BEFORE THE SECRETARY OF INTERIOR

PETITION TO LIST THE TEMBLOR LEGLESS LIZARD (*Anniella alexanderae*) AS A THREATENED OR ENDANGERED SPECIES UNDER THE ENDANGERED SPECIES ACT AND TO CONCURRENTLY DESIGNATE CRITICAL HABITAT

CENTER FOR BIOLOGICAL DIVERSITY
OCTOBER 20, 2020

NOTICE OF PETITION

Submitted this 20th day of October, 2020

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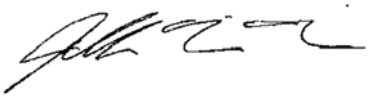

Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. § 1533(b); section 553(e) of the Administrative Procedure Act (APA), 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity hereby petitions the Secretary of the Interior, through the U.S. Fish and Wildlife Service (USFWS), to protect the Temblor legless lizard (*Anniella alexanderae*) as a threatened or endangered species under the ESA.

Petitioners request immediate action on the listing of the Temblor legless lizard, considering the ongoing impacts of oil and gas development in its limited range. The USFWS has the authority to promulgate an emergency listing rule for any species when an emergency exists that poses a significant risk to the species. 16 U.S.C. §1533(b)(7).

The USFWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on USFWS. USFWS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). USFWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition."

The Center for Biological Diversity is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law, supported by more than 1.7 million members and online activists. The Center and its members are concerned with the conservation of endangered species and the effective implementation of the Endangered Species Act.

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Executive Summary

The Temblor legless lizard (*Anniella alexanderae*) is a unique and beautiful reptile that is only found in a few locations in the San Joaquin Valley in central California. The lizard's preferred habitat is alkali desert scrub or annual grasslands with plenty of loose soil and leaf litter for burrowing and hunting. This lizard is dependent on duff and litter layer for moisture and protection. The legless lizard can be distinguished from a snake due to its moveable eyelids and detachable tail, which is used to escape predators.

All species of the genus *Anniella* are currently listed as Species of Special Concern in the state of California and experts recommend listing the Temblor legless lizard under the federal or state Endangered Species Act. The legless lizard is restricted to an exceedingly small area on the southeast side of the Temblor Mountains, from the western edge of Kern County north to western Fresno County. The species' entire range is a single narrow strip less than 200 kilometers long, between the Temblor Range and Highway 33. It is currently only known to exist at four sites. The majority of the lizard's habitat is privately owned and highly developed for oil and gas drilling. Kern County is California's largest oil-producing county, and over 98% of the lizard's range is open for oil and gas development.

The Temblor legless lizard warrants immediate listing as a threatened or endangered species. The lizard is immediately threatened by oil and gas development. A large body of scientific research has documented that oil and gas developments have wide-ranging, adverse impacts on wildlife species and ecosystems. Key ecological impacts include: habitat loss, fragmentation, and degradation; habitat avoidance; decreased water quality and quantity; human disturbance; increased climate disruption; and noise, light, and air pollution. Disturbance from oil and gas activities also removes the duff and litter layer the lizards require.

The Temblor legless lizard is also threatened by habitat loss from urban development, wildfires, invasive species, and climate change. Reptiles are highly sensitive to anthropogenic climate change since all aspects of their life are influenced by temperature and moisture. Temperature related stress due to climate change could exacerbate population declines for the legless lizard, which already has a very limited range. To have a chance at survival and recovery, the Temblor legless lizard requires protection under the Endangered Species Act.

I. INTRODUCTION

Reptiles play a pivotal role in nature as predator, prey, grazer, seed disperser and commensal species; due to their generally narrow distributional ranges and specific microhabitat associations, they are susceptible to anthropogenic threats (Böhm et al. 2013, p. 376). The most significant threats to lizard populations in general, and Temblor legless lizard populations in particular, are habitat loss and degradation, pollution, global climate change, and invasive species (Gibbons et al. 2000, p. 654; Böhm et al. 2013, p. 376-385; Fitzgerald et al. 2018, p. 166). Globally, one in five lizard species are threatened with extinction (Böhm et al. 2013, p. 376). Scientists estimate that more than 25 percent of amphibians and reptiles are at risk of extinction in the U.S. (IUCN 2020, p. 1), yet they represent less than 5% of ESA protected species (USFWS 2020a, p. 1).

First identified in 1852, the California legless lizard, genus *Anniella*, is found only in California and Baja California, Mexico. Originally considered to consist of only two distinct species, *A. pulchra* and *A. geronimensis*, Papenfuss and Parham (2013, p. 1) formally split *A. pulchra* into five distinct species in 2013 based on genetic and morphological differences. *Anniella alexanderae*, the Temblor legless lizard, has the smallest range of all *Anniella* species.

The Temblor legless lizard has a small geographic range (an estimated 1,719 km^2) at the eastern base of the Temblor Mountains in Kern County, along Highway 33 just west of the San Joaquin Valley (Papenfuss et al. 2019, p. 14). Kern County is California's largest oil-producing county (CDC 2020, p. 42). The lizard's habitat is fragmented and restricted by development in the San Joaquin Valley and by oil and gas wells on private land along the base of the Temblor Mountains (Hammerson 2019, p. 2, 4, 6).

The Temblor legless lizard is 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.2). In a conservation assessment prepared for the California Department of Fish and Wildlife in 2019, expert scientists recommend state or federal endangered species protection for the Temblor legless lizard (Parham et al. 2019, p. 24).

II. NATURAL HISTORY

A. Taxonomy and Description

The Temblor legless lizard is in the genus *Anniella*, known as the American legless lizards. *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, Mexico (*A. geronimensis*). *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: *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 Parhum 2013, p. 2). See Figure 1.

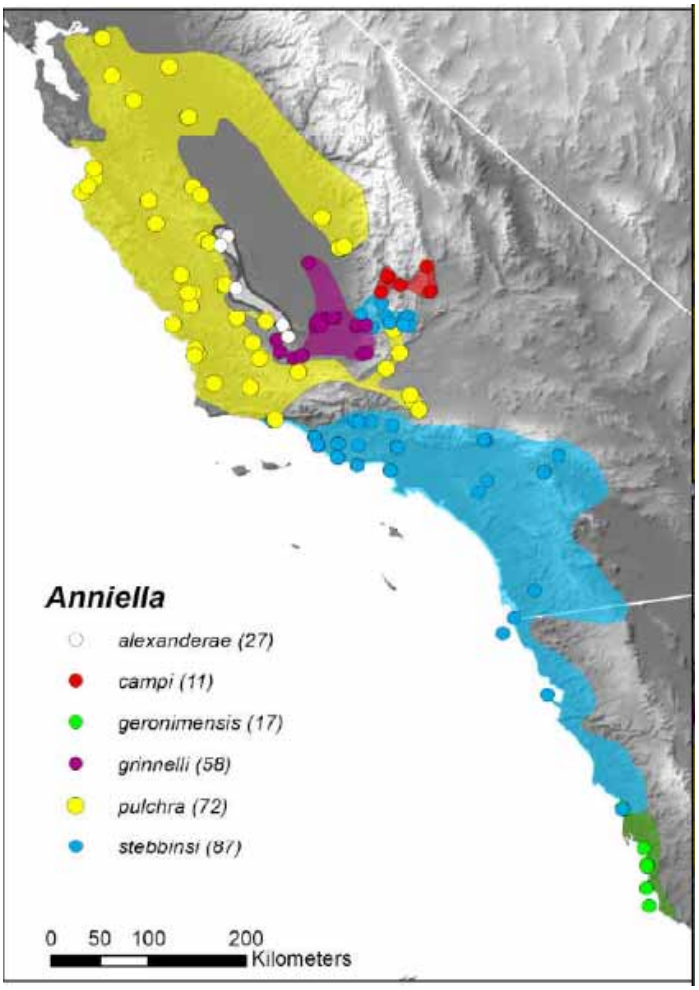

Figure 1: Map showing current range for all six *Anniella* species in Southern California through Baja California, with survey sites (Parham et al. 2019, p. 11). The range for *A. alexanderae* is shown in white, with survey sites represented by white circles.

All *Anniella* species are legless and are differentiated physically from snakes by their eyelids and detachable tail, used to foil predators. The lizard has no external ear openings and senses vibrations through the sand. It is approximately 4 to 7 inches long from snout to vent, excluding tail, with smooth shiny scales and a blunt tail (Miller 1944, p. 276-280). Legless lizards are the only sand swimming specialists in California (Evelyn and Sweet 2018, p. 6).

While there are limited differences in scalation among *Anniella* species (Papenfuss and Parham 2013, p. 3)*, Anniella alexanderae* can be differentiated from others by ventral and dorsum coloration, vertebral counts, and scale counts (Parham et al. 2019, p. 22). *A. alexanderae* has a higher dorsal scale and vertebral count (see Table 1 and Figure 2), with 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, p. 5, 7). Where other species show clear subclades and genetic

diversity, *A. alexanderae* has limited variation, making the morphological characteristics the best way to identify the lizard from others (Parham et al. 2019, p. 22).

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

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. (Papenfuss and Parham 2013, based on tables from p. 5, 8)

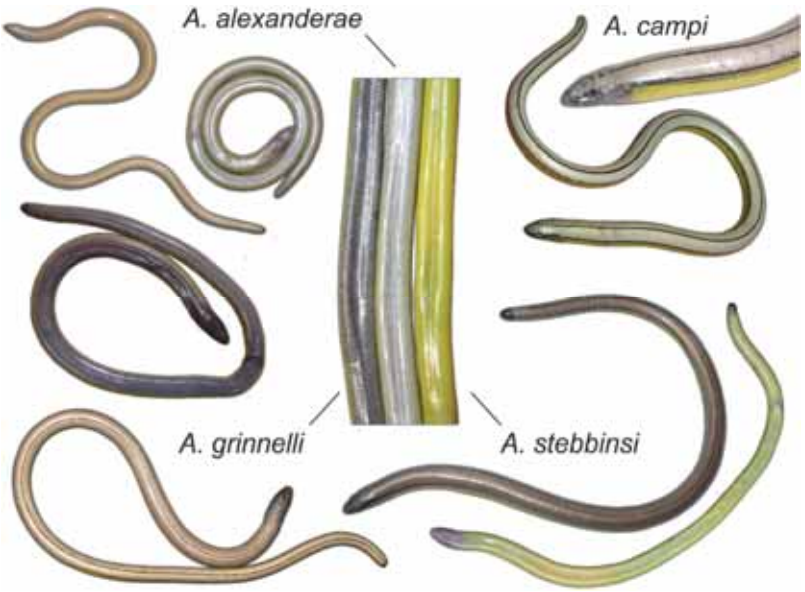

Figure 2. Four new species of *Anniella* and their diagnostic characteristics (Papenfuss and Parham 2013, p. 6)

B. Biology

Since the description of *A. alexanderae* is relatively new, the available biological information primarily refers to what was originally known as *A. pulchra*. Due to the Temblor legless lizard's burrowing nature it is difficult to predict population sizes and 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). In 1944, Charles Miller was one of the first to study the ecological relations and adaptations of *Anniella* species and much of his research is still referenced. Legless lizards reach sexual maturity between two to three years; breed from early spring through July; and have anywhere between one and four fully developed live-born young between September and

November (Miller 1944, p. 274, 276, 288), after a gestation period of approximately four months (Jennings and Hayes 1994, p. 110). The lizards are ovoviviparous and have four age groups: young of the year, immature, subadult and breeding adult (Miller 1944, p. 288). 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).

Temblor legless lizards are fossorial lizards that build burrows in soil with high sand friction (Jennings and Hayes 1994, p. 108) and "swim" through the dry, loose sand with lateral undulations (Stebbins and McGinnis 2012, p. 333). They are rarely active on the surface beyond feeding and mating (Thomson et al. 2016, p. 188) and are sensitive to noise and light pollution (Miller 1944, p. 285), which can affect their hunting (Thomson et al. 2016, p. 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 couple of inches to almost two feet (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, and lizards could be abundant in suitable habitat (Miller 1944, p. 288; Jennings and Hayes 1994, p. 110). Due to its specific requirements for burrowing, the Temblor legless lizard is a microhabitat specialist (Thomson et al. 2016, p. 188). Disturbances that can alter the makeup of the soil - such as urbanization, oil and gas development, and large-scale industrial solar projects - would degrade their habitat as well as cause local extinctions (Thomson et al. 2016, p. 189).

Temperature regulates the key aspects of reptile life history, such as sex determination and incubation (Mitchell and Janzen 2010, p. 129-140) and is an important part of the legless lizard's biology as well. These lizards prefer temperatures between 50 to 80°F (10 to 27°C), do not bask in direct light, are rarely found above ground, and lay just beneath the surface of the substrate for feeding and mating (Miller 1944, p. 284). 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). Consistent temperatures over 100°F (37°C) and below 50°F (10°C) can be lethal to *Anniella* species (Miller 1944, p. 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).

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).

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 (Nafis 2020, p. 1). Regrowth of the tail can take up to one year (Miller 1944, p. 277).

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).

C. Habitat

All species of legless lizards prefer warm, loose soil with moderate plant cover; moisture and soil density are essential to their survival (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). Loose soil and high sand friction also help in the construction of their burrows (Jennings and Hayes 1994, p. 108).

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 Kern County north to western Fresno County, Central California (Parham et al. 2019, p. 10, 12, 21). See Figure 3 for typical habitat.

As mentioned in the section on the biology of the Temblor legless lizard, any anthropogenic activities that alter the soil structure, soil moisture or plant makeup of the lizard's habitat could cause localized population extinctions (Thomson et al. 2016, p. 189). Urbanization, oil and gas development, and other changes associated with climate change such as increased wildfires and invasive species would alter soil moisture, friability, and compaction, as well as the plant cover required for foraging.

Figure 3: Habitat of *A. alexanderae*, Kern County. Photo by Theodore J Papenfuss

III. RANGE & STATUS

A. Range

The known range of the Temblor legless lizard is a narrow strip on the east side of the Temblor Mountain Range from Kern County to western Fresno County, California, between the mountains and State Highway 33 (Papenfuss and Parham 2013, p. 8). See Figure 4 for a range map. 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, but most of that land has now been developed and is highly modified (Parham et al. 2019, p. 16, 21, 22). The lizard cannot survive in urbanized 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).

In 2019, Temblor legless lizards were found during surveys in seven unique localities at four different sites (out of 6 survey sites) ranging in elevation from 168 to 466 meters (Parham et al. 2019, p. 14). Parham et al. (2019, p. 14) estimated the total range of the species to be 1,719.54 km^2. Often a named site can have multiple separate locations with cover boards in place (Parham et al 2019, p. 7). Site 1 is northwest of the city of Taft, CA, surrounded by oil extraction fields (with three localities within one kilometer of each other); site 2 is in the town of McKittrick, CA, surrounded by oil extraction fields; site 3 is at the Pleasant Valley Ecological Reserve, east of Coalinga, CA, surrounded by oil extraction fields; and site 4 is located at the

Palo Prieto Conservation Bank, in the foothills of the Temblor Mountain Range (CNDDB 2020). see Figure 4 for a range map and known sites of occurrence.

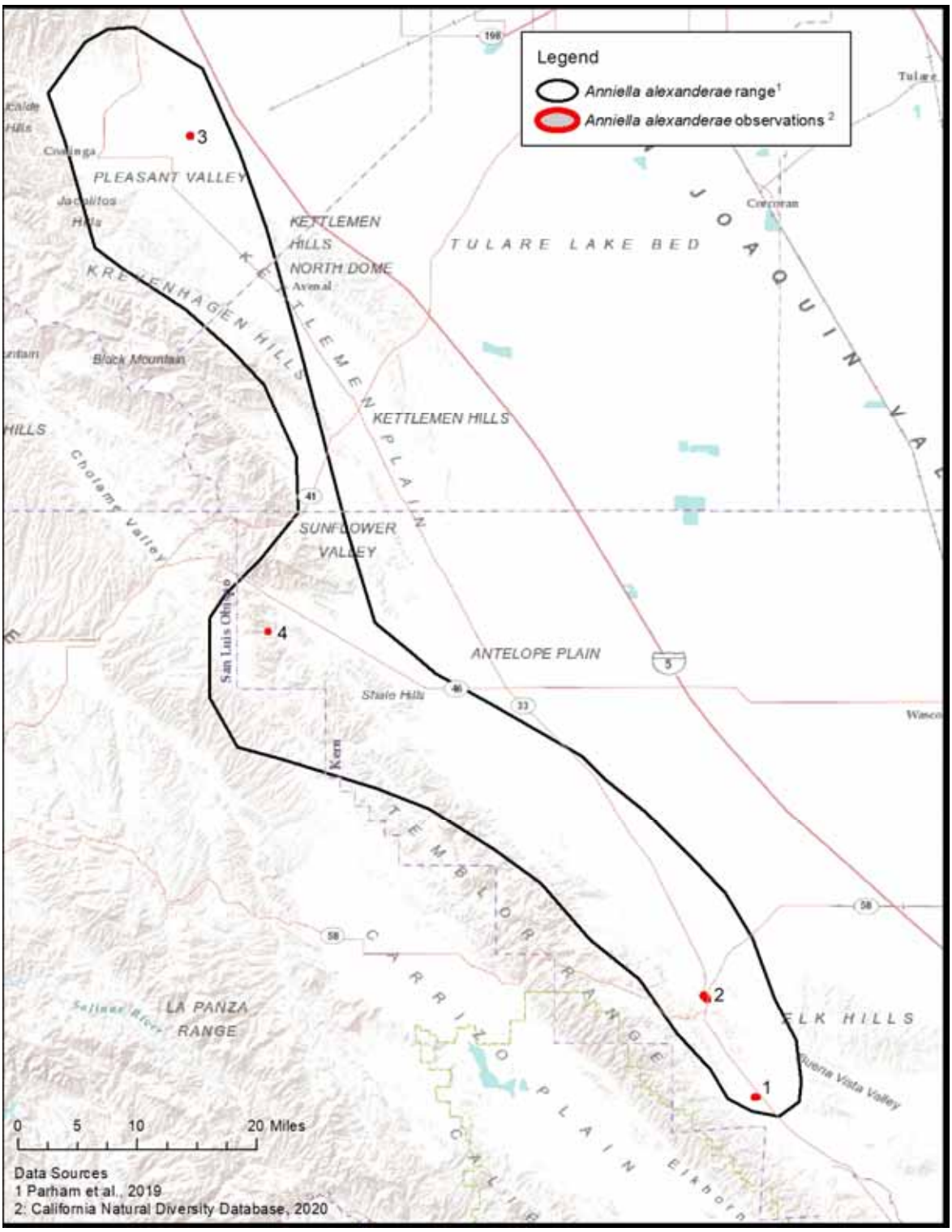

Figure 4: Range of Temblor legless lizard and the 4 sites where they have been found.

Sites 1, 2, and 4 contain six of the seven known localities and are located on private land, while site 3 is part of the California Department of Fish and Wildlife managed Pleasant Valley Ecological Reserve (Parham et al. 2019, p. 22). Per the CDFW Pleasant Valley website (CDFW 2020a), the property was designated as an ecological reserve in 2000 to protect grasslands and saltbush scrub habitats for sensitive animal species and is surrounded by oil fields, cattle grazing, and agriculture. The Palo Prieto Conservation Bank was established in 2006 to preserve San Joaquin kit fox habitat, as well as other sensitive species found in the area (PPCB 2020a).

Parham et al. (2019, p. 14) found that the Temblor legless lizard's elevation range is more limited than the majority of the other legless lizard species. Due to the fossorial nature of the lizard, more understanding of their geographic range and factors that shape their distribution is needed, especially given their imperiled status (Parham et al. 2019, p. 25). The current range of the Temblor legless lizard is very narrow with just a handful of sites, half of them offering no protection at all for this cryptic lizard. Assessment of its demographic and population structure is necessary as next steps in evaluating the Temblor legless lizard's conservation status. Regardless of the specifics of its demography, this lizard is clearly very rare.

B. Historic and Current Distribution and Abundance

The Temblor legless lizard is only known in a few locations; thus, scientists consider it rare and to have a small population density (Papenfuss et al. 2013, p. 14). Due to its cryptic nature, population size estimates are not readily available (Thomson et al. 2016, p. 189). As mentioned above, there is a limited habitat range for the Temblor legless lizard and within that range the lizard has only been found in seven localities at four sites (Parham et al. 2019, p. 11, 14). Due to its fossorial natural, little is known about its abundance across their range (Thomson et al. 2016, p. 190). Temblor legless lizards have high-site fidelity, at least over the short term, and can attain high densities where habitat is suitable (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).

The Temblor legless lizard cannot persist in habitat where the soil has been disturbed and therefore much of its historical habitat is no longer suitable (Thomson et al. 2016, p. 189). Ecological Niche Modeling predicted that the range included a larger swath of the northern San Joaquin Valley, most of which has been developed (Parham et al. 2019, p. 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).

NatureServe classified the Temblor legless lizard as a G1 and S1 critically imperiled global and state ranking status (respectively) (NatureServe 2020). 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

2020). IUCN also classifies the Temblor legless lizard as Vulnerable on its Red List (Hammerson 2019, p. 1-3).

IV. THREATS

A. Present or Threatened Destruction, Curtailment, or Modification of Habitat or Range

Oil and gas exploration and production, urbanization, and habitat fragmentation are the primary imminent threats to all legless lizards and predominate threats for the Temblor legless lizard. Only two of the four known locations where the lizard has been identified (Figure 4) are on protected lands: one location is on the 1,200-acre Pleasant Valley Ecological Reserve (Pleasant Valley ER, p. 2), which is surrounded by oil fields. The lizard was found in one of three small units within approximately 4 mi^2 (CNDDB 2020) at this ecological reserve. The other protected location where the lizard has been identified is a 5-acre parcel on the Palo Prieto Conservation Bank, an easement with five separate parcels of land totaling just over 5,000 acres that includes habitat for the federally endangered San Joaquin kit fox and California tiger salamander; the federally threatened California red-legged frog; and the western spadefoot toad, a species of special concern in California (PPCB 2020a). The conservation land is also used for cattle grazing (CNDDB 2020). All these threats disturb the soil and habitat of the Temblor legless lizard and prevent the lizard from expanding their current estimated range of 1,719.54 km^2 (Papenfuss et al. 2019, p. 14) along the Temblor mountains and into the San Joaquin Valley (Jennings and Hayes 1994, p. 111). Over 90% of the Temblor legless lizard's range has already been developed by a combination of urbanization and oil and gas fields, with a projected 7% increase over the next 30 years (ICLUS 2020), leaving little room for the Temblor legless lizard to expand its range and populations.

i. Oil and Gas Development

The IUCN recently concluded that oil and gas development could propel the species to Critically Endangered status or extinction in the near future (Hammerson 2019, p. 2, 6). Key threats to the Temblor legless lizard from oil and gas development include: habitat loss, fragmentation, and degradation, including removal of the duff and litter layer the lizard requires; oil, chemical, and produced water spills; noise, light, and air pollution; human disturbance; increased climate disruption; and decreased water quality and quantity.

The Temblor legless lizard is currently found in just four locations, and three of those are on private land (two of which are owned by oil and gas companies). Between 2016-2019, over 91% of all oil and gas project applications in Kern County have been approved (Kern County 2019, p. 6). The Temblor legless lizard has already suffered significant habitat loss and fragmentation from oil and gas development in its restricted range (Hammerson 2019, p. 2; Parham et al.

2019, p. 5). Habitat loss and fragmentation from the construction of well pads, roads, pipelines, compressor stations, and other linear corridors impede wildlife movement and dispersal, reduce home range size and patch size below what is needed for foraging and activities, facilitate the spread of invasive species, and increase habitat isolation (Brittingham 2014, p. 11034-11043; Souther et al. 2014, p. 330; Allred et al. 2015, p. 402). See Figure 5 for a map of range and known locations, along with oil and gas wells and status in the surrounding area.

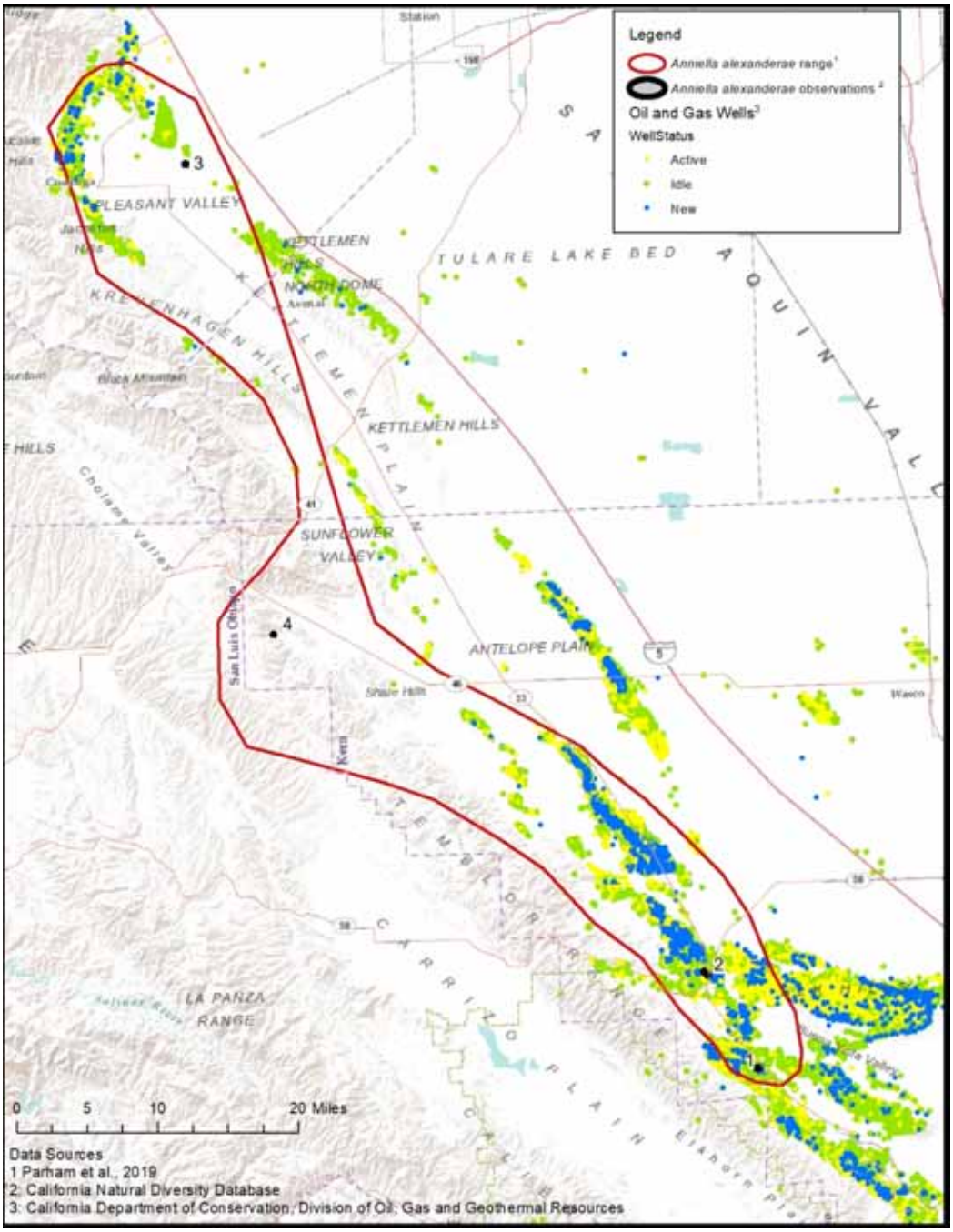

Figure 5: Map of *A. alexanderae* range and known locations, along with oil and gas wells and status in the surrounding area.

Satellite imagery indicates that oil and gas development is destroying and degrading 50-90% of the Temblor lizard's range (Hammerson 2019, p. 6). As oil extraction is ongoing throughout these areas, it serves as a consistent threat to the lizard and its habitat.

Of the four plotted locations where the lizard has been identified (Figure 5), two are found in highly fragmented habitat patches surrounded by oil and gas development in the Midway-Sunset and McKittrick oil fields. Midway-Sunset is the largest oil field in Kern County with the largest remaining volume of crude oil and more than 25,000 active and idle wells (CalGEM 2020). McKittrick has over 2,360 active and idle wells and has issued over 144 new drilling permits this year (CalGEM2020). A third location is on the protected 1,200-acre Pleasant Valley Ecological Reserve (Pleasant Valley ER, p. 2), but which is surrounded by the Guijarral Hills and Pleasant Valley oil fields. Coalinga, which is the northernmost location for the lizard, has over 5,000 active and idle wells and 77 new drilling permits have been issued so far this year (CalGEM 2020). The Temblor legless lizard, a cryptic lizard with localized populations, is being restricted to remnant habitat patches amidst rampant oil and gas development.

As discussed in the previous section on lizard biology, the Temblor legless lizard is a micro-habitat specialist that relies on specific moisture levels for its life cycle (Thomson et al. 2016, p. 188) and has been shown to be sensitive to noise and light (Miller 1944, p. 277, 284, 285, 288). It is restricted to a narrow range, hampered by the encroachment of oil and gas development and urbanization (Thomson et al. 2016, p. 188, 189; Hammerson 2019, p. 6). As discussed in the section on distribution and range, this lizard has a high-site fidelity (Miller 1994, p. 288; Jennings and Hayes 1994, p. 110), and inhabits a reduced range with limited opportunity for expansion or movement due to impeding oil and gas exploration (Hammerson 2019, p. 6).

Fiehler and Cypher (2011, p. 21) found that native species in heavily impacted saltbush scrub habitat in San Joaquin valley declined with increasing oil field development, and most of the species were no longer detected in areas with 70 percent habitat disturbance or more. For a microhabitat specialist such as the Temblor legless lizard, which requires sandy soil for burrowing (Thomson et al. 2016, p. 188) and does not respond well to disturbed soil moisture levels or compacted soil (Thomson et al. 2016, p. 189), oil and gas development in their habitat has severe negative consequences.

While all oil and gas development poses a threat to the species, commonly used oil and gas extraction techniques in Kern County, including steam flooding, cyclic steaming, water flooding, and fracking, are energy and water intensive, causing a wide range of harms to species and ecosystem functions in addition to the threats from conventional extraction. They require pumping large volumes of water, steam, sand and chemicals at high pressures into rock formations, causing them to crack and release oil and gas (Wolf et al. 2017, p. 5). With the Temblor legless lizard's high susceptibility to mechanical disturbances (Miller 1944, p. 280) and need for loose, friable sand for burrowing (Thomson et al. 2016, p. 188), oil and gas development is a significant threat to the lizard's habitat.

During steam injection, 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.

Fracking is a significant threat. A 2014 review of fracking's ecological impacts identify key harms such as habitat loss and fragmentation; surface and groundwater contamination; localized air, noise and light pollution; climate change; and other cumulative impacts (Souther et al. 2014, p. 330). Another review of the impacts of fracking concluded that species and habitats with limited ranges, small population size, specialized habitat requirements, and high sensitivity to disturbance are at particular risk (Brittingham et al. 2014, p. 11034), all factors of concern for the Temblor legless lizard. Fracking and other extraction methods have ecological effects on wildlife and cause widespread mortality to vegetation and damage to surface soil (Adams 2011, p. 1340-1344). The California Council on Science and Technology concluded that the vast majority of habitat loss and fragmentation in the state due to fracking is in Kern County (CCST 2015, p. 399).

Legless lizards are sensitive to noise and light pollution, changes in soil moisture, reduced water quality, temperature changes, and loss of plant life (Miller 1944, p. 285, 288, 289), all effects of oil and gas development. Loose sand and high friction aids in the lizard's movement and burrow construction (Jennings and Hayes 1994, p. 108) and the compaction from construction and other oil and gas development activity would severely limit their movement. Road density in oil and gas development is also a concern, since oil and gas roads increase soil compaction and lessen habitat quality by lessening the amount of loose substrate for the lizard to move through.

The Temblor legless lizard can sense vibrations through the ground and has a keen sense of mechanical disturbances, as discussed in the section on the lizard's biology (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). Oil and gas development create significant intermittent and chronic noise pollution due to construction, drilling, fracking, truck transport, compressors, human activity and other sources, and noise pollution from drilling and well stimulation is particularly significant (CDC 2015, p. 7-30). During spills, oil companies will utilize strobe lights and propane cannons through the night to ward off wildlife. These vibrations and noise disturbances would affect their ability to hunt (Thomson et al. 2016, p. 189, 190).

Oil, chemical, and produced water spills also adversely affect the Temblor legless lizard. Kern County has the highest concentration of produced water spills (55 percent) and chemical spills (42 percent) of any county in the state (CCST 2015, p. 161). Produced water spills related to oil production adversely affect habitat suitability for the Temblor legless lizard by altering soil and moisture content. The Temblor legless lizard is dependent on specific moisture levels and sand

consistency, as discussed in the section on habitat requirements (Miller 1944, p. 277, 288; Evelyn and Sweet 2018, p. 6-7). Since these lizards are usually found from a couple inches to a couple feet deep in the soil (Thomson et al. 2016, p. 188), water spills would have a negative effect on the Temblor legless lizard's life cycle and habitat.

There are currently four active oil spills in the legless lizard habitat range and 22 that have just been controlled in the past year (CalGEM 2020). 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 oil and water (CDFW Spill Watch 2019, p. 1) over a mile-long stretch of a seasonal streambed (see Figure 6). Four oiled birds – three barn owls and a lesser nighthawk – were recovered (CDFW Spill Watch 2019). The Oil and Gas Supervisor determined that the spill presented a significant threat of harm to human health and the environment (CalGEM 2019, p. 5-6). Another surface spill in the Cymric oil field, GS-5, has spilled more than 86 million gallons of oil and wastewater intermittently for 16 years (CDFW Spill Watch 2019; Wilson and Younes 2020), threatening wildlife and plant species in the area.

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 from underground, making it impossible to document. Without focused surveys it would it 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. 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 6: A cleaned-up oil/water surface expression in Cymric oil field, Kern County 2019. A berm and netting remain as a precaution (upper right) to contain any further oil and keep birds and animals out (CalGEM 2020).

Pollution and contaminants from oil and gas production are threats as well. All 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, p. 77-78). Injected water that helps generate fractures for oil extraction returns to the surface and can contain 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).

One of the disposal methods for produced water from stimulated wells is via percolation pits, which can contain hazardous chemicals from hydraulic fracking treatments, as well as reaction byproducts of these chemicals (CCST 2015, p. 23). It is unknown how long these chemicals persist in produced water or at what concentrations or how it changes over time, therefore there could be hazardous levels of contaminates in produced water disposed into these pits (CCST 2015, p. 23).

Some states have phased out the use of percolation pits for produced water disposal because their use has demonstrably contaminated ground water but percolation pits in Kern County still receive produced water from hydraulically fractured wells (CCST 2015, p. 24). Currently, many of the percolation pits are throughout the range of the Temblor legless lizard (see Figure 7).

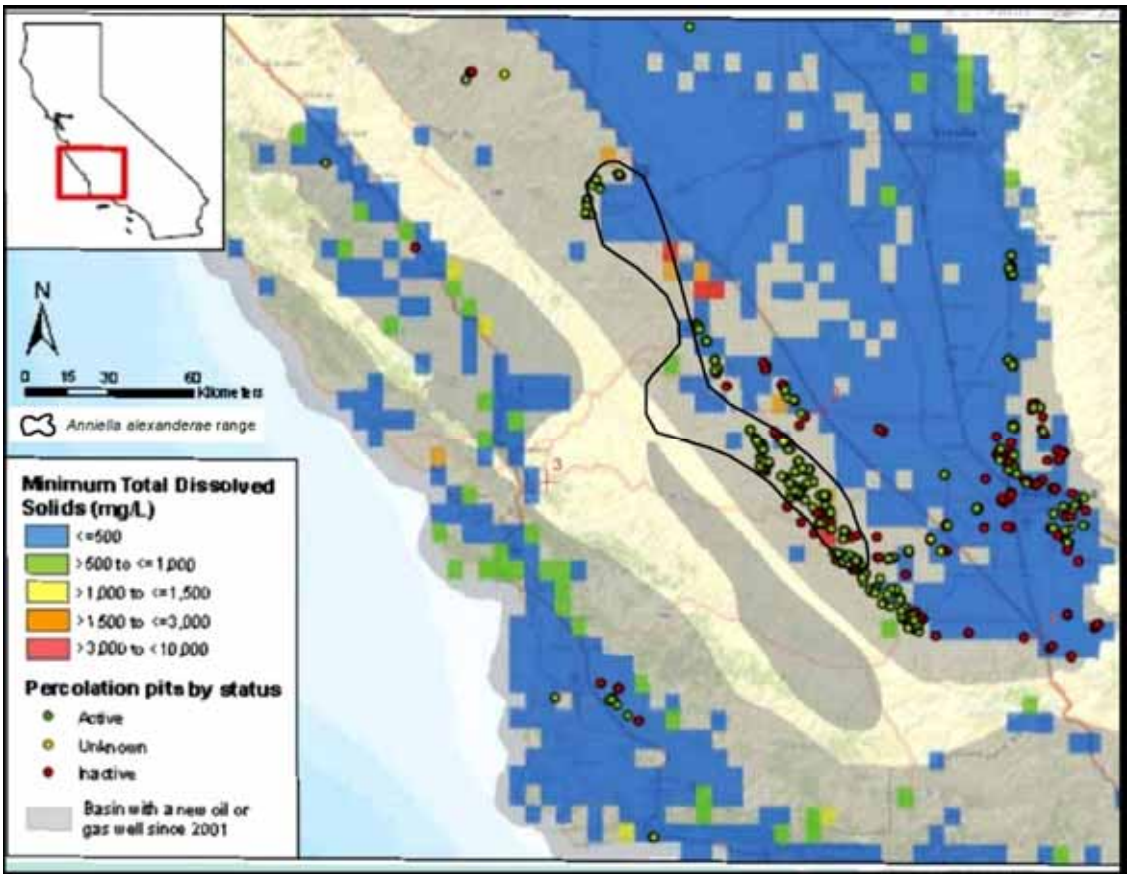

Figure 7: Location of active percolation pits used for produced water disposal in the Temblor legless lizard's range and the location of groundwater of varying quality (CCST 2015, p. 25).

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 on lizards (Zychowski and Godard-Codding 2016, p. 28, 29) and 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.

Newly proposed oil and gas development in western Kern County further jeopardizes the Temblor legless lizard. In 2019 BLM finalized its Resource Management Plan, designating federal lands within the range of the Temblor legless lizard range in Kern, King, and Fresno Counties as open to drilling and fracking. BLM currently plans to hold a lease sale on December 10, 2020, including one parcel within the species' known range and multiple parcels nearby. When combined with private lands open to drilling, over 98% of the Temblor legless lizard's range is now open for oil development (see Figure 8). A considerable amount of activity takes place outside of the range of legless lizard as well.

An environmental assessment was recently performed on 7 parcels of land for a proposed oil and gas lease sale scheduled for December 2020 (DOI EA 2020). One of these parcels falls within the known habitat range of the Temblor legless lizard (see Figure 9). This proposed parcel would jeopardize any populations and habitat of this imperiled lizard, leading to foreseeable increases in traffic, oil spills, chemical spills, and other disturbances resulting from oil and gas development. The Bureau of Land Management (BLM) failed to analyze the impacts of the project's development on the Temblor legless lizard, despite the fact that the proposed lease sale occurs in the species' range and the lizard has been designated as a Species of Special Concern (DOI EA 2020, p. 19-24, 46-53). BLM is supposed to give special status consideration to any species listed or proposed for listing under the Endangered Species Act (ESA) and species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA (DOI EA 2020, p. 22).

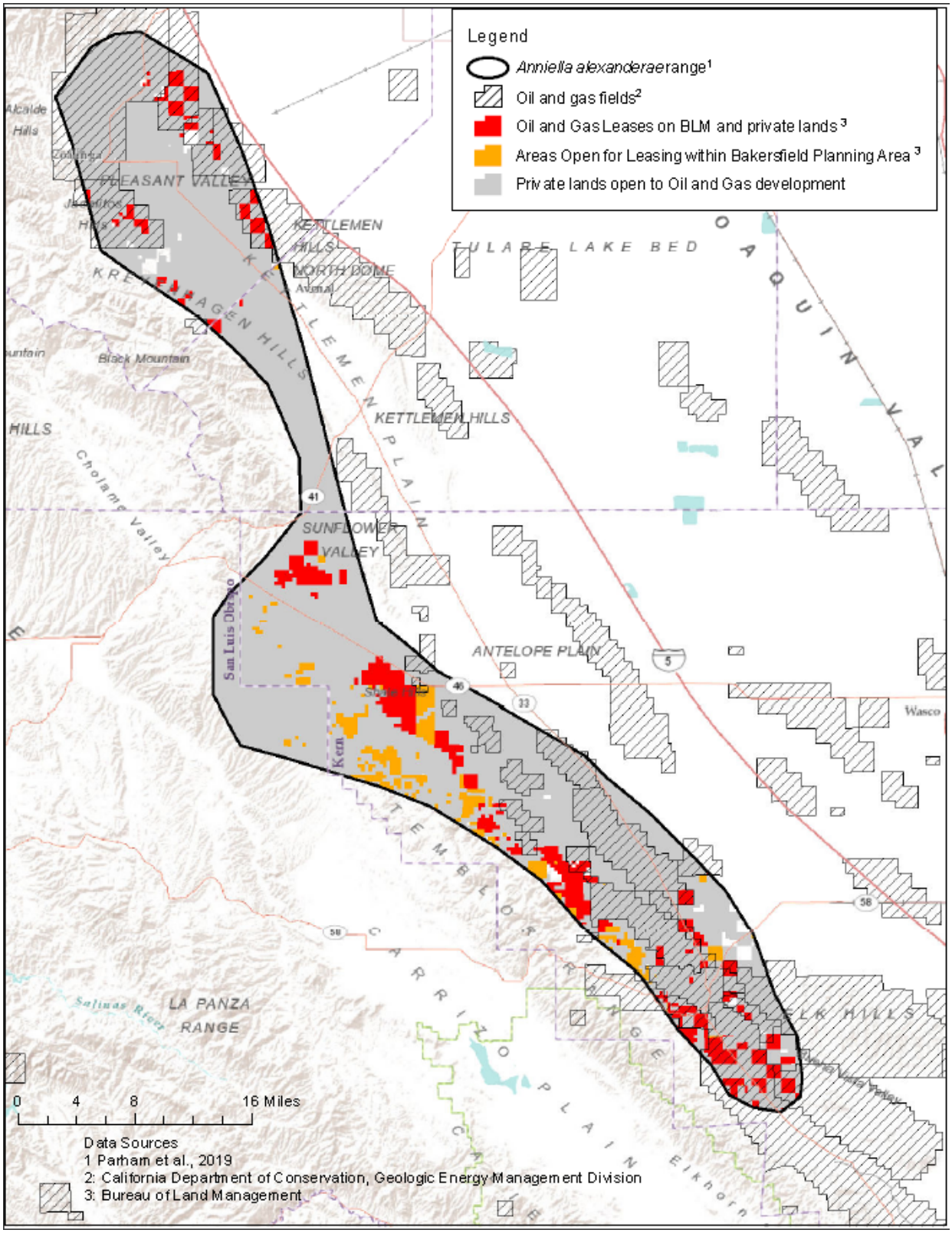

Figure 8: Temblor legless lizard range with public and private lands open to oil and gas leasing and drilling, covering over 98% of the species' entire range

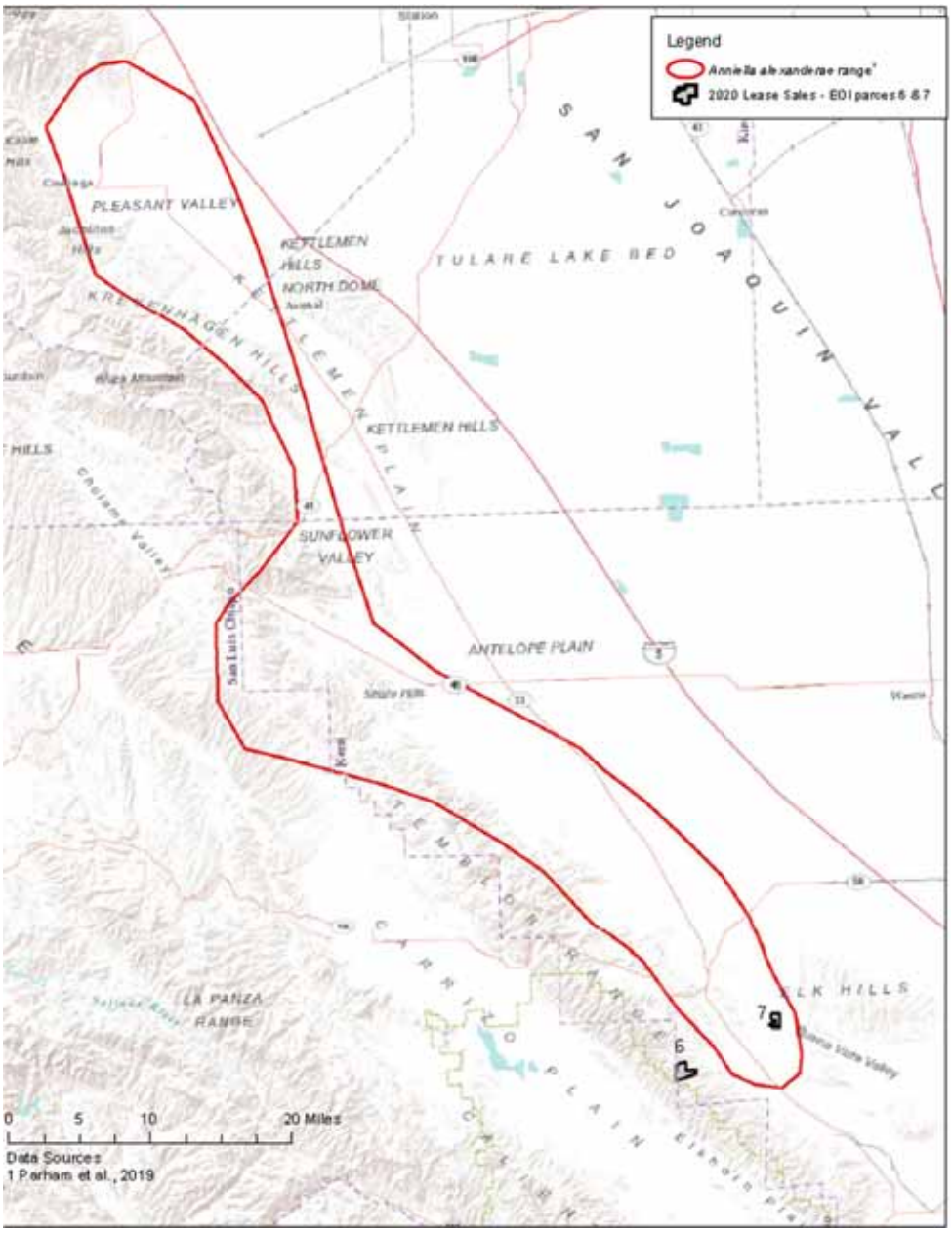

Figure 9: New 2020 BLM lease sale in Kern County within the habitat range of the Temblor legless lizard

ii. Urbanization

Encroaching urbanization has been associated with altered habitat 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 (Williams et al. 1998, p. 1). An estimated 90% of the lizard's range has been developed by a combination of urbanization and oil and gas fields, eliminating suitable habitat for the lizard (ICLUS 2020). Development in the lizard's range is predicted to increase 7% over the next 30 years, the majority from urbanization (ICLUS 2020).

iii. Habitat Fragmentation

Urbanization, converted cropland, and land changes due to oil and gas extraction (such as well pads, roads, pipelines and other linear corridors) impede wildlife movement and dispersal, reduce home range size and patch size, and increase habitat isolation (Brittingham 2014, p. 11034; Souther et al. 2014, p. 330; Allred et al. 2015, p. 402), leading to fragmented habitat. Reptiles such as the Temblor legless lizard that have a lower mobility and specialized microhabitats are likely to be more vulnerable to local extinction (Mac Nally and Brown 2001, p. 116-117). Fragmentation creates "habitat islands" that can disrupt migration and dispersal instability (Mac Nally and Brown 2001, p. 116) and erode genetic variation in small populations and promote inbreeding (Templeton et al. 1990, p. 13-27). Currently the Temblor legless lizard is known to persist at only 4 widely separated sites (Papenfuss et al. 2019, p. 11, 13). Since the Temblor legless lizard has a high site fidelity and small home range (Miller 1994, p. 288; Jennings and Hayes 1994, p. 110) habitat fragmentation can prevent the lizard from dispersal to maintain genetic variation and expand populations.

iv. 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, and a massive solar project that would have huge impact still in the planning stage (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 2020, p.1). Cumulatively these projects could lead to habitat fragmentation or destruction of current habitat for the Temblor legless lizard.

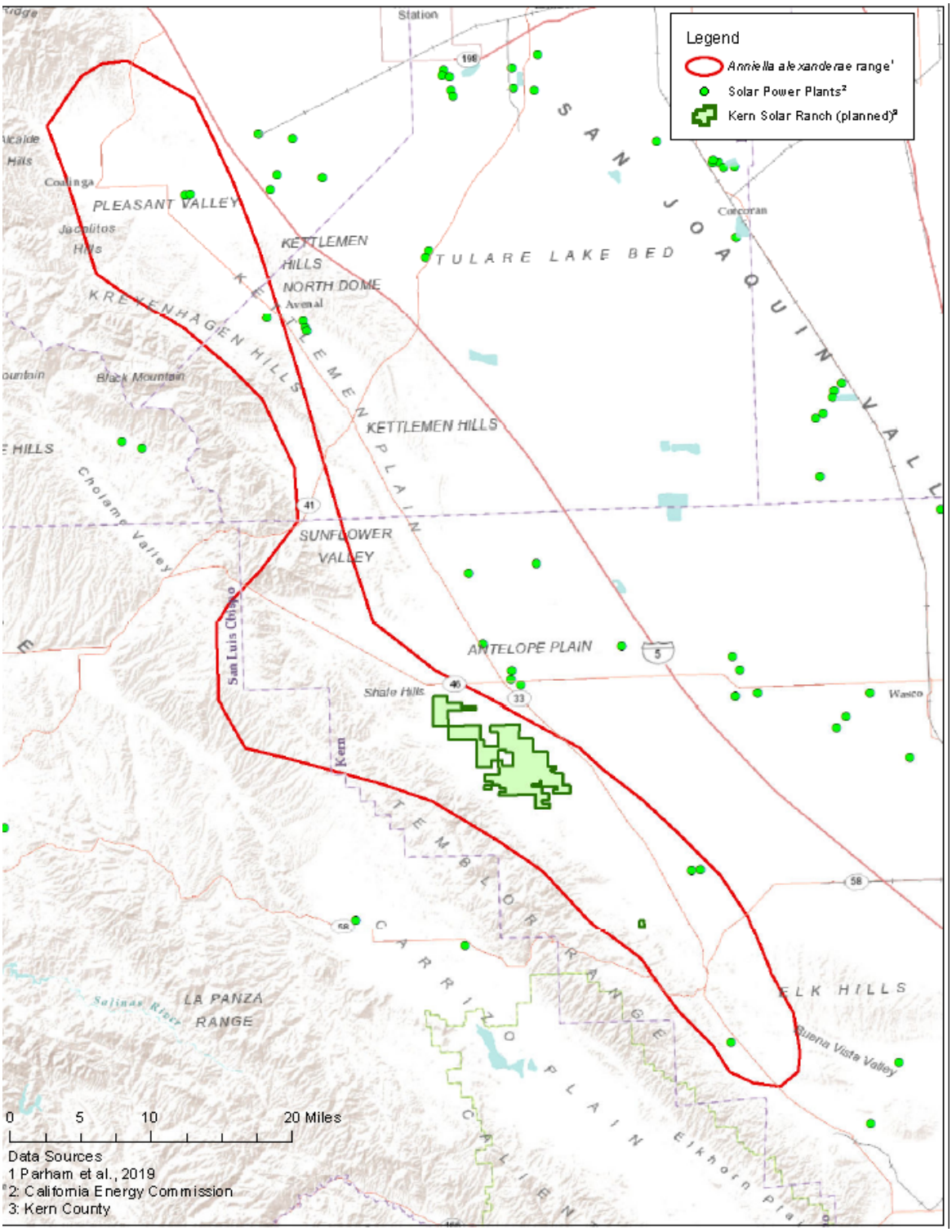

Figure 10: Map of all industrial solar projects in the range of *A. alexanderae*

B. Overutilization

Overutilization is not known to pose a significant threat to the Temblor legless lizard.

C. Disease and Predation

Disease or predation are not known to pose a significant threat to the Temblor legless lizard at this time.

D. Inadequacy of Existing Regulatory Mechanisms

i. Federal Protections

Federal regulatory mechanisms that theoretically could provide protections for Temblor legless lizards include overlap in range or habitat with other species that are already listed under the Endangered Species Act, or any federal Habitat Conservation Plans that cover the species.

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."(USDOI 2020b, p. 1) 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 (USDOI 2020b, p. 1). 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. Also, 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 2020b, p. 1).

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 habitat disturbance, destruction and fragmentation, livestock grazing, and effects of oil and gas development. Both species were listed as endangered in 1967 and 1971, respectively, with no critical habitat designated. While the Palo Prieto Conservation Bank supplies protection 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 (Williams et al. 1998, p. 128). This gives them the opportunity to move when food is scarce or during periods of drought (Williams et al. 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 (Williams et al. 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 (Williams et al. 1998, p. 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 recent 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 (Williams et al. 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.

In December 2019, the Trump administration took steps to break an eight-year moratorium on leasing public land in California for oil drilling and fracking, a decision that allows more than 1 million acres of public land to be put up for auction, with much of the Temblor legless lizard's habitat included (DOI BLM 2018, p.1). While the Bureau of Land Management has acknowledged that endangered species such as the San Joaquin kit fox, which overlaps in habitat with the legless lizard, may be affected by oil drilling on the parcels, there is no mention of the Temblor legless lizard (DOI EA 2020, p. 19-24, 46-53).

Federal 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.

ii. State Protections

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 small populations, habitat decline and fragmentation, limited research available, and occurring in an area with oil and gas production (CNDDB 2019, p. 8, 64, 107). 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 2020b, 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 2020c, 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, only if they meet the criteria of sensitivity under Section 15380 of the CEQA Guidelines. However, project impacts to legless lizards would not have to be analyzed if project proponents are able to 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.

Besides ensuring environmental protection through procedural and informational means, CEQA also has substantive mandates for environmental protection. The most important of these is the provision requiring public agencies to deny approval of a project with significant adverse effects when feasible alternatives or feasible mitigation measures can substantially lessen such effects. In practice however, this substantive mandate is rarely implemented. If significant impacts remain after all mitigation measures and alternatives deemed feasible by a lead agency have been adopted, a lead agency is allowed under CEQA to approve a project despite environmental impacts if it finds that social or economic factors outweigh the environmental costs. It is important to note that CEQA is not, nor was it ever intended to be, a habitat protection mechanism.

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.

iii. Local Zoning

The Kern County General Plan generally states that all threatened and endangered species should be protected in accordance of 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). The Temblor legless lizard is not included in the listed species of Kern County (Kern County 2004, p. 4-4-22 – 4-4-25). 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.

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)). Before the court's ruling, Kern County issued more than a thousand permits a year since the ordinance's passage (Kern County 2020b, p. 3-2). The court ordered that the environmental impact report and the ordinance be set aside until the county can demonstrate it complies with the law. The ruling means environmental review of new drilling proposals in Kern County will revert back to state authorities (*King and Gardiner Farms*, *supra*, 45 Cal.App.5th at 897, n. 50). Kern County is now attempting to adopt another local ordinance to allow oil and gas development that would eliminate project-by-project environmental impact reports for most oil and gas projects in the county (Wilson 2020). If this ordinance gets adopted, it would have significant detrimental impacts to the lizard and its habitat.

E. Other Factors

Other factors such as climate change, wildfires, and invasive species are threats to the survival of the Temblor legless lizard.

i. Climate Change

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).

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 both on land and in the ocean (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). Warmer and drier conditions are contributing to an increase in the acreage burned by wildfires and a longer fire season, with a 77 percent increase in mean area burned by 2100 projected under the current emissions rate (Bedsworth et al. 2018, p. 9, 30).

Kern County is expected by 2050 to have an increase in winter average temperatures by 3-4 degrees Fahrenheit (5-6 degrees Fahrenheit 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). As reptiles, Temblor legless lizards are highly sensitive to anthropogenic climate change (Mitchell and Janzen 2010, p. 129-140; Tuberville et al. 2015, p. 822-834) and won't respond well to higher temperatures and changes in moisture levels. Ectothermic animals such as the lizard are heavily influenced by their environment, especially by temperature and moisture, in all aspects of their life. 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).

Climate change will affect the legless lizard at individual and population levels via: shifts in phenology and range; habitat alterations such as hydrology, vegetation, and soil; changes in pathogen-host dynamics and predator-prey relationships; and interactions with other factors such as UV-B radiation and contaminants. All of these can affect survival, growth and reproduction (Mitchell and Janzen 2010, p. 129-140; Wright et al. 2015, Boyle et al. 2016; Levy et al. 2016). If warming continues at the current rate, 20% of lizard species world-wide could be driven out of their thermal niches by 2080 and face a high risk of extinction (Sinervo et al. 2010, p. 894). 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). Temperature regulates the key aspects of reptile life history, such as sex determination and incubation, and stress related to temperature and climate change 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 – June (Goldberg and Miller 1985, p. 618), implying that their sexual process is temperature and seasonal dependent.

They also require specific moisture levels and temperature ranges for general survival (Thomson et al. 2016, p. 189-190). 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 Temblor legless lizard's current optimal temperature range is 50- 80 degrees Fahrenheit. Climate change is already associated with extreme temperatures and weather

conditions (Melillo et al. 2014, p. 1-67) and higher and lower temperatures for more than a few days can be lethal for the Temblor legless lizard (Miller 1944, p. 278, 284, 288, 289).

Fossorial lizards such as the legless lizard can differ from other lizards in their thermal requirements, and studies have shown that the legless lizard prefers temperatures which are lower than basking lizards and are adapted to more activity during the morning or late afternoon when the temperatures are cooler (Bury and Balgooyen 1976, p. 152, 154). Rising temperatures could decrease the amount of time they are actively feeding and on the surface, negatively impacting their ability to hunt and mate, resulting in lower reproductive output.

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 rapid habitat changes and may suffer more extinctions than birds as a result of the rapid rate of climate change because of their limited dispersal abilities (Gibbons et al. 2000, p. 660). Gibbons et al. (2000, p. 660) also points out that existing nature reserves may become inadequate to preserve biodiversity as an already fragmented landscape will slow species response to climate-induced habitat changes. The Temblor legless lizard is a micro-habitat specialist, amid a fragmented habitat range and the extreme temperatures, extended drought and increased flooding predicted with climate change will affect their success of survival.

Existing regulatory mechanisms are wholly inadequate to mitigate the harms of anthropogenic climate change to the Temblor legless lizard. The United States has contributed more to climate change than any other country. The U.S. is the world's biggest cumulative emitter of greenhouse gas pollution, responsible for 25 percent of cumulative global CO_2 emissions since 1870 (Global Carbon Project 2018, p. 19) and is currently the world's second highest emitter on an annual basis and highest emitter on a per capita basis. (LeQuéré et al. 2018, p. 2163). However, U.S. climate policy is wholly inadequate to meet the international Paris Agreement target to avoid the worst damages from the climate crisis. As summarized by the Fourth National Climate Assessment, 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).

In 2016, the U.S. committed to holding the long-term global average temperature to well below 2°C and "to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" under the international Paris Agreement (UN 2015, p. 22). Existing U.S. domestic laws including the Clean Air Act, Energy Policy and Conservation Act, Clean Water Act, Endangered Species Act, and others provide authority to executive branch agencies to require greenhouse gas emissions reductions from virtually all major sources in the U.S., sufficient to meet the Paris Agreement climate targets.

However, the Trump administration has focused on pushing through harmful rollbacks of federal climate policy, and federal agencies are either failing to implement or only partially implementing domestic law and policy mandating greenhouse gas reductions. Trump administration rollbacks of federal climate policy include rescinding the Climate Action Plan, repealing and replacing the Clean Power Plan, a plan to dramatically expand offshore oil drilling in all oceans along U.S. coast, an attempt to rescind the Obama-era withdrawal of offshore drilling in U.S. federal waters in most of the Arctic and parts of the Atlantic, lifting of the moratorium on new federal coal leases, weakening emissions standards for cars and light duty trucks, delaying the implementation of methane emissions standards for new and modified oil and gas facilities, and the intended withdrawal from the Paris Agreement. (Wentz and Gerrard 2019, p. 1-65).

As a result, current U.S. climate policy has been ranked as "critically insufficient" by an international team of climate policy experts and climate scientists who concluded in 2017 that "[t]hese steps represent a severe backwards move and an abrogation of the United States' responsibility as the world's second largest emitter at a time when more, not less, commitment is needed from all governments to avert the worst impacts of climate change." (Climate Action Tracker 2017, p.1)

ii. Wildfires

Wildfires in the western U.S. are increasing in frequency and extent and are likely to continue to increase in the coming decades, especially for southwestern California and the Sierra Nevada (Link 2020, p. 1). California had extreme wildfire activity in 2017, 2018, and 2020, with records set for the largest individual wildfire and most destructive wildfire (Park Williams et al. 2019, p. 892). Fire has a large impact on habitat, especially in Southern California where the Temblor legless lizard resides. Data is limited, but conversion of chaparral to grassland because of fire would have a negative impact on the legless lizard (Evelyn and Sweet 2018, p. 7). The Temblor legless lizard is reliant on leaf litter and scrub for burrowing and hunting, and wildfires would remove the habitat while opening the land to non-native grasses (Evelyn and Sweet 2018, p. 7). The average depth of habitat for the legless lizard is from one to four inches (Miller 1944, p. 289) and past fire data estimates that animals four inches below the surface would be insulated to 500 degrees Celsius below surface temperatures during a fire (Evelyn and Sweet 2018, p. 7). It's unlikely that the Temblor legless lizard could burrow deep enough to avoid direct mortality

during a high intensity wildfire, and the loss of their habitat and food source would have long term negative consequences for the species' survival.

iii. Invasive Species

While many of the factors listed above (oil and gas extraction, urbanization, climate change, wildfires) 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 hogs are changing the landscape and threatening the habitat and survival of the legless lizard.

Invasive plants are a threat for other *Anniella* species along the coastal sand dunes in California: invasive grasses and ice plants are altering the lizard's habitat (Gallegos 2019, p. 3). 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 feeds 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 the land. They currently have a state management plan as a designated game mammal and while actual numbers are unknown, animals hunted grew 15% in a seven-year period (Waithman 2001, p. 7) and continue to increase. They have a moderate to high density in the Temblor mountain range (Sweitzer et al. 2000, p. 533), throughout the habitat of the

Temblor legless lizard. 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). For the Temblor legless lizard, they are competing for a food source as well as becoming prey for this non-native species.

V. REQUEST FOR CRITICAL HABITAT

The Center for Biological Diversity requests that the USFWS designate critical habitat for the Temblor legless lizard concurrently with its listing. Critical habitat as defined by Section 3 of the Endangered Species Act is: (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protections; and (ii) the specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species. 16 U.S.C. § 1532(5).

Congress recognized that the protection of habitat is essential to the recovery and/or survival of listed species, stating that "classifying a species as endangered or threatened is only the first step in ensuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence... If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat." H. Rep. No. 94-887 at 3 (1976).

Critical habitat is an effective and important component of the Act, without which the Temblor legless lizard's chance for survival diminishes. The Center thus requests that the USFWS propose critical habitat for the legless lizard concurrently with its proposed listing.

VI. CONCLUSION

Anniella alexanderae, the Temblor legless lizard, is a newly described species recently split from other *Anniella* legless lizards. There are only four known locations where this lizard persists, in a small range along the base of the Temblor Mountains, less than 100 kilometers long. Half of the known locations are surrounded by oil and gas development and one, while considered a conservation bank for the San Joaquin kit fox, is also used for grazing. 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 has lost habitat due to anthropogenic and environmental factors. While the CDFW and the IUCN recognize that this species is under threat and in need of protection, there are no existing regulatory mechanisms

in place to protect the lizard from oil and gas development, climate change, habitat loss and wildfires. 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. Based on these factors that have already resulted in considerable habitat loss and are ongoing today, leading researchers conclude that the Temblor legless lizard should not only continue to be afforded special status in California, but that a federal listing may be warranted given the lizard's potentially imperiled status. Based on the best available scientific information, the Temblor legless lizard qualifies for protection under the Endangered Species Act. Without adequate measures to protect the lizard, this species is at risk for extinction.

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