are within oil field boundaries and surrounded by extensive oil and gas development. In total, 31 oil fields overlap the Temblor legless lizard’s narrow range.¹ More than 98% of the lizard’s restricted range is already open or potentially available to oil and gas development. The IUCN recently concluded that oil and gas development could propel the Temblor legless lizard to Critically Endangered status or extinction in the near future (Hammerson 2019, pp. 2, 6). Oil and gas development threatens the Temblor Key legless lizard through habitat loss and fragmentation; soil compaction, removal of the duff and litter layer the lizard requires, loss of native plant life, and changes in soil moisture; oil spills and produced water spills; noise and light pollution; human disturbance; and climate change.

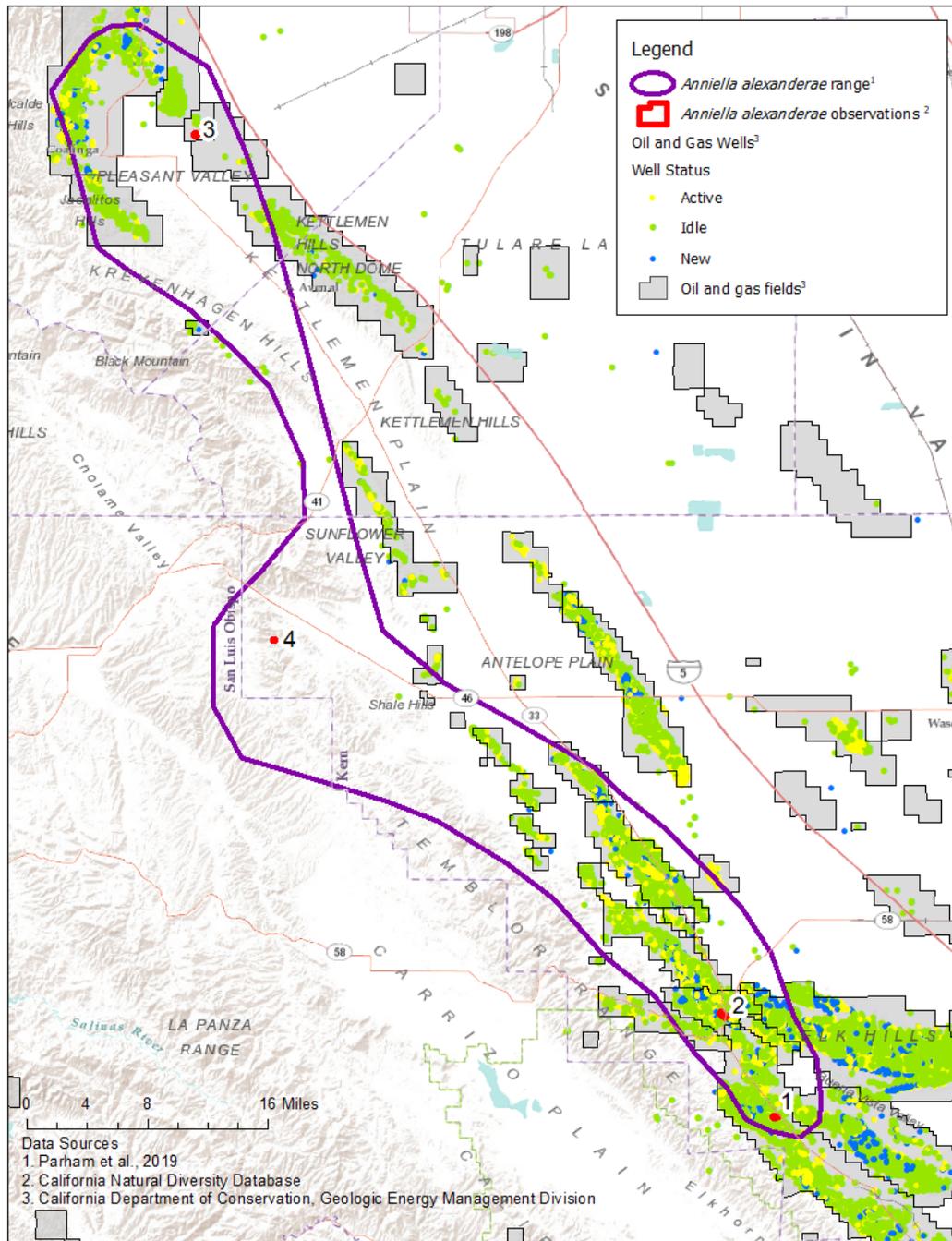
Oil and gas development is extensive in the Temblor legless lizard’s limited range

Oil and gas development is extensive and continues to expand in the Temblor legless lizard’s restricted range. State and local agencies continue to approve thousands of new oil and gas permits each year, a substantial portion of which are in the 31 oil fields overlapping the species’ habitat. Areas already open to oil and gas development and potentially available to oil and gas

¹ These 31 oil fields are Antelope Hills, North Antelope Hills, Antelope Plains Gas (ABD), Asphalto, Belgian Anticline, Blackwells Corner, Buena Vista, Cal Canal Gas, Carneros Creek, Chico-Martinez, Coalinga, Coalinga East Extension, Cymric, Elk Hills, Gujarral Hills, Jacalitos, Kettleman North Dome, Kreyenhagen (ABD), McDonald Anticline, McKittrick, Midway-Sunset, Monument Junction, North Belridge, Pleasant Valley, Pyramid Hills, Railroad Gap, Shale Flats Gas (ABD), Shale Point Gas (ABD), South Belridge, Temblor East (ABD), and Temblor Ranch.

development comprise 98.3% of the lizard’s range, including private lands, areas open for leasing, and existing leases (see Figures 5, 6). Moreover, Kern County, where the majority of remaining Temblor legless lizard habitat is located, is attempting to streamline oil and gas permitting to make future approvals for projects faster and hidden from public scrutiny. In 2019 the Bureau of Land Management (BLM) opened up oil and gas drilling and fracking on more than one million acres of public lands and mineral estate in Central California, including a significant portion of the Temblor legless lizard’s restricted range.

Figure 5. Active oil and gas development in the Temblor legless lizard range.

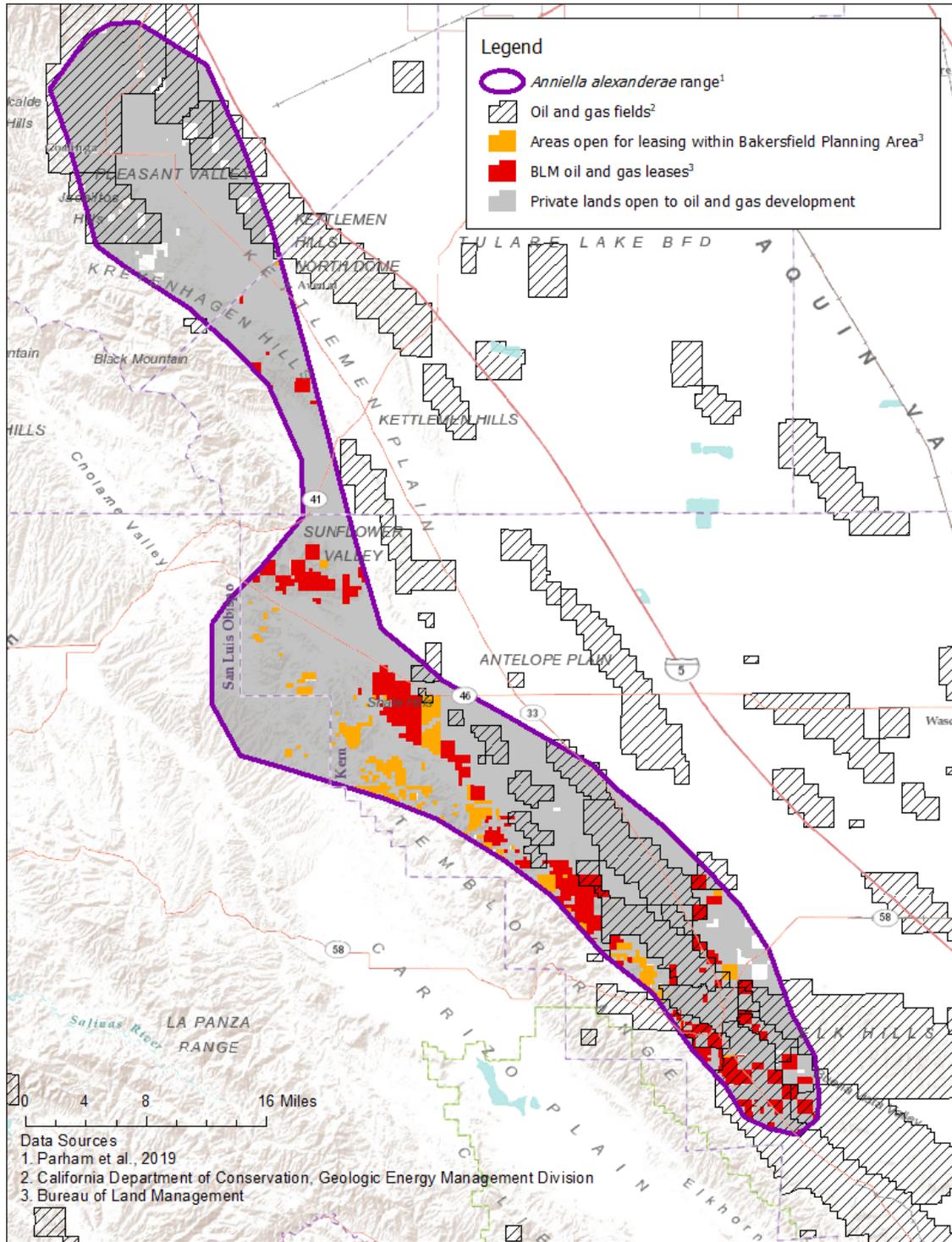


The state oil regulator, California Geologic Energy Management Division (CalGEM), under Governor Newsom has approved more than 9,700 new permits for oil and gas development in California since 2019 (Consumer Watchdog and FracTracker Alliance 2021), including more than 5,000 permits for new drilling (Center for Biological Diversity 2021). Midway-Sunset, the location of lizard detection site 1, is the largest oil field in Kern County with the largest remaining volume of crude oil and heavy drilling activity. Midway-Sunset has more than 25,000 active and idle wells (CalGEM 2021a), and CalGEM has issued at least 870 new drilling permits in this oil field since 2019 (Center for Biological Diversity 2021). McKittrick, the location of lizard detection site 2, has nearly 2,000 active and idle wells (CalGEM 2021a) with at least 314 new drilling permits issued since 2019 (Center for Biological Diversity 2021). Lizard detection site 3 is located on the Pleasant Valley Ecological Reserve (Pleasant Valley ER, p. 2), but is surrounded by the Pleasant Valley oil field and adjacent to the Coalinga and Gujarral Hills oil fields. Coalinga oil field has more than 4,100 active and idle wells (CalGEM 2021a) with at least 209 new drilling permits issued since 2019 (Center for Biological Diversity 2021). The Pleasant Valley and Gujarral oil fields each have 5 active or idle wells (CalGEM 2021a). With ~1,184 permits approved for new drilling in the Midway-Sunset and McKittrick oil fields alone since 2019, where two of the four lizard detection sites are located, clearly oil and gas development is a serious and increasing threat to the lizard and its habitat.

Furthermore, in 2015 Kern County issued an ordinance that attempted to “streamline” oil and gas permitting in the county by not requiring any further environmental review or public notice for up to 72,000 wells over the next 25 years (Kern County 2015). However, in a February 2020 ruling, California’s Fifth District Court of Appeals ruled that Kern County violated the California Environmental Quality Act by failing to fully evaluate and disclose the environmental damage that would occur as a result of the county’s plan, including harm from water use, air pollution, and increased noise (*King and Gardiner Farms et al. v. County of Kern et al.*, 45 Cal.App.5th 814 (2020)). After the ordinance passage and before the court ruling, Kern County was issuing more than a thousand oil and gas permits each year (Kern County 2019, Table 1). In March 2021, Kern County approved a supplemental environmental impact report under a nearly identical ordinance to serve as a single environmental review for more than 40,000 new oil and gas projects over the coming decades (Kern County 2021a). This environmental impact report fails to adequately disclose, evaluate, and mitigate harms to the imperiled Temblor legless lizard and is being challenged in court (*Committee for a Better Arvin et al. v. County of Kern et al.*, 2021). This ordinance, if adopted, would jeopardize the Temblor legless lizard and its habitat through foreseeable increases in habitat loss and fragmentation, traffic, oil spills, chemical spills, and other disturbances resulting from oil and gas development.

Recently proposed oil and gas development on federal lands further jeopardizes the Temblor legless lizard. In November 2019, the Bureau of Land Management (BLM) under the Trump administration issued an environmental analysis, being challenged in court (*Center for Biological Diversity v. U.S. Bureau of Land Management*, No. 2:20-CV-00371 DSF, 2020), for the Bakersfield Resource Management Plan to allow oil and gas drilling and fracking on more than one million acres of public lands and mineral estate in Central California (BLM 2019), including a significant portion of the Temblor legless lizard’s remaining habitat (see Figure 6).

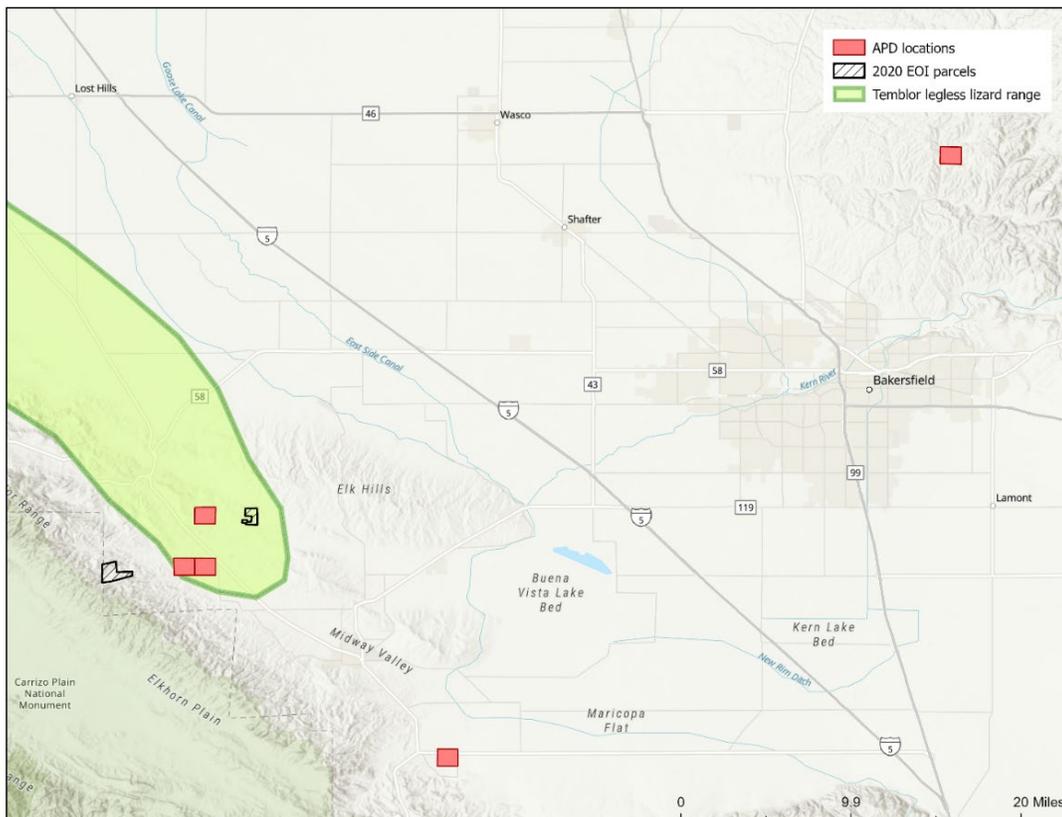
Figure 6. More than 98% of the lizard's range is available for oil and gas development. Oil and gas leases on federal lands or on lands with federal mineral rights are shown in red. Areas recently opened to leasing under the Bakersfield Resource Management Plan are shown in orange. Private lands potentially available for oil and gas development are shown in gray.



In December 2020, the BLM approved the first oil and gas lease sale of federal public lands in California in eight years, covering 4,000 acres in Kern County (BLM 2020). One of the seven parcels falls within the known habitat range of the Temblor legless lizard (see Figure 7). Yet the BLM failed to analyze the impacts of this development on the Temblor legless lizard, despite the fact that the lizard is a Species of Special Concern (*Center for Biological Diversity et al. v. U.S. Bureau of Land Management et al.*, No. 21-cv-475, 2021) and is being considered for federal listing under the U.S. Endangered Species Act (ESA) (USFWS 2021a) following an October 2020 petition from the Center for Biological Diversity (Center for Biological Diversity 2020). BLM is supposed to give special status consideration to any species listed or proposed for ESA listing as well as species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA (BLM 2020, p. 22).

BLM has since proposed to approve dozens of new drilling permits in the Midway Sunset oil field. In April 2021 BLM proposed to approve 14 Applications for Permit to Drill (APDs) submitted by Chevron to drill new wells in Midway Sunset (BLM 2021a), and in July 2021 BLM proposed to approve another 50 APDs submitted by Berry Petroleum Company (BLM 2021b). At least three APD projects fall directly within the Temblor legless lizard’s known range, as shown in Figure 7. This proposed oil and gas development would jeopardize the remaining populations and habitat of this imperiled lizard in this region.

Figure 7. 2020 BLM lease sale within the habitat range of the Temblor legless lizard, shown as “2020 EOI parcel.” Proposed permits to drill shown as “APD locations.”



Overview of harms from oil and gas development

Oil and gas development causes severe and often permanent damage to the ecosystems where it occurs by destroying and fragmenting habitat, reducing water supplies often in water-stressed areas, causing air, noise, and light pollution, contaminating surface and ground water, and facilitating the spread of ecologically disruptive invasive species (Butt et al. 2013, Brittingham et al. 2014, Pickell et al. 2014, Souther et al. 2014, Allred et al. 2015, Harfoot et al. 2018). During the construction of well pads, roads, pipelines, compressor stations and other oil and gas infrastructure, native vegetation is cleared, and soils are bulldozed and compacted. Fossil fuel development also creates the significant risk of oil spills and chemical-laden produced water spills which can kill wildlife and cause devastating effects over large areas. Spills and leaks require large volumes of soil to be excavated and transported to hazardous waste facilities (Goldberg 2019). The “surface expression” spills caused by steam injection create gaping sinkholes in the ground and destabilize the entire area (Wilson and Younes 2020). Unlined wastewater pits allow contaminants to seep into the soil (DiGuilio et al. 2021). Remediation of the land may be infeasible once chemicals have contaminated the soil beneath such facilities. Thus, oil and gas operations can destroy vegetation and soil and permanently degrade habitat. For many species, the harms from fossil fuel development have led to mortality, changes in behavior, population declines, disruptions to community composition, and loss of ecosystem function (Endangered Species Coalition 2012).

While all oil and gas development poses a threat to the Temblor legless lizard, commonly used oil and gas extraction techniques in the lizard’s range in Kern, Kings and Fresno Counties, such as steam flooding, cyclic steam injection, water flooding, and fracking, are particularly destructive, causing additional impacts. These extreme extraction techniques require pumping large volumes of toxic chemicals, steam, water, and sand at high pressures into rock formations, causing them to crack and release oil and gas. Cyclic steaming and steam flooding are heavily used in Midway-Sunset, Cymric, Coalinga, McKittrick, and South Belridge oil fields in the lizard’s range (Fleming et al. 2021, p. 20, Figures 10 and 11). During steam injection for cyclic steaming and steam flooding, the operator repeatedly injects steam at very high temperature and pressure into the well to heat up the surrounding formation. Repeated steam injection creates some of the harshest conditions to which a well can be subjected. The process is known to result in a particularly high rate of well failure, can cause the ground to shift and collapse, and can cause oil and wastewater to rise to the surface (“surface expressions”) which can kill wildlife and plants and destroy habitat, as detailed further below. Fracking is another commonly used extraction technique particularly in South Belridge oil field in the lizard’s range (CalGEM 2021a). Fracking uses toxic chemicals and causes wide-ranging ecological harms including habitat loss and fragmentation; surface and groundwater contamination; localized air, noise and light pollution; vehicle traffic; climate change; and other cumulative impacts (Souther et al. 2014, p. 330; CCST 2015, p. 311).

Habitat loss and fragmentation

The Temblor legless lizard has already suffered significant habitat loss and fragmentation from oil and gas development (Hammerson 2019, p. 2; Parham et al. 2019, p. 5). Satellite imagery

indicates that oil and gas development has already destroyed and degraded 50% to 90% of the Temblor lizard's range (Hammerson 2019, p. 6). Fracking and cyclic steaming has led to increased habitat loss and fragmentation in Kern County by enabling oil and gas development in previously unexploited natural habitat and by increasing well densities in developed areas (CCST 2015, p. 399).

Oil and gas exploration activities and the construction and operation of well pads, roads, pipelines, compressor stations and other oil and gas infrastructure clears habitat, removes native vegetation, and disturbs and compacts soil. Numerous scientific studies demonstrate that habitat loss and fragmentation from oil and gas infrastructure negatively affects species by impeding movement and dispersal, reducing home range size, reducing patch size below what is needed for foraging and life history activities, increasing habitat isolation, altering physical characteristics such as light, moisture, and temperature, facilitating the spread of invasive species, and altering species dynamics including interactions and abundance (Brittingham 2014, pp. 11034-11043; Souther et al. 2014, p. 330; Allred et al. 2015, p. 402). Fragmentation creates "habitat islands" that can disrupt movement (MacNally and Brown 2001, p. 116) and erode genetic variation in small populations and promote inbreeding (Templeton et al. 1990, p. 13-27).

Fragmentation also increases the proportion of disturbed edge habitat to undisturbed interior habitat which can increase the likelihood of predation, parasitism, and human disturbance. For example, in the Marcellus shale, while each drilling pad and associated infrastructure results in the clearing of 8.8 acres, each drilling pad affects 30 acres after accounting for ecological edge effects (Johnson 2010). Similarly, in the Big Piney-LaBarge field in Wyoming, a study found that while the overall area of oil and gas infrastructure covered 4% of the total area, 97% of the total area fell within one-quarter mile of oil and gas infrastructure (Weller et al. 2002).

Fracking has become an increasingly important driver for enabling oil and gas production: 20% of the land area that was newly developed for oil and gas production between October 2012 and September 2014 was attributed to fracking (CCST 2015, p. 366). Kern County has experienced the majority (61% percent) of the habitat loss and fragmentation attributable to fracking-enabled production in the state, estimated at 13,400 hectares of altered natural habitat and 6,700 hectares of other altered land areas (CCST 2015, pp. 365, 399). Fracking-enabled activity exerts high local impacts on habitat in the southwestern San Joaquin Valley "where frequently stimulated fields overlap with high-quality habitat for rare species" (CCST 2015, p. 366).

In the San Joaquin Valley, high levels of habitat disturbance and fragmentation from oil and gas development prevent endemic species from persisting in those areas, including the blunt-nosed leopard lizard, San Joaquin kit fox, San Joaquin antelope squirrel, and endangered kangaroo rats (Fiehler and Cypher 2011, 2017). Most of these species were no longer detected in areas with 70% habitat disturbance or more (Fiehler and Cypher 2011, p. 21). Similarly, the USFWS Recovery Plan for the Upland Species of the San Joaquin Valley reports that blunt-nosed leopard lizard "population densities decrease as oil activity increases" and they tend to inhabit areas where little to no petroleum development occurs (USFWS 1998, p. 119).

Species like the Temblor legless lizard with limited ranges, small population size, low mobility, specialized habitat requirements, and high sensitivity to disturbance are at particular risk from habitat loss and fragmentation from oil and gas development (MacNally and Brown 2001, pp. 116-117; Brittingham et al. 2014, p. 11034). In short, the Temblor legless lizard, a cryptic lizard with localized populations, is being restricted to remnant habitat patches amidst rampant oil and gas development.

Soil compaction, loss of native plant life, changes in soil moisture

Oil and gas development compacts soils and clears native vegetation through construction, road-building, vehicle traffic, and other heavy equipment use. Oil and gas development can change soil moisture through clearing and grading of well pads that increases sediment runoff; and construction, maintenance, and/or use of culverts, pipelines, and other structures that alters water flow (Brittingham et al. 2014, p. 11038). In addition, cleared or altered areas generally allow more solar radiation to reach the ground during the day and more to re-radiate to the atmosphere at night, resulting in larger temperature and moisture gradients and higher variability near development edges compared with undisturbed areas (Wilson 2016, p. 4). Differences in air temperature, air and soil moisture, and light intensity have been estimated to extend more than 240 meters from disturbed area edges (Wilson 2016, p. 4).

The Temblor legless lizard is a micro-habitat specialist that requires loose, sandy soil for burrowing, a litter and duff layer, and specific moisture levels for its life cycle (Jennings and Hayes 1994, p. 108, Thomson et al. 2016, p. 188). It does not respond well to disturbed soil moisture levels, compacted soil (Thomson et al. 2016, p. 189) or mechanical disturbances (Miller 1944, p. 280). Oil and gas development—including construction, road-building, and heavy equipment and vehicle traffic—poses a significant threat by compacting the soil, decreasing the amount of loose substrate for the lizard to move through, removing the litter and duff layer, and altering soil moisture levels.

Noise and light pollution

Oil and gas development creates significant intermittent and chronic noise pollution due to construction, drilling, venting, flaring, fracking, truck transport, compressors, human activity, and other noise sources (CDC 2015, p. 7-30). Noise pollution from drilling, well stimulation, and compressor stations is particularly significant. CalGEM reports the noise from pumping during a frack job at 107 decibels (CDC 2015, p. 7-30) while noise from pumping during acid matrix stimulation can range between 75 to 100 decibels (CDC 2015, p. 7-37). Compressor stations can produce constant sound over 80 decibels — as loud as a busy highway. Drilling operations often continues 24 hours a day until completion, meaning that surrounding areas can be exposed to noise from drill rigs, air compressors, drill pipe connections and power generators day and night.

Oil and gas development can also lead to significant amounts of light pollution. Drilling sites are lighted at night to allow for 24-hour operation of the drill rig, and well drilling lasts an average of 23 days but can continue for more than 60 days (Kern County 2015, p. 3-41). During inevitable oil and produced water spills, oil companies will utilize strobe lights and propane cannons through the night to ward off wildlife.

Anthropogenic noise is a widespread pollutant that affects a wide array of species including reptiles (Kunc and Schmidt 2019). Research shows that noise pollution from oil and gas-related activities can cause wildlife to temporarily or permanently abandon habitat areas and can negatively impact abundance, stress levels, behavior and fitness (Bayne et al. 2008; Francis et al. 2013; Patricelli et al. 2013; Wilson 2016, pp. 2-4; Kleist et al. 2018, p. E468). Light pollution has been shown to disrupt animal foraging, breeding, and migratory behaviors; cause disorientation; disrupt natural day-night cycles of plants; lead to mortality and predation; and change community composition (CCST 2015, p. 350).

The Temblor legless lizard is particularly sensitive to noise and light (Miller 1944, p. 277, 284, 285, 288). It can sense vibrations through the ground and has a keen sense of mechanical disturbances (Miller 1944, p. 280). The lizard uses this sense to follow their prey from below and come up ahead of the prey and catch it (Miller 1944, p. 280). The chronic and intermittent vibrations and noise disturbances from oil and gas development could harm the lizard's ability to hunt (Thomson et al. 2016, p. 189, 190). Although they are mostly subsurface, legless lizards use the surface for feeding and mating (Thomson et al. 2016, p. 188) and may also use the surface on warm nights (Jennings and Hayes 1994, p. 110). Because legless lizards are sensitive to light, light pollution from oil and gas development may interrupt these surface activities.

Oil spills and produced water spills

Oil and produced water spills threaten the Temblor legless lizard including by contaminating habitat with toxic chemicals, altering soil density and moisture content, and injuring and killing lizards during spills or clean-up activities. As detailed below, oil and produced water spills are rampant in the Temblor legless lizard's restricted range, including at least 20 "surface expression" spills since 2019, two of which are currently active.

Oil and produced water spills and leaks are inherent to oil and gas production and occur with troubling frequency in California. Between January 2009 and December 2014, a total of 575 produced water spills and 31 chemical spills were reported, equivalent to 99 produced water spills per year (CCST 2015, p. 345). One acid spill ruptured beyond a secondary containment apparatus and spilled 5,500 gallons of hydrochloric acid (CCST 2015, p. 128). Kern County has the highest concentration of produced water spills (55%) and chemical spills (42%) of any county in the state (CCST 2015, p. 161). Kern County estimates that there have been 613 spills and 87 well leaks reported from 2009 through 2014 (Kern County 2015, p. 4.9-72). The number of incidents reported is likely smaller than the number of actual spills and leaks, either because they have not yet been discovered, or operators have not reported them.

Produced water spills contain a toxic mix of chemicals. One comprehensive study found that 40% of the chemicals added to fracking fluids have ecological effects, indicating that they can harm wildlife (Colborn 2012). A 2017 study of the chemicals used in routine oil and gas activities in California – including well drilling, well completion, and well rework – found that there is widespread use of toxic chemicals (Stringfellow et al. 2017). Although 70% of the disclosed chemical additives could not be fully evaluated because of insufficient reporting on chemical identity by the oil and gas industry, commonly used chemical additives in routine

activities include ecotoxic biocides and corrosion inhibitors, as well as the use of high concentrations of hydrochloric acid and hydrofluoric acid for maintenance acidizing. In total, 58 chemical additives were identified as being ecotoxic.

Steam injection causes large and frequent “surface expressions” in the Temblor lizard range, in which oil and produced water are pushed up to the surface and cause large-volume spills. These surface spills are particularly common in Cymric, McKittrick, and Midway-Sunset oil fields in the lizard’s restricted range. There are currently at least two active surface spills in the legless lizard’s range and 18 that have just been controlled in the past two years (CalGEM 2021b). For example, the Cymric 1Y Oil Field spill in Kern County was first reported in early May 2019 and took 5 months to clean up an estimated 1,339,926 gallons (31,903 barrels) of spilled oil and water (see Figure 8) (CDFW 2019, p. 1). The Oil and Gas Supervisor determined that the spill presented a significant threat of harm to human health and the environment (CDC 2019, p. 6). Another surface spill in the Cymric oil field, GS-5, has leaked more than 16.8 million gallons of oil and about 70 million gallons of wastewater intermittently since 2003, more than the Exxon Valdez spill (CDFW 2019; Wilson and Younes 2020), threatening wildlife and plant species in the area. Of particular concern, the frequency of reported large spills has increased since CalGEM adopted changes to state regulations in April 2019 to allow higher pressure steam injection to occur (Cal. Code Regs, tit. 14, § 1724.10.3 (Apr. 1, 2019)).

There are no meaningful disincentives for oil companies to prevent surface expressions. In fact, many become a financial windfall. Operators have “commercialize[d] surface expressions, despite warnings by staffers about environmental and human harm” (Wilson and Younes 2020). According to Wilson and Younes (2020), “[i]n the last three years alone, the crude collected from GS-5 [the Cymric GS-5 spill] has generated an estimated \$11.6 million.”

It is well-documented that oil and chemical spills can have catastrophic ecological impacts due to their toxic effects, the potentially large volume of spills, and the difficulty of containment and clean-up (i.e., produced water spills cannot be contained by traditional oil spill response methods). In Kern County, wildlife that live in burrows near spills are “entombed” by the spilled crude oil (Wilson and Younes 2020). Records show “dozens of dead and decaying birds and small mammals around spill sites” (Wilson and Younes 2020).

The Temblor legless lizard is a small, reclusive reptile that would not be readily visible during an oil spill. They would be entombed by fast-rising crude oil and produced water from underground. Without focused surveys it would be unknown if any legless lizards were killed in an oil spill. The process of cleaning up an oil spill, involving removal of significant amounts of soil during a clean-up, could easily wipe out an entire legless lizard population (see Figure 8). An oil spill during the legless lizard breeding season from early spring to July (Jennings and Hayes 1994, p. 110) could also wipe out breeding populations.

Figure 8. A “cleaned-up” oil and produced water surface spill in Cymric oil field, Kern County.



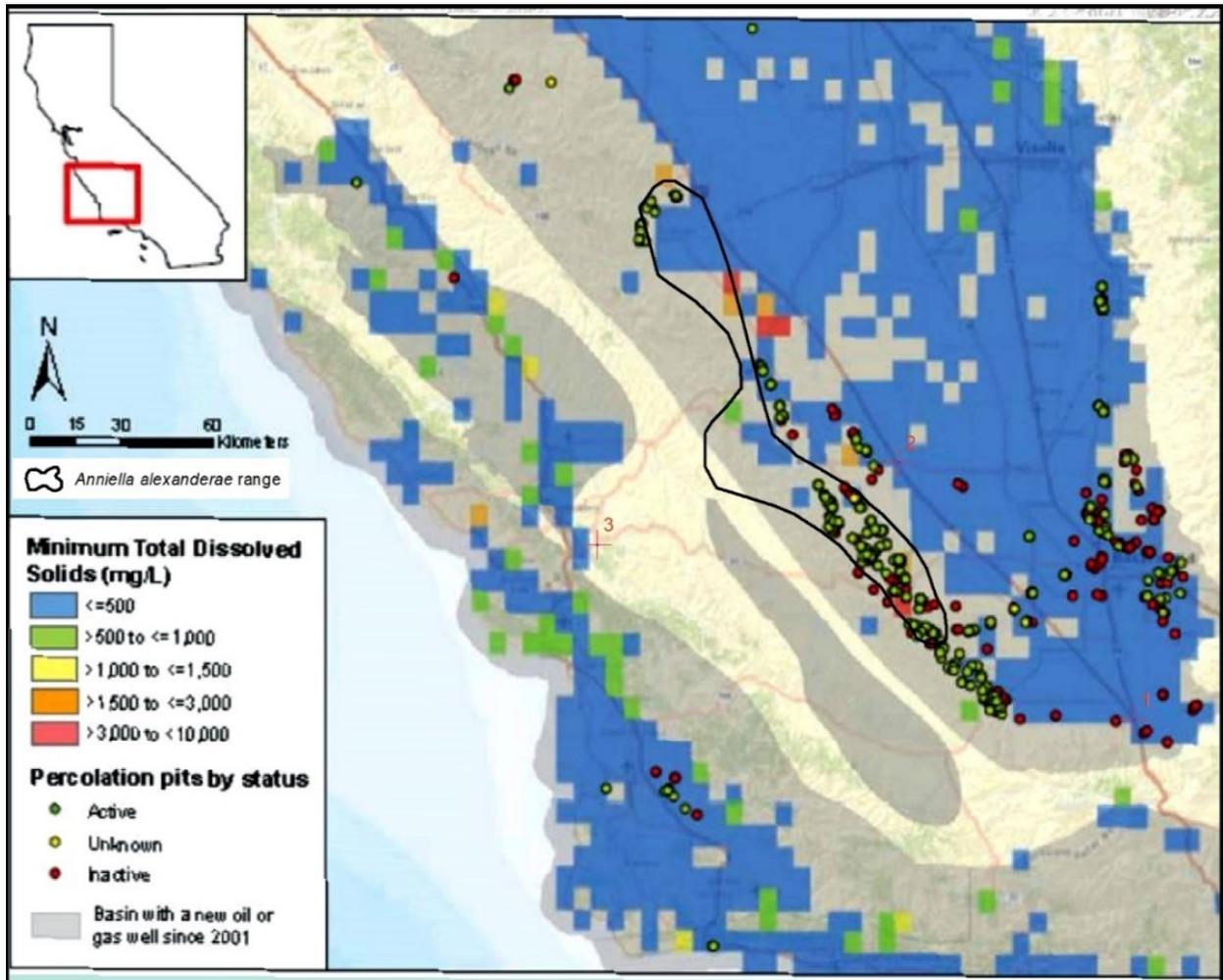
Spills could also harm habitat suitability for the Temblor legless lizard by altering soil density and moisture content. Furthermore, reptiles are sensitive to contaminants and accumulate and magnify them to levels equal or greater than those reported for mammals and birds (Crain and Guillette 1998, pp. 77-78). As detailed above, produced water contains hydraulic fracturing fluids, radioactive materials, heavy metals and other compounds such as polycyclic aromatic hydrocarbons, alkenes, alkanes and other volatile and semi-volatile organics (Pichtel 2016, p. 1). Some of these pollutants are known to be toxic or carcinogenic in the environment, while others are endocrine disruptors (Pichtel 2016, p. 2). A reptile’s endocrine system controls nearly every aspect of its life and is instrumental in regulating processes such as metabolism, development, reproduction, tissue function and behavior (Norris and Lopez 2011, p. 373). Disruption of these processes can sabotage sexual development, sex ratio and metabolic compensation for environmental stress; in combination with other stressors such as habitat loss and global climate change, it can contribute to local extinctions (Cheek 2006, p. 1.) Studies have shown that endocrine disruptors can affect reptile testosterone levels, gonad size, population levels, energy levels related to reproduction and growth, hatching and developmental abnormalities, and mortality (Gibbons et al. 2000, p. 657; Zychowski and Godard-Codding 2016, p. 26; Crain and Guillette 1998, p. 77-86). Only a modest amount of information is available on the exposure of these compounds to lizards (Zychowski and Godard-Codding 2016, pp. 28, 29). While specific impacts to the Temblor legless lizards are not yet known due to its fossorial and cryptic nature and lack of focused monitoring, there is enough information to show that the survival of the Temblor legless lizard is threatened by toxic compounds and endocrine disruptors.

Wastewater disposal pits

California is the only state with significant oil production that allows oil and gas wastewater to be dumped into unlined pits (Center for Biological Diversity 2019). The use of wastewater

disposal pits as a part of wastewater management is a historic and dangerous practice in the oil and gas industry, particularly throughout the San Joaquin Valley and Kern County in particular. California rules allow three types of pits: drilling sumps, evaporation sumps, and operations sumps (Earthworks 2021, p. 11). A February 2016 report found that there were 790 active pits in California and that a vast majority of them are unlined (Earthworks 2021, p. 11). There are hundreds more that are technically “inactive” but continue to harm the environment (Earthworks 2021, p.11). Further, 60% of waste pits in California either do not have a permit or are otherwise out of compliance with state water quality standards, but nevertheless have been allowed to remain in operation (Earthworks 2021, p.11). As of April 2015, over 200 unlined pits in the Central Valley alone were operating without the necessary permits (CCST 2015, p. 110). Currently, many wastewater disposal pits are located throughout the Temblor legless lizard’s range (see Figure 9).

Figure 9. Location of active percolation pits used for produced water disposal in the Temblor legless lizard’s range and the location of groundwater of varying quality. Source data: CCST 2015, p. 25.



Wastewater pits can contain hazardous chemicals from hydraulic fracking treatments, as well as reaction byproducts of these chemicals (CCST 2015, p. 23). The Central Valley Regional Water Board is supposed to require that fluid in pits meets certain water quality standards for salinity, chlorides, and boron (CCST 2015, p. 344). However, there is no testing required, or thresholds specified, for other contaminants (CCST 2015, p. 344). Even wastewater that exceeds the salinity thresholds may be discharged in “unlined sumps, stream channels, or surface water if the discharger successfully demonstrates to the Regional Water Board in a public hearing that the proposed discharge will not substantially affect water quality nor cause a violation of water quality objectives” (CCST 2015, p. 110). There is “ample evidence” of groundwater contamination from waste pits in California (CCST 2015, p. 112). In the Central Valley, the Regional Water Quality Control Board ordered the closure of several waste pits in the North and South Belridge and Lost Hills oil fields because of their negative impacts on groundwater (CCST 2015, p. 112). Indeed, a new study confirms that unlined pits endanger groundwater in the San Joaquin Valley, documenting how the disposal of over 16 billion barrels of oil and gas wastewater into unlined pits over a 50-year period has introduced salts, carcinogens, and other toxins into regional aquifers (DiGuilio et al. 2021).

This is particularly concerning because a statewide science review reported that oil and gas wastewater storage and disposal ponds can cause wildlife harms and mortality, concluding that “[w]ildlife can suffer negative effects or mortality by drinking from or immersing themselves in wastewater storage or disposal ponds” (CCST 2015, p. 343). The report points out that “oil field wastewater typically contains other chemicals such as volatile organic compounds (VOCs), benzene, and naturally occurring radioactive material (NORM) that are of concern for human and environmental health” (CCST 2015, p. 344). And further that “constituents besides oil could impact the health of organisms that come in contact with the sumps, particularly if the produced water contains traces of stimulation chemicals” (CCST 2015, p. 345). The report points to documented cases in California in which endangered blunt-nosed leopard lizards, giant kangaroo rats, and San Joaquin kit foxes drowned in spills of oil-laden wastewater (CCST 2015, p. 343).

In short, wastewater pits which are common in the Temblor legless lizard’s remaining habitat pose a risk through habitat destruction to create pits, soil and water contamination, and drowning of lizards in wastewater.

B. Urbanization

Encroaching urbanization has been associated with habitat destruction and reptile extinction; urbanization tends to decrease native species richness and promote diversity of exotic and/or non-native species (French et al. 2018, p. 954). Urbanization has caused imperilment of over 275 threatened and endangered species in the United States (Czech 2004, p. 10). Many lizard species are unlikely to move to new habitat if there are changes due to habitat alteration (Howland et al. 2014, p. 3), and the Temblor legless lizard is known to have limited ability to disperse, thus is likely to be extirpated by urbanization.

Parham et al. (2019, p. 22) found that all estimated range maps for the Temblor legless lizard based on ecological niche modeling predict that there is a strong likelihood of potential

extirpation from human development. The lizard's suitable habitat historically extended into the San Joaquin Valley, but much of that has been lost to development. By 1979 nearly all the San Joaquin Valley floor was urbanized or converted to cropland and less than 5% of the Valley floor remains uncultivated – with much of that uncultivated land already developed for oil and gas extraction (USFWS 1998).

C. Industrial Solar Projects

While renewable energy is urgently needed to address the climate emergency, the direct loss of habitat and sand movement from improperly sited industrial solar projects can harm the Temblor legless lizard. The legless lizard is a microhabitat specialist that needs loose soil to burrow as well as shaded areas for feeding and mating (Thomson et al. 2016, p. 188). Habitat is changed considerably with the installation of a solar power plant: the soil is often scraped bare during construction; herbicides or mowing can be used to keep vegetation down; and the panels themselves cast shadows and change the microclimate (Turney and Fthenakis 2011, p. 3265). Soil compaction and ecosystem disturbance from solar projects can take years for recovery (Turney and Fthenakis 2011, p. 3266).

There are numerous industrial solar fields across the San Joaquin Valley, with a few already located within the lizard's range (see Figure 10). Currently, there are more than 19 commercial solar projects in the permitting process and two utility scale solar projects in the approval process with the California Energy Commission in Kern County (Kern County 2021b). Cumulatively these projects could lead to habitat fragmentation and destruction of lizard habitat.

D. Climate Change

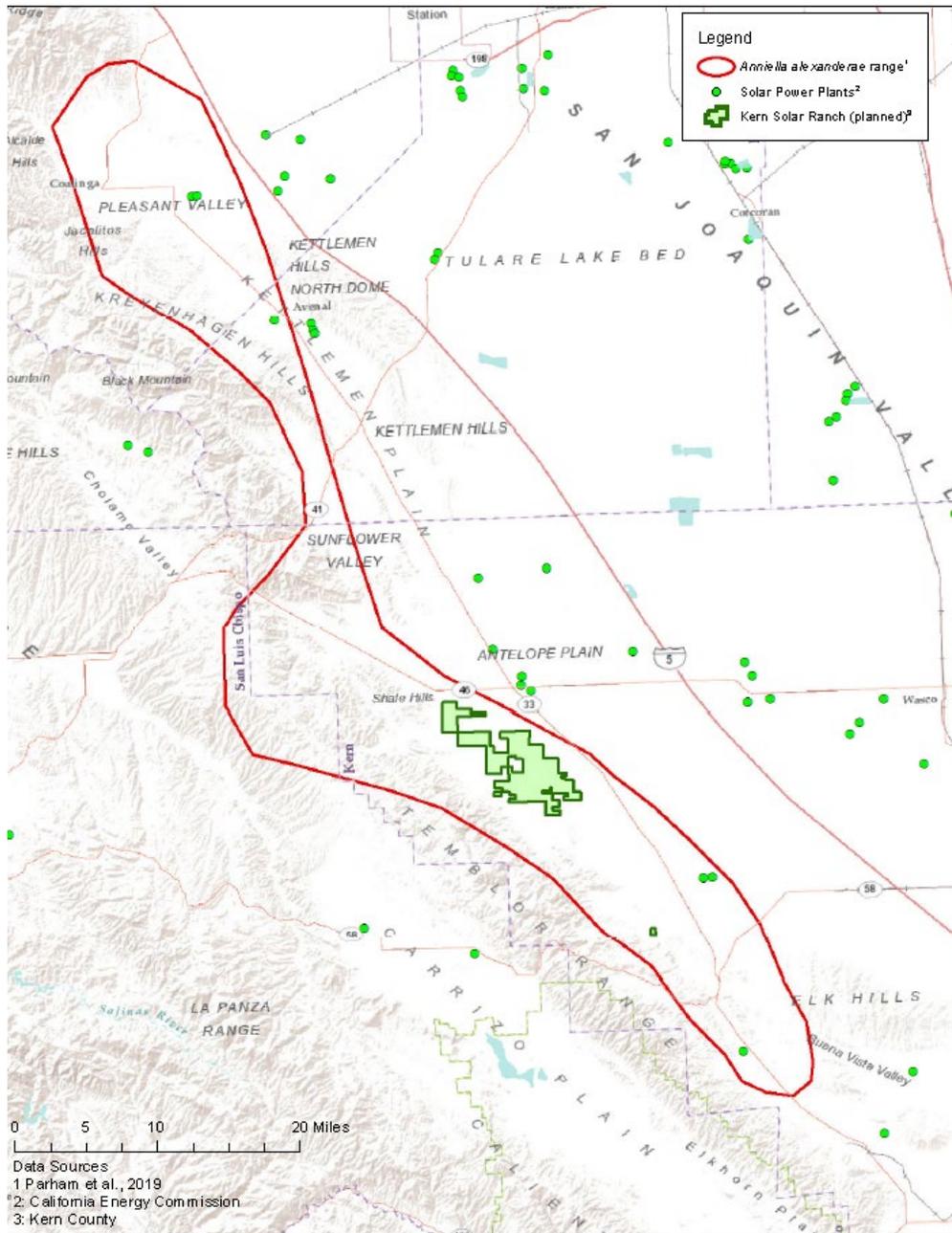
Anthropogenic climate change poses an escalating threat to the Temblor legless lizard. As reptiles, Temblor legless lizards are highly sensitive to climate change (Mitchell and Janzen 2010, p. 129-140; Tuberville et al. 2015, p. 822-834), particularly to changes in temperature and precipitation.

California is particularly vulnerable to harms of the climate crisis, identified as “one of the most ‘climate-challenged’ regions of North America” (Bedsworth et al. 2018, p. 13). The state is already experiencing rising temperatures, declining snowpack, more heavy precipitation events, intensifying drought, and increasing area burned by wildfire (Thorne et al. 2018, p. 4). Climate change has contributed to a series of some of the most extreme events in California's recorded history: a severe drought from 2012-2016, an almost non-existent Sierra Nevada winter snowpack in 2014-2015, increased destruction of communities by wildfires, and back-to-back years of the warmest average temperatures (Thorne et al. 2018, p. 3).

Specifically, average annual temperatures have increased in California by 2°F since the early 20th century (Frankson et al. 2017, p. 5) and are projected to rise by 8.8°F by 2100 if emissions continue at current rates (Thorne et al. 2018, p. 5). Heat waves are becoming more frequent (Thorne et al. 2018, p. 3, 15). Precipitation is becoming more variable, and heavy downpours – with their associated flooding – are projected to become more frequent, especially due to an increase in atmospheric rivers (Thorne et al. 2018, p. 24-25). Mountain snowpack is declining,

and by 2050 the average water supply from snowpack is projected to decline to two-thirds of historical levels (Thorne et al. 2018, p. 5). Rising temperatures and loss of snowpack are intensifying drought conditions which threaten water supplies (Gonzales et al. 2018, p. 1103, 1104, 1107). Kern County is expected by 2050 to have an increase in winter average temperatures by 3-4°C (5-6°F in the summer), increase by 3-5 days of heat waves, and a decline of 1-2 inches of precipitation (Advancement Project California 2019, p. 3).

Figure 10. Map of solar projects in the range of *A. alexanderae* habitat.



Temblor legless lizards require specific temperature ranges and soil moisture levels for their survival (Thomson et al. 2016, p. 189-190). Legless lizards prefer temperatures between 59 to 77°F (15 to 25°C) (Miller 1944, p. 284, 288). They are inactive at temperatures below 55°F (13°C), and temperatures in a laboratory setting above 104°F (40°C) are lethal to *Anniella* species (Miller 1944, p. 284, 288). Studies indicate that the legless lizard prefers temperatures which are lower than basking lizards and that they adapted to more activity during the morning or late afternoon when the temperatures are cooler (Bury and Balgooyen 1976, p. 152, 154). Rising temperatures and the increasing frequency of heat waves could decrease the amount of time they are actively feeding on or near the surface, negatively impacting their ability to hunt and mate, resulting in lower reproductive output.

Temperature regulates the key aspects of reptile life history, such as sex determination and incubation, and stress related to temperature rise is predicted to exacerbate population declines and lower global reptile diversity (Mitchell and Janzen 2010, p. 129-140). While it is not known at this time exactly how temperature changes from climate change will affect the Temblor legless lizard in regard to sex determination, it is known that male legless lizard's sperm matures throughout the fall and winter and the females experience ovulation from May to June (Goldberg and Miller 1985, p. 618), indicating that sexual reproduction is temperature and seasonally dependent.

A set moisture level in the sand is necessary for proper skin shedding to ensure that sloughing occurs around the face and the eyes for hunting and eating. If the sand is too dry, the shedding could stick to the new skin, which proves especially difficult for hunting if it covers the eyes and limits vision, potentially starving the lizard (Miller 1944, p. 277). The increase in extreme precipitation events, including the increase in heavy downpours and drought intensity, could change soil moisture levels or prey availability in ways that are harmful to these lizards. In addition, heavy flooding could drown lizards in low-lying habitat areas. The on-going drought in the state of California has likely already suppressed legless lizard populations (Hammerson 2019, p. 1-7).

Reptiles are vulnerable to the rapid rate of climate change because of their limited dispersal abilities (Gibbons et al. 2000, p. 660). Studies have already linked climate change to reptile range shifts (Moreno-Rueda et al. 2011; Hatten et al. 2016) and population extirpations (Whitfield et al. 2007, p. 3252-8356; Sinervo et al. 2010). If warming continues at the current rate, 20% of lizard species worldwide could be driven out of their thermal niches by 2080 and face a high risk of extinction (Sinervo et al. 2010, p. 894). Indeed geological evidence points towards historical shifts in climate having detrimental effects on ectotherm biodiversity as these species are significantly slower at shifting into new niches compared to endotherms (Rolland et al. 2018, p. 460).

In sum, because the Temblor legless lizard is a micro-habitat specialist amid a fragmented habitat range, the extreme temperatures, extended drought and increased flooding due to climate change pose escalating threats to their survival.

E. Invasive Species

While many of the factors listed above (oil and gas development, urbanization, climate change) are themselves main threats to the Temblor legless lizard, they also facilitate spread of invasive species, which can alter community and trophic interactions (French et al. 2018, p. 948). Invasive grasses and non-native wild pigs are changing the landscape and threatening the habitat and survival of the legless lizard.

In the Temblor legless lizard's range, *Bromus* grass species have taken over rangeland, leading to widespread increases in fire frequency, where native shrubs don't recover as well (Bossard et al. 2000, p. 12). *Bromus* grasses reduce soil moisture, change the root structure making the sand unsuitable for burrowing, outcompete native plants that provide high quality microhabitats and reduce the number of insects that inhabit the sand and leaf litter that the lizards feed on (Gallegos 2019, p. 3; Jennings and Hayes 1994, p. 111). Wildfires are likely to convert chaparral to grassland dominated by non-native grasses, which alter the abundance or composition of the lizard's prey (Evelyn and Sweet 2018, p. 7), leading to higher levels of predation and a change in the composition of leaf litter that the lizard needs for burrowing and survival (Howland et al. 2016, p. 2).

Oil and gas extraction facilitate the spread of invasive species via extensive earth moving activities, construction of new roads, expansion of existing roads, heavy truck traffic, and importing of materials that could lead to unintentional introductions (Brittingham et al. 2014, p. 11034). Urbanization disturbs habitats, opening niches to invasive species and leading to invasive species introductions (Czech 2004, p. 8-9). Overgrazing by domestic livestock also facilitates the spread of invasive plant species by reducing desirable grass competitiveness and increasing invasive plants (DiTomaso et al. 2010, p. 43-47). While many of these non-native grasses are now being controlled by livestock grazing, they are normally not considered good foraging plants and can get entangled in wool or lodge in the digestive tracts of some livestock (Bossard et al. 2000, p. 74). Invasive species usually have broad climatic tolerances, large geographic ranges, and other characteristics that facilitate rapid range shifts, therefore lending them to be more successful and abundant due to climate change (Hellmann et al. 2007, p. 535).

Wild pigs are another invasive species that are a threat to the Temblor legless lizard. They are not native to California, and as their numbers have increased over the years, so has the damage they inflict on habitat. Wild pigs are opportunistic omnivores that dig and overturn soil to eat not just roots and plant life, but other small animals including insects and lizards (Frederick 1998, p. 82-83). Therefore, wild pigs compete with lizards for food sources and eat legless lizards themselves. They have a moderate to high density in the Temblor Mountain range (Sweitzer et al. 2000, p. 533). For example, in the Palo Prieto Conversation Bank, one of the four identified sites inhabited by the Temblor legless lizard, wild pigs are common and root in the litter under juniper searching for grubs and lizards (Theodore Papenfuss, personal communication).

IX. Degree and Immediacy of Threat

As demonstrated in the previous sections, the threats facing *A. alexanderae* are severe and immediate. More than 98% of the lizard's remaining restricted range is already open or

potentially available to oil and gas development. Of the four sites where the lizard has been detected, three are within oil field boundaries and surrounded by extensive oil and gas development, only two have some measure of habitat protection, and all are on extremely limited habitat patches. The IUCN recently concluded that oil and gas development could propel the Temblor legless lizard to Critically Endangered status or extinction in the near future (Hammerson 2019, pp. 2, 6). The escalating climate crisis, as well as invasive grasses and wild pigs, and habitat loss and fragmentation from crop cultivation and industrial solar projects pose additional threats. The Temblor legless lizard is “in serious danger of becoming extinct throughout all, or a significant portion, of its range” or “likely to become so “in the foreseeable future.” Cal. Fish & Game Code § § 2062 & 2067.

X. Inadequacy of Existing Regulatory Mechanisms

No existing regulatory mechanism are currently in place at the national, state or local levels that adequately address the threats facing *A. alexanderae*.

A. Federal Regulatory Mechanisms

Oil and Gas Development

The Federal agencies overseeing fossil fuel development and land management in the Temblor legless lizard’s range have failed to protect the lizard from the threats from oil and gas development. In 2019 the BLM under the Trump administration opened oil and gas drilling and fracking on more than one million acres of public lands and mineral estate in Central California with much of the Temblor legless lizard’s habitat included. In December 2020, the BLM rushed the sale of seven oil and gas leases on public lands in Kern County. Even though one of lease parcels falls within the known habitat range of the Temblor legless lizard, the BLM failed to analyze the impacts of this oil and gas development on the species.

Moreover, U.S. federal policies aggressively promote ever greater fossil fuel production and infrastructure, threatening the Temblor legless lizard with expanding oil and gas development on federal lands and mineral estate. Due to policies favoring the fossil fuel industry, the U.S. is a dominant driver in expanding global fossil production and is currently the world’s largest oil and gas producer and second-largest coal producer (SEI et al. 2021, Table 4.1). The United Nations *Production Gap Report* found that governments are planning to permit the production of more than double the oil, gas, and coal by 2030 than is consistent with limiting warming to the Paris Agreement climate limit of 1.5°C (SEI et al. 2020, 2021). U.S. oil and gas production is poised to expand by the largest absolute increase globally by 2030, more than twice as much as any other country (Achakulwisut and Erickson 2021, Figure 3). A separate study found that the U.S. oil and gas industry is on track to account for 60% of the world’s projected growth in oil and gas production between now and 2030 (Oil Change International 2019)—the time period over which the IPCC concluded that global carbon dioxide emissions should be roughly halved to meet the 1.5°C Paris Agreement limit (IPCC 2018, p. SPM-15). U.S. policies that promote fossil fuel production and infrastructure include enabling fracking, lifting the crude oil export ban, and providing billions in government subsidies to the fossil fuel industry (Erickson et al. 2017, Oil Change International and Greenpeace 2020, SEI et al. 2021, p. 39).

In January 2021, President Biden issued a “whole of government” directive that every federal agency “avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents” (White House 2021). The President immediately paused oil and gas leasing on federal lands and launched a review of the fossil fuel leasing and permitting program (White House 2021). However, the Biden administration is stalling out on reigning in fossil fuel development, approving nearly 2,500 new drilling permits on public lands and waters in the first six months in office, roughly the same amount approved by the Trump administration during its first entire year in office, supporting the Line 3 and Dakota Access pipelines, and maintaining strong support for carbon capture and storage that perpetuates fossil fuel extraction (Civil Society Equity Review 2021, pp. 54-55).

Climate Change

U.S. climate policy is inadequate to meet the international Paris Agreement climate limits and avoid the worst damages of the climate crisis. The U.S. is the world’s biggest cumulative emitter of greenhouse gas pollution, responsible for 25% of cumulative global CO₂ emissions since 1870 (Global Carbon Project 2021, p. 85), and is currently the world’s second highest emitter on an annual basis and highest emitter on a per capita basis (Global Carbon Project 2021, pp. 19-20). Estimates of an equitable U.S. “fair share” of emissions reductions needed to meet a 1.5°C climate limit equate to cutting U.S. domestic emissions by at least 70% below 2005 levels by 2030 and reaching near zero emissions by 2040, paired with financial and technological support for large-scale emissions reductions internationally (Muttitt and Kartha 2020; U.S. Climate Action Network 2020). However, the United Nations *Emissions Gap Report* warned that the United States is vastly off-track to limit warming to 1.5°C or even 2°C and must greatly accelerate greenhouse gas emissions reductions (UNEP 2019, p. 37). The report concluded that limiting warming to 1.5°C requires countries to strengthen their climate pledges fivefold to cut emissions by at least 7.6% per year through 2030, for a total emissions reduction of 55% between 2020 and 2030 (UNEP 2019, pp. XV, XX, 26). Importantly, the report concluded that the U.S. “in particular” must ramp up climate action to meet global climate limits and its pledge under the Paris Agreement (UNEP 2019, pp. 11, 12, Table 2.2). The report warned that further delays in emissions cuts threaten the global economy, food security, and biodiversity:

Further delaying the reductions needed to meet the goals would imply future emission reductions and removal of CO₂ from the atmosphere at such a magnitude that it would result in a serious deviation from current available pathways. This, together with necessary adaptation actions, risks seriously damaging the global economy and undermining food security and biodiversity (UNEP 2019, p. XX).

Yet as summarized by the Fourth National Climate Assessment, U.S. efforts to mitigate greenhouse gas emissions do not approach the scale needed to avoid “substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades”:

Climate-related risks will continue to grow without additional action. Decisions made today determine risk exposure for current and future generations and will either broaden or limit options to reduce the negative consequences of climate

change. While Americans are responding in ways that can bolster resilience and improve livelihoods, neither global efforts to mitigate the causes of climate change nor regional efforts to adapt to the impacts currently approach the scales needed to avoid substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades (USGCRP 2018, p. 34).

Importantly, to meet a 1.5°C limit, most U.S. and global fossil fuels must remain undeveloped including an immediate halt to new fossil fuel production and infrastructure and a phase-out of existing production and infrastructure within the next several decades (IPCC 2018, Oil Change International 2019). However, rather than reducing fossil fuel extraction and use, U.S. policies aggressively promote ever greater fossil fuel production and infrastructure, as detailed above.

Threats Reduction and Habitat Protection

Federal regulatory mechanisms that could provide protections for Temblor legless lizards include an Endangered Species Act (ESA) listing, conservation actions for ESA listed species that overlap in range, and federal Habitat Conservation Plans that cover the species.

The Temblor legless lizard was petitioned for protection under the federal ESA in October 2020 (Center for Biological Diversity 2020). In June 2021, the U.S. Fish and Wildlife Service made a positive 90-day finding that the species may warrant protection under the ESA (USFWS 2021a). However, the Service must still make a 12-month finding, which is now overdue, and a final listing determination, and the species gets no federal protection until and unless it is listed.

Two proposed Habitat Conservation Plans (HCP) in the Temblor legless lizard's range do not include the Temblor legless lizard. The Block 12 Development Project (Docket No. FWS-R8-ES-2018-0116) would “develop 131 wells, including 98 oil producers and 33 steam injectors, and associated facilities on approximately 55 acres in Blocks 7, 10, and 12 of the South Belridge Oil Field” (USDOJ 2020). The HCP would support an application by Aera Energy, LLC to the U.S. Fish and Wildlife Service for a 35-year Incidental Take Permit under the federal Endangered Species Act for five species: Kern mallow, blunt-nosed leopard lizard, giant kangaroo rat, San Joaquin antelope squirrel, and San Joaquin kit fox (USDOJ 2020). The project overlaps the range of the Temblor legless lizard, but the HCP and EA do not include this species. Further, the HCP and EA do not meet the requirements of the ESA and the National Environmental Policy Act. Secondly, the Planning Agreement between Aera Energy, LLC, the California Department of Fish and Wildlife, the United States Fish and Wildlife Service, and the Department of Conservation regarding Aera's Southwest San Joaquin Valley HCP and Natural Community Conservation Plan (NCCP Planning Agreement No. 2810-2020-001-04) does not include the Temblor legless lizard.

While there are HCPs in Carlsbad and East Contra Costa County that include *Anniella pulchra*, none cover the Temblor legless lizard in Kern County (USFWS 2021b).

Much of the Temblor legless lizard habitat overlaps with the ranges of the blunt-nosed leopard lizard (*Gambelia sila*) and the San Joaquin kit fox (*Vulpes macrotis mutica*) (Parham et al. 2019, p. 6; PPCB 2020b, 2020c) which are both protected under the Endangered Species Act. Threats

to these two species include many of the same threats that the legless lizard is facing, such as oil and gas development, and habitat disturbance, destruction and fragmentation. Both species were listed as endangered in 1967 and 1971, respectively, with no critical habitat designated. While the Palo Prieto Conservation Bank provides some protections for the kit fox and a variety of other species, there is a lot of a variability in how these banks supply protection and what other activities are allowed on the property (Fox and Nino-Murcia 2005, p. 996-1007).

The San Joaquin kit fox been listed as endangered for over 50 years. Foxes move around frequently with numerous dens throughout the year and appear to have a home range of 12 square miles (USFWS 1998, p. 128). This gives them the opportunity to move when food is scarce or during periods of drought (USFWS 1998, p. 128). Unlike the kit fox, the Temblor legless lizard doesn't emigrate far (Miller 1944, p. 288), and if the resources needed for survival become scarce, the lizard may not be able to move to more suitable habitat. Kit foxes can also be found in virtually every soil type (USFWS 1998, p. 129) while the legless lizard must be in friable sand with shade cover for burrowing and hunting (Miller 1944, p. 288). Finally, kit foxes can survive within or adjacent to cropland, urbanization and oil and gas fields as long as they have an adequate prey base and den size (USFWS 1998, pp. 130, 134-136), whereas the Temblor legless lizard is a microhabitat specialist with very specific needs for survival (Thomson et al. 2016, p. 188). A 5-year review by the U.S. Fish and Wildlife Service states that the San Joaquin kit fox continues to face habitat loss to agriculture and urban development, has a population dynamic that fluctuates yearly, remains in isolated and highly fragmented populations, and that not all the protected habitat parcels contain the requisite contiguous acreage, vegetation and prey base to sustain kit foxes in the future (USFWS 2010a, p. 70). ESA protection for the San Joaquin kit fox is not adequate to rely on to protect the Temblor legless lizard.

The blunt-nosed leopard lizard has also been listed as endangered for over 50 years. While the Temblor legless lizard and the blunt-nosed leopard lizard share the same habitat range as well as some of the same prey and predators, they have different requirements within their habitat. The blunt-nosed leopard lizard will use several abandoned ground squirrel burrows for shelter (USFWS 1998, p. 117), moving back and forth as needed, while Temblor legless lizards construct their own burrows in the sand (Jennings and Hayes 1998, p. 108, 111). The blunt-nosed leopard lizard uses abandoned burrows and is not dependent on the smooth, fine sand that Temblor legless lizards need to burrow, move and catch prey (Miller 1944, p. 288).

In 2010 U.S. Fish and Wildlife Service updated the recovery plan for the blunt-nosed leopard lizard and found that most populations continue to have low densities and unstable populations, and that the species continues to be threatened by degradation and loss of habitat throughout most of its range (USFWS 2010b, p. 3, 21, 43). Blunt-nosed leopard lizard population densities are not yet self-sustaining and the recovery criterion of at least 5,997 acres of contiguous habitat in 5 areas has not been achieved (USFWS 2010b, p. 4-15). Management plans for the blunt-nosed leopard lizard have not been approved or implemented for all the protected areas identified in the recovery plan as important to the continued survival of the lizard (USFWS 2010b, p. 6). ESA protection for the blunt-nosed leopard lizard is not adequate to rely on for protection of the Temblor legless lizard.

While some of the habitat range and threats for the San Joaquin kit fox and the blunt-nosed leopard lizard are similar and overlap with the Temblor legless lizard, the legless lizard has more specific microhabitat needs based on sand and moisture level (Thomson et al. 2016, p. 189-190; Miller 1944, p. 277) that are not addressed by protections for the kit fox and leopard lizard. Both of the 5-year review summaries and evaluations for the San Joaquin kit fox and the blunt-nosed leopard lizard show that these species are not recovering themselves and therefore cannot be relied upon as surrogates for protection of the Temblor legless lizard. Due to their cryptic nature, Temblor legless lizard locations will be unknown without proper surveying that would come with Endangered Species Act protection.

B. State Regulatory Mechanisms

Oil and Gas Development

State agencies overseeing projects and land management in the Temblor legless lizard's range have failed to protect the lizard from the threats due to oil and gas development. As detailed above, CalGEM continues to approve thousands of new oil and gas permits each year, a substantial portion of which are in the 31 oil fields and adjacent areas overlapping the lizard's range. Kern County, where the majority of remaining Temblor legless lizard habitat is located, is attempting to streamline oil and gas permitting to make future approvals for drilling faster and hidden from public scrutiny.

In April 2021, Governor Newsom directed CalGEM to initiate regulatory action to end the issuance of new permits for fracking by January 2024 and requested that the California Air Resources Board analyze pathways to phase out oil extraction across the state by no later than 2045. While ending new permits for fracking in 2024 is an important step, other common extreme extraction methods such as cyclic steaming, steamflood, and waterflood are still permitted and will enable continued oil and gas extraction in the lizard's range. Furthermore, an oil and gas production phaseout by 2045 would still allow extensive oil and gas development across the lizard's range during the ensuing 24 years.

Climate Change

California's currently established climate goals are not consistent with the state doing its fair share to limit global temperature rise to 1.5°C under the Paris Agreement. SB32 calls for reductions in greenhouse gas emissions of 40% below 1990 levels by 2030. California Executive Order S-3-05 calls for a reduction in greenhouse emissions of 80% below 1990 levels by 2050. Executive Order B-55-18 calls for the state "to achieve carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions thereafter."

However, the landmark 2018 report from the Intergovernmental Panel on Climate Change established that to limit warming to 1.5°C, global CO₂ emissions must be cut in half by 2030 and reach near zero by 2050 (IPCC 2018, pp. 12-14, Figure 2.6). A recent analysis found that, for the U.S. to do its fair share given historical emissions and capability, it should in effect reduce its CO₂ emissions by a total of 195% below 2005 levels by 2030, with at least 70% of those emissions reductions achieved within the U.S. by 2030 and the remainder through support to

developing countries and their emissions reduction programs (U.S. Climate Action Network 2020). Because California represents the largest share of the U.S. economy, it too has an outsized responsibility to reduce its emissions, including a rapid decarbonization of its energy sector during this decade. A target compatible with limiting warming below 1.5°C would mean California strengthening its goals to reduce emissions by ~70% by 2030 through a just and equitable transition to 100% clean energy, and reaching near zero emissions by 2040.

Threats Reduction and Habitat Protection

State regulatory mechanisms that theoretically could provide protections for Temblor legless lizards include state listing as a Species of Special Concern, consideration under the California Environmental Quality Act, or any state Natural Community Conservation Plans that cover the species.

The lizard is listed as a Species of Special Concern by CDFW due a number of factors such as habitat loss and fragmentation and climate change (Thomson et al. 2016, p. 189). However, this status provides no actual legal protections. The intent of Species of Special Concern status is to focus attention, stimulate research, and achieve conservation and recovery of species before they meet requirements to be listed on a state or federal level. However, the designation offers no substantive protections.

The Natural Community Conservation Plan (NCCP) is a California Department of Fish and Wildlife program that takes a broad-based approach to planning for the protection and perpetuation of biological diversity (CDFW 2021b, p.1). East San Diego County and Bakersfield are listed as having NCCPs for other species of *Anniella*, but there are no NCCPs that cover the Temblor legless lizard (CDFW 2021c, p. 9, 46).

The environmental review process under the California Environmental Quality Act, or CEQA (California Public Resources Code §§ 21000-21177), requires state agencies, local governments and special districts to evaluate and disclose impacts from "projects" in the state. CEQA declares that it is the policy of the state to prevent "the elimination of fish or wildlife species due to man's activities, ensure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities" (California Public Resources Code, section 21001(c)). The CEQA process is triggered when discretionary activities of state agencies may have a significant effect on the environment. When the CEQA process is triggered, it requires full disclosure of the potential environmental impacts of proposed projects.

The operative document for major projects is usually the Environmental Impact Report. Under CEQA, Species of Special Concern must be considered during the environmental review process, with an analysis of the project impacts on the species if they meet the criteria of sensitivity under Section 15380 of the CEQA Guidelines. However, project impacts to legless lizards might not be analyzed if project proponents claim insignificant impacts to non-listed species, the project does not have population-level or regional effects, or the project impacts a small proportion of the legless lizard's range.

C. Local Regulatory Mechanisms

Oil and Gas Development

As detailed above, Kern County is attempting to “streamline” oil and gas permitting in the county under an ordinance that would not require further environmental review or public notice for more than 40,000 new oil and gas projects over the coming decades. The county’s environmental impact report fails to adequately disclose, evaluate, and mitigate harms to the Temblor legless lizard.

Threats Reduction and Habitat Protection

The Kern County General Plan generally states that all threatened and endangered species should be protected in accordance with state and federal laws and that the county “should work closely with state and federal agencies to assure that discretionary projects avoid or minimize impacts to fish, wildlife, and botanical resources” (Kern County 2009, p. 67). Policies under the Environmental Impact Report of the Kern County General plan support CEQA to determine the impact and necessary mitigation measure to reduce the level of impact to the special status species on an individual project level analysis basis (Kern County 2004, p. 4-4-39). The general plan also states that Species of Special Concern are an informal designation that does not provide legal protection but notes that they are recognized as sensitive (Kern County 2004, p. 4-4-21). No *Anniella* lizard species are recognized in the Kern County General Plan (Kern County 2004). Other protection policies are couched in qualifiers such as “when feasible” and that “discretionary projects avoid or minimize impacts to fish, wildlife and botanical resources.” The Kern County general plan provides little protection for the legless lizard or its habitat.

XI. Recommended Management and Recovery Actions

The Temblor legless lizard requires immediate reductions in the key threats to its survival, particularly immediately stopping new oil and gas development in its restricted range and phasing out existing oil and gas development. The lizard also requires strong habitat protections to reduce other threats, including limiting habitat conversion by urban development, cropland conversion, and industrial solar projects; strong climate action; and limiting the spread and impacts of invasive plants and predators. Key management and recovery actions include:

1. The governor directs CalGEM to end new approvals for oil and gas extraction, fossil fuel infrastructure, and other fossil fuel projects in California, and begin a phase-out of existing oil and gas production and infrastructure in line with the 1.5°C Paris Agreement climate limit.
2. The governor acts now, not in 2024, to ban fracking and related extreme techniques that enable and amplify the damage from fossil fuel extraction.
3. The governor declares a climate emergency and takes all necessary action to set California on a path to full decarbonization of our economy (e.g. banning the sale of new fossil fuel vehicles by 2030 and requiring the generation of all electricity from carbon-free sources by 2030).

4. CDFW prepares a recovery plan for *A. alexanderae* pursuant to Cal. Fish & Game Code § 2079.1.
5. CDFW acquires additional ecological reserves to protect land where Temblor legless lizards are known to occur.
6. CDFW works with local jurisdictions within the range of *A. alexanderae* to develop NCCPs that protect from development all remaining suitable habitat on private lands.
7. The California Department of Parks and Recreation seeks to acquire habitat to expand existing state parks for protection and restoration of *A. alexanderae* habitat.
8. CDFW expands its cooperative work with relevant federal agencies (NPS, DoD, BLM, USFWS) to protect the Temblor legless lizard on federal land.
9. CDFW works with the University of California and other institutions and agencies to develop effective measures to control invasive grasses and wild pigs in *A. alexanderae* habitat.

XII. Conclusion

Anniella alexanderae, the Temblor legless lizard, is a recently described species split from other *Anniella* legless lizards. There are only four known sites where this lizard persists in a restricted range along the base of the Temblor Mountains estimated at only 1,720 km². Three of the four known sites are surrounded by oil and gas development, three are on private lands, and only two have some measure of habitat protection. The Temblor legless lizard possesses many of the characteristics of a species at risk of extinction. It is a habitat specialist, has a restricted and fragmented distribution within its narrow range, and faces immediate, high-magnitude threats. While the CDFW and the IUCN recognize that this species is under threat and in need of protection, existing regulatory mechanisms are inadequate to protect the lizard from oil and gas development, urban development, climate change, invasive species and other threats to its continued existence. This leaves the lizard vulnerable to local extinction with little chance of recolonization of habitat, which is compounded by the lizard's poor ability to disperse, and in jeopardy of global extinction. Based on these factors that have already resulted in considerable habitat loss and are ongoing today, experts on the species recommend listing under the California Endangered Species Act and U.S. Endangered Species Act. Based on the best available scientific information, the species qualifies for protection under the California Endangered Species Act as an endangered species, and would benefit greatly and immediately from such protection.

XIII. References

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