Comments submitted by electronic and certified mail

March 31, 2011

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Re: Petition to List the American pika (*Ochotona princeps*) under the California Endangered Species Act

Dear Commissioners, Mr. Loft, Mr. Osborn, and Mr. Applebee,

These comments are submitted on behalf of petitioner Center for Biological Diversity ("Center") to inform the decision to list the American pika (*Ochotona princeps*) under the California Endangered Species Act. The purpose of this letter is to apprise the California Department of Fish and Game ("Department" or "CDFG") and the California Fish and Game Commission ("Commission") of important new scientific information regarding taxonomy, natural history, and threats to the American pika in California. The best-available scientific evidence indicates that the American pika has (a) experienced significant population extirpations in warmer, lower elevation regions in California (i.e. Bodie Hills and the Lassen region of northern California); (b) is projected to lose much of its suitable habitat and face a high

probability of extirpation across much of its range in California within this century due to climate change; and (c) is experiencing accelerating climate change-related population losses and unprecedented upslope range contractions at well-studied historic sites in the Great Basin ecosystem of southern Oregon and Nevada, just across the border from California. These studies clearly indicate that that the American pika in California faces serious threats to its continued existence from climate change, combined with cumulative threats from grazing and mining. The best-available science presented in the Center's 2007 Petition, May 2009 comment letter, and these comments undoubtedly meet that threshold of "provid[ing] sufficient information to indicate that the petitioned action may be warranted."

We ask the Department to closely consider this information in its evaluation report for the American pika, and for the Commission to carefully consider this information when making the determination as to whether listing the American pika in California may be warranted. We expect to present this information at any public hearing(s) on the pika listing decision. Thank your for your consideration of these comments.

I. Summary of Center for Biological Diversity and Earthjustice Actions Regarding the American Pika Listing in California

The Center submitted the Petition to List the American pika (*Ochotona princeps*) under the California Endangered Species Act ("CESA") in August 2007, identifying climate change as the principal threat to the pika. In April 2008, the California Fish and Game Commission concluded that the Center's petition ("Petition") did not provide sufficient information to indicate that listing may be warranted and therefore rejected the Petition. The Commission adopted written findings in support of its decision in June 2008. In April 2009, San Francisco Superior Court Judge Peter Busch ruled that the Commission abused its discretion in rejecting the Center's listing petition by using the incorrect legal standard to evaluate the Petition. The Court issued a writ of mandate in May 2009 directing the Commission to set aside its June 2008 findings and to reconsider whether the pika may warrant listing.

During remand, the Center provided the Commission with additional information indicating that pikas may warrant listing under CESA in a detailed letter sent in May 2009. In June 2009, the Commission voted to reject the pika petition once again, ostensibly on the grounds that there was insufficient information to indicate that listing pikas as threatened may be warranted. The Commission adopted written findings in support of this determination in October 2009. In October 2010, Judge Busch ruled that the Commission did not follow CESA's requirement that the Commission consider all the information before it when making the listing determination, most notably by failing to consider the information submitted in the Center's May 2009 letter. The Court issued a writ of mandate in November 2010 directing the Commission to set aside in June 2009 listing decision and to reconsider whether the pikas may warrant listing in light of the available evidence.

On February 3, 2011, the Commission accepted for consideration the Center's Petition to list the American pika (*Ochotona princeps*) as a threatened species, as amended with information including the Center's comment letter submitted in May 2009. Pursuant to Section 2073.7 of the Fish and Game Code, on February 10, 2011, the Commission transmitted the amended petition to

the Department of Fish and Game for review pursuant to Section 2073.5 (CA Regulatory Notice Register 2011, No. 10-Z). The Department has 90 days to prepare a report per Fish and Game Code section 2073.5, after which time the Commission will vote as to whether listing may be warranted pursuant to Fish and Game Code section 2074. In this comment letter, we are submitting new information to the Department to inform the evaluation report for the pika and the subsequent Commission decision.

II. Legal Standard for Evaluating the Petition and Other Submitted Information

The question before the Department and Commission in evaluating the Petition and other submitted information is to determine whether these submissions "provide sufficient information to indicate that the petitioned action may be warranted." (Fish & G. Code § 2074.2.) In *Natural Resources Defense Council v. California Fish & Game Comm'n* (1994) 28 Cal. App. 4th 1104, the Court of Appeal clarified that this threshold inquiry requires only "that amount of information . . . that would lead a reasonable person to conclude there is a substantial possibility the requested listing could occur." (*Ibid.* at 1126, emphasis added.) The court described a "substantial possibility" as "something more than the [California Environmental Quality Act] standard of reasonable possibility, which is the equivalent of only a fair argument," but "something less than the preliminary injunction standard of reasonably probable, which, in the CESA candidate-listing process, would deem it 'more likely that not' that listing 'will' occur." (*Ibid.* at 1125.) Thus, the question at issue is whether the pika "may be warranted" for listing under the "reasonable person" standard.

III. New Scientific Information to Inform the Listing Determination for the American Pika in California

According to Fish and Game Code section 2073.5, the Department's report shall contain an evaluation of whether the petition and other submitted comments provide sufficient scientific information to indicate that the petitioned action may be warranted. The Fish and Game Code section 2072.3 asks for information on 12 topic areas. The Center's 2007 Petition and May 2009 letter addressed all 12 of these topic areas. However, these comments provide new information pertaining to many of these topic areas that should be considered in the Department's evaluation report. We have delineated the new information relevant to these topic areas in the following order, in addition to providing new information on taxonomy: (A) taxonomy, (B) population trend; (C) distribution; (D) abundance; (E) life history; (F) kind of habitat necessary for survival; (G) factors affecting the ability to survive and reproduce; (H) degree and immediacy of threat; (I) impact of existing management efforts; and (J) suggestions for future management.

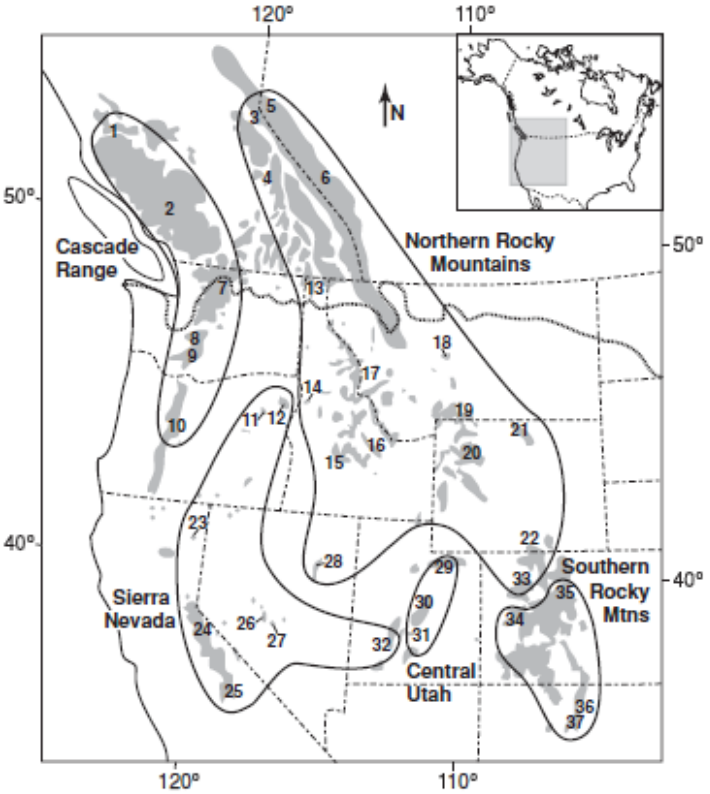
A. Taxonomy

The Center's Petition identified five subspecies of the American pika in California, consistent with the best-available science on pika taxonomy in 2007 (i.e. Hall (1981)): Taylor pika (*O. p. taylori*), gray-headed pika (*O. p. schisticeps*), Yosemite pika (*O. p. muiri*), Mount Whitney pika (*O. p. albata*), and White Mountains pika (*O. p. sheltoni*). However, studies by Galbreath et al. (2009), Galbreath et al. (2010), and Hafner and Smith (2010) based on genetic analyses provide evidence supporting five American pika phylogeographic groups or likely

subspecies in North America, including one subspecies in California--*O. p. schisticeps* (i.e. Sierra Nevada and Great Basin pika). Galbreath et al. (2010) suggested that future genetic research using other markers may detect substructure within these lineages that warrants further taxonomic subdivision, meaning that it is possible that *O. p. schisticeps* in California may be further subdivided.

Galbreath et al. (2009) conducted a phylogenetic analysis of the American pika using mitochondrial DNA, with the purpose of examining the influence of climate-driven elevation shifts on genetic differentiation and historical demography of the American pika across its range. The study found evidence for five clades within *Ochotona princeps* that include a Sierra Nevada, Cascade Range, Northern Rocky Mountain, Southern Rocky Mountain, and central Utah lineage, each of which "include multiple populations that are isolated from one another under current conditions" (p. 2859). See Figure 1 below. The researchers noted that gene flow among lineages likely increased during the favorable climate conditions of glacial periods, which was countered by extinctions during unfavorable inter-glacial periods. In addition, the researchers noted that life-history characteristics of pikas likely limited introgression between lineages even during favorable glacial conditions, including the pika's limited dispersal ability and its limited opportunities for successful colonization of habitat patches.

Figure 1. Distribution of the American pika sampling localities and major mitochondrial DNA lineages. Gray patches indicate the approximate distribution of pikas. Mitochondrial lineages are denoted by heavy lines; numbers indicate sampling localities.
Source: Galbreath et al. (2009): Figure 1.

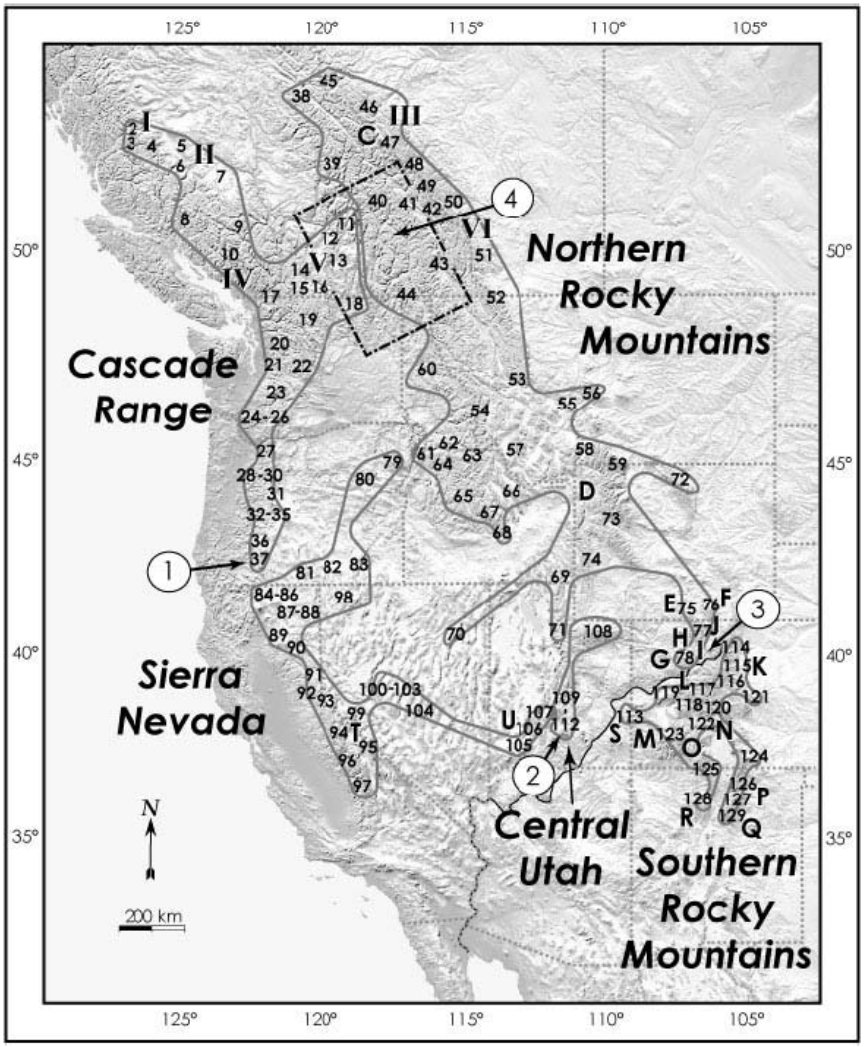


Galbreath et al. (2010) expanded the analysis of Galbreath et al. (2009) by analyzing mtDNA from a larger number of individuals as well as nuclear introns from a subset of individuals, and similarly found evidence for "five major pika phylogroups" that "have independent evolutionary trajectories at multiple loci and should probably be considered distinct evolutionarily significant units (sensu Moritz, 1994) for management purposes." The researchers found evidence for substructure within groups, as well as apparent isolation among populations that "may warrant management at finer scales." This study recommended future research to investigate variation within and among the major phylogroups, such as difference in vocalizations and parasite assemblages, which may warrant further taxonomic subdivision and are relevant to regional conservation efforts.

Based in part on Galbreath et al. (2009, 2010), Hafner and Smith (2010) proposed a taxonomic revision for the American pika based on molecular phylogenetic analyses (i.e. allozyme electrophoresis and sequencing of mitochondrial and nuclear genomes). This study proposed reclassifying the 36 recognized American pika subspecies into five subspecies, corresponding to the five major pika phylogroups of Galbreath et al. (2009): *O. p. princeps* (Northern Rocky Mountains), *O. p. fenisex* (Coast Mountains and Cascade Range), *O. p. saxatilis* (Southern Rocky Mountains), *O. p. schisticeps* (Sierra Nevada and Great Basin), and *O. p. uinta* (Uinta Mountains and Wasatch Range of Central Utah). See Figure 2. The authors concluded that these "5 subspecies represent evolutionarily meaningful units for consideration of possible management applications if populations of *O. princeps* are imperiled by human activities." *O. p. schisticeps* is the subspecies inhabiting California. The authors described its range as "patchily distributed in cool, rocky habitat (usually in montane situations, but occasionally in lower-elevation ecosystems) of the southern Cascades, Klamath Mountains, and Warner Mountains of California, throughout the Sierra Nevada of California and Nevada, and isolated highlands throughout the Great Basin of Nevada, eastern Oregon (north to the Blue Mountains), and southwestern Utah." This subspecies description is as follows:

> Description.—Size and cranial features small for the species in virtually all characters except bullar length, which is average for the species (and so relatively large in this subspecies); pelage color variable. Past introgression (probably during LGM contact) with O. p. fenisex and O. p. uinta is indicated by allozyme data in the population of O. p. fenisex at Mt. McLaughlin in southern Oregon and the population of O. p. uinta on the Aquarius Plateau of southern Utah (Hafner and Sullivan 1995). Short call (at least for single populations in California and Utah—Conner 1982) usually (87%) characterized by multiple notes (up to 4) of relatively low fundamental frequency (511–537 Hz) and short duration (0.13–0.15 s). (Hafner and Smith 2010: 412).

Figure 2. Geographic distribution of *Ochotona princeps* indicating 5 genetic units identified in allozyme, mitochondrial DNA, and nuclear DNA studies (gray outlines), and grouped localities used in morphometric analyses.
Source: Hafner and Smith (2010): Figure 1.



B. Population Trend

Since the submission of the Petition, several scientific studies have provided additional information on pika population trends in California. The Center's May 2009 letter provided information from Moritz et al. (2008) and Nichols (2009), which examined occupancy of pika sites over time in Yosemite National Park and the Bodie Hills, respectively. Here we provide information on pika population trends from recent studies that have examined pika site occupancy over time, including studies by Dr. Lyle Nichols in the Bodie State Historic Park and Bodie Hills; Dr. Andrew Smith in Bodie State Historic Park; Dr. John Perrine in northern California; and David Wright and Joseph Stewart in the Sierra Nevada. These studies indicate that pikas have experienced significant extirpations in the Bodie Hills region and in the Lassen region of northern California, both of which are warmer, lower elevation regions where pikas

would be expected to first experience stress from global warming in California. Re-surveys in the colder, higher elevation Sierra Nevada region by Wright and Stewart of CDFG and Moritz et al. (2008) provide evidence for pika extirpations at lower elevation sites that raise cause for concern for pikas in this region as well.

1. Research by Dr. Lyle Nichols in Bodie State Historic Park and Bodie Hills

a. Overview of Nichols (2009)

As detailed in the Center's May 2009 letter, Nichols (2009) discussed the status of pika populations in the Bodie Hills in Mono County, California. Dr. Nichols first transmitted a summary of his pika research findings to the California Department of Fish and Game ("CDFG" or "Department") in his 2007 review of the pika Petition which was solicited by the CDFG. In his review, Dr. Nichols not only supported the Petition, but also provided information on the declining population status of the American pika in the Bodie Hills and expressed his support of CESA protection of these populations:

> Like other pika populations in the Great Basin the Bodie Hills population has suffered marked declines in recent decades. I have surveyed 29 talus patches in the Bodie Hills that have evidence of pika occupation (droppings, haypiles, bones) and found that 21 of these sites (72%) are extinct (unpublished data). Only one site (at Bodie State Historic Park) has a relatively stable population.
>
> Protection under the California Endangered Species Act should certainly be extended to the Bodie Hills population regardless of its taxonomic status.
>
> (from Nichols (2007), Review of Petition to list the American pika as threatened under the California Endangered Species Act, dated August 21, 2007.)

Nichols (2009) provided an analysis of the status of pika populations in Bodie State Historic Park ("Bodie SHP") and in the surrounding Bodie Hills. Nichols (2009) surveyed for the presence of pikas (either sightings or vocalizations) and pika sign (droppings, haypiles, and whitewash) in 50 talus patches in the Bodie Hills surrounding Bodie SHP in 2008. Nichols (2009) also censused a subset of ore-dump patches in Bodie SHP in 2003-2006 and 2008, which have been censused periodically by researchers since 1972.

Nichols (2009) found that 48 of 50 Bodie Hills talus patches surveyed "were positively determined to be extinct" (Figure 3). All 50 talus patches had been occupied by pikas in the past as indicated by the presence of droppings, but 48 were determined to be extinct based on the conditions of dropping and lack of direct detection of pikas. The two remaining patches appear to have been last occupied by pikas in late spring or early summer 2008. In addition, Nichols (2009) documented a significant decline in the percentage of occupied ore-dump patches in Bodie SHP between 1972 and 2008 (Figure 4).

Figure 3. Bodie Hills study area showing surveyed patches. Extinct patches are indicated with an "X" (n=48). The two recently extinct patches (Masonic) are indicated with a "?" (n=2). The single extant population (actually metapopulation) at Bodie SHP is indicated with a solid dot. Coordinates are UTM grid 11S.
Source: Nichols (2009): Figure 1.

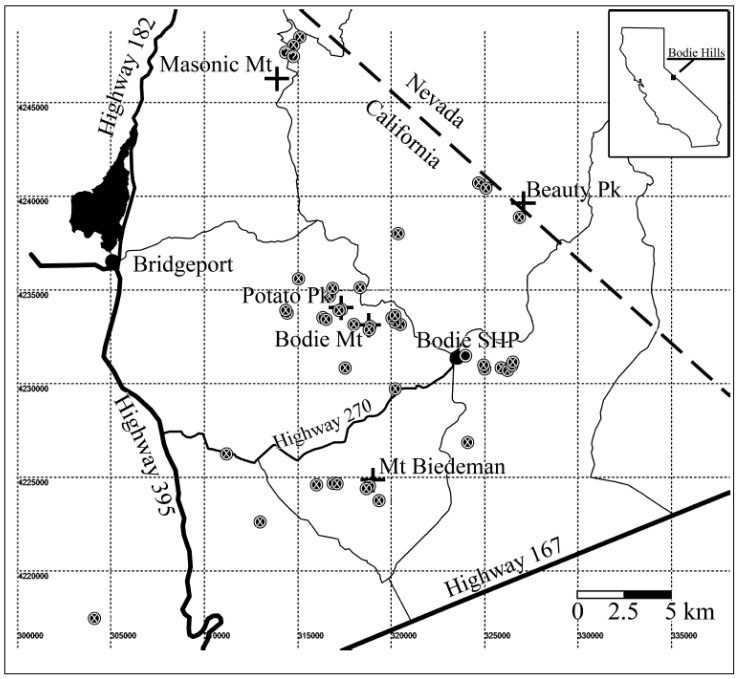
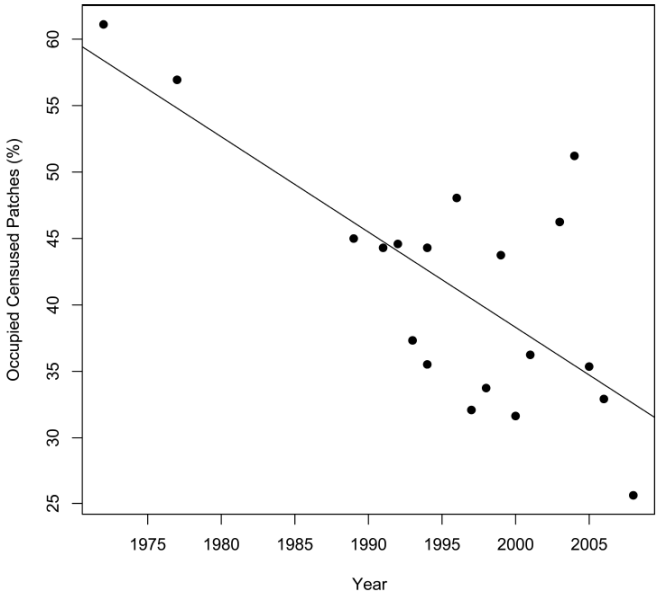


Figure 4. Changes in patch occupation by pikas (*Ochotona princeps*) in Bodie State Historic Park from 1972 through 2008 as measured by percentage of censused patches (n=79). $R^2 = 0.49$, $F(1, 17) = 18.5$, $p = 0.00048$.
Source: Nichols (2009): Figure 2.



Overall, Nichols (2009) concluded that pikas appear to be extinct in the Bodie Hills outside of Bodie SHP, and that the Bodie SHP population is declining and "may be well on its way to extinction":

> Pikas appear to be extinct in the Bodie Hills outside of Bodie SHP. The possibility remains that a population has survived in an unsurveyed area; however, many apparently high quality patches were included in this survey and all are extinct. Several Bodie Hills patches have apparently gone extinct very recently. Two patches at Masonic went extinct in 2008. In June 2003 Bodie Mountain was occupied by pikas. By June 2008 the Bodie Mountain population had gone extinct.
>
> The decline in occupied patches in Bodie State Historic Park is consistent with the decline of pikas region-wide. Because patches of pika habitat in Bodie SHP are so close together this population functions as an interconnected metapopulation (Smith and Gilpin 1997). Metapopulation dynamics may have allowed the Bodie SHP pika population to decline more slowly than more isolated populations on natural talus piles throughout the Bodie Hills (but see Clinchy et al. 2002). In spite of metapopulation dynamics it appears that the Bodie SHP population may be well on its way to extinction. (Nichols 2009: 2-3).

b. Overview of Nichols (2010, 2011)

Nichols (2011) provided an update on the status of pika populations in the Bodie State Historic Park and Bodie Hills at the California Pika Consortium ("CPC") meeting in February 2011. The Bodie SHP ore dump sites are characterized by a southern, middle, and northern constellation of artificial habitat patches. In Bodie SHP, Nichols (2011) found that pika occupancy in the middle and southern patch constellations had declined significantly between 1972 and 2010, resulting in the complete extirpation of the middle and southern patches in the SHP in the last decade. Pika occupancy in the northern patch constellation fluctuated over time between ~55% and ~90% occupancy between 1972 and 2010, and experienced a non-significant decline over this time period.

In the large Bodie Hills study region surrounding Bodie SHP, Nichols (2011) found that pikas suffered a region-wide population collapse in the late 20th century. Nichols surveyed for pika occupancy in natural talus patches in the Bodie Hills and in one area of artificial ore dump habitat (New York Hill) that had signs of prior pika occupancy (i.e. pellets and/or haypile). Nichols noted that historic records from Severaid (1955) indicated that pikas were historically abundant in the Bodie Hills:

> Currently every mine dump or rock pile, regardless of size, shape, or height, contains therein one or more pikas, or family units, providing only that the rubble is of sufficient size to permit them a thorofare [sic] into and throughout the dump. Only the relatively few dumps which consist only of slag are completely without these mammals. Thus, hundreds, perhaps even thousands, of pikas, now inhabit

the Bodie mine field. (Severaid, JH. 1955. The Natural History of the Pikas (Mammalian genus *Ochotona*). Ph.D. Dissertation, University of California at Berkeley, CA)

Based on Nichols' surveys, pika occupancy in 51 natural talus patches in the Bodie Hills was 0%. The Bodie Hills findings were consistent with prior work (Nichols 2009) that found that pikas have been largely extirpated from the Bodie Hills. In the New York Hill artificial ore dump site, pika occupancy was 41% in 17 sites. Nichols estimated the date of last patch occupancy in the Bodie Hills sites using the pellet dating methods described in Nichols (2010). Based on the estimated dates of last occupancy, Nichols (2011) concluded that the Bodie Hills and New York Hill sites "suffered a region-wide collapse in the late 20th century." Nichols (2011) raised concern that pikas in occupied sites in the Bodie SHP and New York Hill have little or no protection, although these populations are critical to the continued persistence of pikas in the Bodie Hills: "two declining relict populations survive on vulnerable anthropogenic sites." Overall, Nichols' research indicates that pikas have experienced a region-wide collapse in the Bodie Hills in recent decades and remain in two vulnerable artificial habitat patches (Bodie SHP northern constellation and New York Hill). This research raises great cause for concern about pika persistence in this warmer, lower elevation region.

2. Presentation by Dr. Andrew Smith on the Bodie SHP pika population status

At the 2011 CPC meeting, Dr. Smith presented data on pika occupancy over time in Bodie State Historic Park. Consistent with Nichols (2011), Dr. Smith's presentation indicated that pika occupancy in the southern constellation of the SHP declined over time eventually resulting in complete extirpation, while occupancy in the northern constellation has fluctuated over time.

3. Presentation by Dr. John Perrine on northern California pika population status

At the 2010 and 2011 CPC meetings, Dr. John Perrine and graduate student Cody Massing presented data on pika occupancy over time in their northern California study region. Dr. Perrine and colleagues re-surveyed 17 Grinnell-era sites where pikas had historically been detected in the Lassen Volcanic National Park, Mineral, Eagle Lake, and Madeline Plains regions of California, in addition to 28 nearby sites in the same regions where pikas had historically been detected. Of the 17 Grinnell-era historic sites surveyed, Perrine found that 10 sites were currently occupied, 6 sites were abandoned but had signs of historic occupation, and 1 site was abandoned but had no pika sign (Perrine and Patton 2010). Of the 28 additional historic sites, 11 were currently occupied, 15 were abandoned but had signs of historic occupation, and 2 were abandoned but had no pika sign (Perrine and Patton 2010). Thus, of 45 total historic sites, 21 were occupied and 24 had been abandoned.

4. Presentation by Joseph Stewart on Sierra Nevada pika population status

At the 2010 and 2011 CPC meetings, David Wright and Joseph Stewart of CDFG presented data on pika occupancy over time in the Sierra Nevada. Wright and Stewart re-surveyed 19 historic sites in CDFG Region Two (Plumas County to Alpine County) where pikas had historically been detected. They found that 17 sites were currently occupied and 2 sites were abandoned (i.e. Pacific Grade Summit on HWY 4 and anthropogenic railroad talus 4 miles West of Donner Summit). One of the occupied sites, Eagle Falls, was considered a "marginal site" because the majority of talus was not occupied and the time to first detection of pikas was long. This study examined whether elevation or habitat area were associated with pika extirpations, and found that the extirpated sites were associated with low talus area within a 1-km search area of the estimated historic site location. Low elevation sites also had a marginally significant association with extirpation.

5. Ability of Millar and Westfall (2010) to detect pika population trends

We note that Millar and Westfall (2010) conducted rapid, one-time surveys of pikas in the Sierra Nevada and southwestern Great Basin. In the published version of their study (although not in the original version), Millar and Westfall (2010) stated that their "rapid survey results suggest that the pika populations in the Sierra Nevada and southwestern Great Basin are thriving… and show little evidence of extirpation or decline." However, as discussed in Wolf (2010), their one-time surveys do not have the ability to detect trends in pika population status, and thus they cannot assess whether pikas are increasing, stable, or decreasing in their study regions. Determining whether pikas are thriving, as opposed to stable or decreasing, entails an assessment of pika population status over time that should be based on appropriate population data over time, such as temporal changes in site occupancy (i.e. Beever et al. 2003, 2010, 2011), demographic rates (Ray 2010), or density and/or population size. The one-time detection of a single pika or its sign does not provide information on the persistence of pikas in those patches.

C. Range

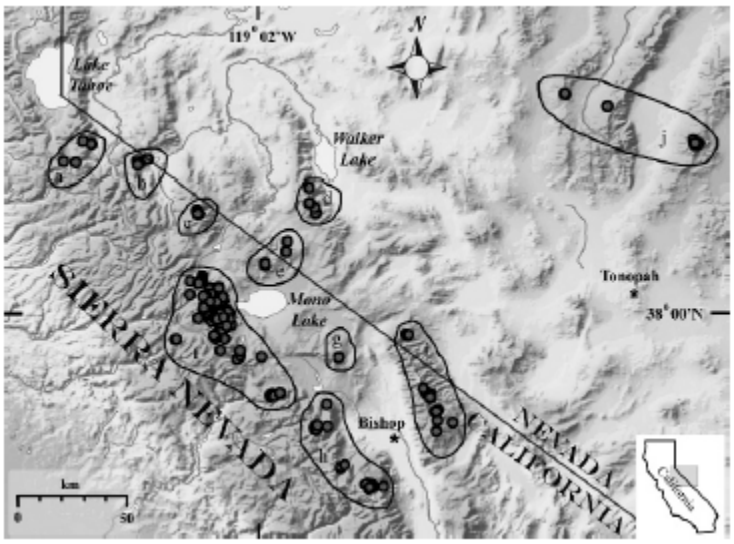
As noted above, Hafner and Smith (2010) describe the range of *O. p. schisticeps* as "patchily distributed in cool, rocky habitat (usually in montane situations, but occasionally in lower-elevation ecosystems) of the southern Cascades, Klamath Mountains, and Warner Mountains of California, throughout the Sierra Nevada of California and Nevada, and isolated highlands throughout the Great Basin of Nevada, eastern Oregon (north to the Blue Mountains), and southwestern Utah" (Hafner and Smith 2010: 412).

D. Distribution

Millar and Westfall (2010) surveyed for the presence of American pikas in several regions of the Sierra Nevada ("SN") of California and southwest Great Basin ("swGB") ranges of California and Nevada during 2007–2009. As detailed below, this study added new distributional information for pikas in California, including information on locations with recent pika occupancy, pika use of rock-ice geomorphic features, and surface temperature and precipitation conditions near pika-occupied sites.

(1) Pika occurrence locations. Millar and Westfall (2010) detected pikas or pika sign at 329 sites in the SN (6 north of Robinson Cyn, 294 in the central SN, and 29 south of Duck Pass) and at 67 sites in the swGB including Monitor Pas, Sweetwater, Bodie, Glass, and White Mountains (Figure 5). This distribution is consistent with the previous known distribution for pikas summarized by Hafner (1993) and as indicated by pika occurrence records from the California Natural Diversity Database (CNDDB).

Figure 5. Map of study region showing distribution of pika sites recorded in the Sierra Nevada, six southwestern Great Basin ranges, and three central Great Basin ranges. Mountain regions with pika samples include: Sierra Nevada (north, a; central, f; and southern, h); southwestern Great Basin ranges including Monitor Pass range (b), Sweetwater Mtns. (c), Wassuk Range (d), Bodie Mtns. (e), Glass Mtn. Range (g), and White/Inyo Mtns. (i); and central Great Basin ranges (j), including, from west to east, Shoshone, Toiyabe, and Toquima Ranges.
Source: Millar and Westfall (2010): Figure 1.



(2) Elevational distribution. In relation to elevational distribution, Millar and Westfall (2010) found pikas or pika sign in high-elevation habitat in their study regions (i.e., 90% of all pika sites were above 2500 m), ranging from 1827 m to 3768 m (average 3052 m) in the SN and ranging from 2113 m to 3887 m (average 3041 m) in the swGB. The elevation distribution reported by Millar and Westfall (2010) is consistent with previous accounts and museum records indicating that pikas occur generally above 2040 m (Stephens, 1906: 182) or 2134 m (Howell, 1924: 36) in the SN. Similarly, Grinnell and Storer (1924) described the Yosemite pika *O. p. muiri* as inhabiting a general elevational range of ~6000 to ~13,000 feet: "[c]ommon resident of the Hudsonian Zone, extending down locally into part of the Canadian Zone and up into Arctic-Alpine"[1] (Grinnell and Storer 1924:218).

[1] The Canadian Zone refers to areas from approximately 6,000- 8,000 feet in elevation, the Hudsonian Zone to areas from approximately 8,000-11,000 feet in elevation, and the Arctic Zone to areas from approximately 11,000-13,000 feet in elevation. For a fuller description of these life zones, see Grinnell and Storer (1924:4-12).

(3) Geomorphic relationships. Millar and Westfall (2010) found that pikas tended to occur in rock-ice feature landforms, including boulder streams and cirque rock glaciers, which accounted for 83% of pika sites (excluding anthropogenic sites). Millar and Westfall (2010) suggested that rock-ice features may provide favorable thermal conditions for pikas because the within-rock matrix environments are cooler-than-expected for their elevation for mean summer temperatures, and warmer than expected for winter temperatures. Additionally, rock-ice features are associated with the occurrence of dense, wetland forb, shrub, and herbaceous vegetation patches directly adjacent to rock-ice feature fronts and sides, which Millar and Westfall (2010) suggest may also provide conducive habitat for pikas.

(4) Climatic relationships. Millar and Westfall (2010) characterized surface temperature and precipitation conditions near pika-occupied sites using PRISM data. The 396 pika sites from the SN and swGB experienced average annual precipitation ranging from 279 to 1610 mm with an overall mean of 910 mm. Average temperatures across SN and swGB pika sites were 2.4 ºC annually, 24.9 ºC for January, and 12.2 ºC for July. Minimum surface temperatures overall averaged -3.9 ºC and maximum temperatures averaged 8.7 ºC. January minimum temperatures for all sites averaged -10.8 ºC and July minimum temperatures for all sites averaged 5.3 ºC. January maximum temperatures averaged 1.0 ºC, and July maximum temperatures averaged 19.0ºC.

As discussed by Wolf (2010), although Millar and Westfall (2010) concluded that ‘‘pikas in our region tolerate a wider range of temperatures and precipitation than previously interpreted’’ (p. 84), their results are consistent with prior studies that have found that pikas inhabit cool, higher-precipitation habitats. The two studies cited by Millar and Westfall (2010) to support their assertion (that pikas tolerate a wider range of temperatures and precipitation than previously interpreted) did not seek to characterize the range of climate conditions experienced by pikas in the SN or swGB and thus do not provide an appropriate basis for comparison. Moreover, Millar and Westfall’s (2010) findings for surface temperature and precipitation at pika sites in the SN and swGB appear to fall within the climatic range reported for the species by Hafner (1993) based on surface conditions in 50 geographically distinct habitat patches[2]. In sum, while Millar and Westfall (2010)’s broad-scale sampling provides additional information on surface-temperature and precipitation conditions near pika-occupied sites in the SN and swGB from 1971 to 2000, their results are consistent with prior studies that have found that pikas inhabit cool, higher-precipitation habitats

In addition, in contrast to their conclusion that “pikas are tolerating a wide range of thermal environments,” Millar and Westfall’s (2010) findings suggest that pika distribution is being shaped by recent climate and that pikas may not be tolerating warmer and drier conditions. Millar and Westfall (2010) found a pattern of higher occupancy in (cooler, wetter) SN sites compared to (warmer, drier) GB sites. Only 6% of pika sites were definitively occupied in the central GB and 35% in the swGB, as compared to 77% in the SN. In addition, modeled climate

[2] Hafner (1993) found that pikas live in regions with short summers of less than 20 days per year above 35°C (82% of 50 patches), long winters with greater than 180 days per year below 0°C (94%), a freeze-free period of less than 90 days (86%), and annual precipitation of more than 300 mm (96%). All extant pika populations are restricted to regions of <30 days/year above 35°C, >150 days/year below 0°C, a freeze-free period of <120 days, and annual precipitation of >200 mm (Hafner 1993).

conditions at old pika sites (i.e., those with old pika sign) were significantly warmer and drier than at recently occupied sites. Nonoccurrence sites (those with no pika sign) were also significantly warmer and drier than occurrence sites (those with pikas or pika sign). Further underscoring the importance of recent climate, Millar and Westfall (2010) suggested that pika distribution in their region has changed over time in relation to climate conditions: ‘‘The truncated and skewed nature of several temperature variables suggests a recent disequilibrium in pikas’ range wherein sites at warmer values have been recently abandoned and a new, normally distributed range of occupation sites has not been achieved’’ (p. 84).

E. Abundance

As noted in the Petition, there is little information on pika abundance at the present time. Early- to mid-20th century natural history accounts indicate that the pika was abundant in the Sierra Nevada. For example, the pika was described as ‘‘abundant’’ in the SN (Howell, 1924: 44), ‘‘a common resident’’ in the SN (Grinnell and Storer, 1924: 218), and relatively dense in the SN: ‘‘In one typical rock slide, at the head of Lyell [Canyon], our estimates indicated a population of at least one cony for every 750 square yards. This would mean a population of about six to an acre’’ (Grinnell and Storer, 1924: 218).

F. Life history

As noted above, “classic” metapopulation dynamics for the pika has only been described for pikas in the artificial, human-created habitat of the ore dumps of Bodie State Historic Park (i.e. sensu Moilanen et al. 1998), but not in natural habitat. As noted by Moilanen et al. (1998), the Bodie SHP ore dumps have characteristics that are very different from natural talus habitat: ore dumps are comprised of piles of broken rock with a structure and composition unlike natural talus; they are smaller than many natural talus patches and thus there are no large “mainland” populations and population size in the ore dumps tends to be small; and the spatial configuration of the patches may not be representative of natural configurations. Thus, pikas in natural talus habitats should not be expected to conform to classic metapopulation dynamics characterized by high population turnover where populations frequently “wink” in and out. Rather, pikas in natural talus habitat likely exhibit other types of patchy population dynamics such as mainland-island dynamics or source-sink dynamics, in which some populations are self-sustaining and likely to exhibit long-term persistence (in the absence of additional stressors) while others may persist due to immigration from mainland or source populations. In short, as noted at the February 2011 CPC meeting, the American pika should not be assumed to exhibit classic metapopulation dynamics, as is often mistakenly assumed. This has bearing on the interpretation of pika extirpations since it should not be assumed that pika populations should experience high “natural” extirpation rates.

G. Kind of habitat necessary for survival

Information on pika habitat (i.e. geomorphic and climatic characteristics) in California from Millar and Westfall (2010) is provided in the Distribution section above.

H. Factors affecting the ability to survive and reproduce

The Petition identified climate change as the most serious threat to the pika's continued persistence in California and throughout its range in the western United States. New research by Beever et al. (2010, 2011) provides additional evidence that climate change threatens the pika. Beever et al. (2010, 2011) identified climate-related factors as the best predictors of pika population extirpations in the Great Basin and documented an accelerating rate of extirpation and an unprecedented upslope range shift for pikas in this region. As detailed below, grazing and mining also pose threats to pika populations in California.

1. Climate Change

Beever et al. (2010, 2011) presented new research indicating that pika populations in the Great Basin are experiencing an accelerating rate of extirpation and exceptionally high rate of upslope range shift that is linked to climate change. Although these studies were conducted in the Great Basin of Nevada and Oregon, many pika populations in eastern California also inhabit the Great Basin ecosystem and are likely experiencing similar climate stress. Indeed, several pika populations that have disappeared from the Great Basin are adjacent to the California border (see Figure 1 in Beever et al. (2011)).

Beever et al. (2010) tested alternative models of the predictors of pika population extirpations in the Great Basin, and found that climate factors were good predictors of pika population losses. Beever et al. (2010) placed temperature sensors at 156 locations within pika habitats in the vicinity of 25 sites with historical records of pikas, and used historic climate data, to construct time series of ambient temperature data within pika habitats from 1945 through 2006. This study tested alternative metrics of direct thermal stress to pikas: (1) acute cold stress (number of days below a threshold temperature); (2) acute heat stress (number of days above a threshold temperature); and (3) chronic heat stress (average summer temperature).The researchers found that patterns of pika persistence were well predicted by climate metrics (i.e. climate metrics accounted for much of the variance in pika persistence). The best predictors were chronic heat stress during summer, followed by acute heat stress during summer and acute cold stress in winter based on days below -5ºC presumably because pikas were exposed to cold extremes during winter with loss of snowpack. The study concluded that "extremely rapid distributional shifts [of pikas] can be explained by climatic influences" and that pikas appear to be "an early warning indicator" of biotic responses to climate change:

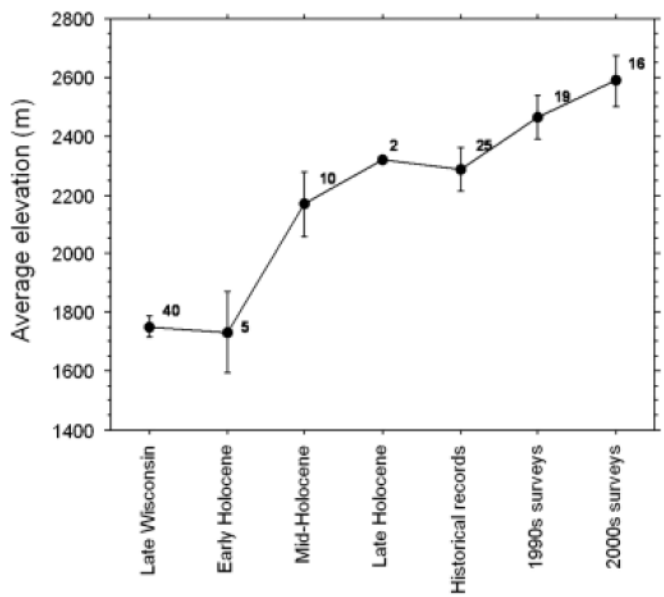
> Given that rate of climatic change may be as or more important for biota than the magnitude or duration of change (Davis et al. 2005), the rate of future losses of pikas and other patchily distributed species may hinge critically on the rate of further atmospheric changes. Our results to date confirm that mammals can experience range adjustments within just a few decades (e.g., Burns et al. 2003), though responses will likely vary widely across species. Rates of loss in *O. princeps* suggest the species as an early warning indicator of biotic response to altered climate. (Beever et al. 2010: 176).

Beever et al. (2011) expanded upon Beever et al. (2010) by (a) documenting an accelerating rate of extirpation and upslope range shift for pikas in the Great Basin and (b)

testing multiple predictors of pika population extirpations including climate, biogeographic, and anthropogenic factors. Consistent with Beever et al. (2010), Beever et al. (2011) found that climate factors best predicted pika population losses. As summarized by Beever et al. (2011), "[t]his study used fine-scale distributional records developed over the past century, combined with spatially comprehensive microclimatic data, to demonstrate a dramatic shift in the range of a climate-sensitive mammal and to infer the increasingly important role of climate in local extinctions of this species across a 38.2 million-ha area." Based on records from 1898–2008 at 25 sites in 16 mountain ranges, Beever et al. (2011) documented six pika site extirpations during the 20th century and four additional pika site extirpations since 1999, equating to a nearly five-fold increase in the rate of local extinction during the last ten years compared with the 20th century.

In addition, the rate of upslope range retraction increased nearly eleven-fold in the last ten years compared with the 20th century, averaging 3.2 m/decade during 20th century and 145 m/decade since 1999. The rate of pika upslope range retraction is much faster than other lower boundary retraction rates reported in the ecological literature, and is 24 times faster than the average rate experienced by many other species (6m/decade) reported by Parmesan et al. (2003). Indeed, the current rate of loss of pikas in Great Basin far outstrips that from the paleontological record (Figure 6).

Figure 6. Comparison of minimum elevations (mean _ 1 SE) of Ochotona princeps at locations throughout the hydrographic Great Basin since historic records, with elevations of now-extinct populations from the region across geologic time.
Source: Beever et al. (2011): Figure 2.



By testing alternative models, Beever et al. (2011) found that these pika extirpations and range retractions were best explained by climate predictors rather than biogeographic factors (i.e. size of talus, isolation) or anthropogenic factors (i.e. grazing, distance to road). Extirpated sites were warmer in summer (both chronically and acutely), more frequently extremely cold in winter, and drier overall. Summer maximum temperature was a particularly good predictor of

pika population extirpations during the recent study period in the 2000s, while frequency of extremely cold days and latitude-adjusted maximum elevation of habitat were particularly good predictors both in the 2000s and across the overall study period. Across pika-extant sites in the Great Basin, pika abundance was also positively correlated with latitude. Higher pika densities occurred in the more northerly sites, and losses of individuals between the 1990s and 2000s sampling were greatest in southern sites. As noted by Beever et al. (2011), losses of pikas have ecosystem consequences due to the pikas' role as a food source for other species and its role as an ecosystem engineer through altering plant composition and soil chemistry via selective herbivory, seed dispersal, and redistributing nutrients.

2. Grazing

As noted in the Petition, livestock grazing surrounding pika talus habitat may negatively affect pikas by lowering the quality and abundance of vegetation for pika foraging and haying. Beever et al. (2003) and Beever et al. (2011) found evidence that livestock grazing may reduce pika population persistence. Beever et al. (2003) concluded that cattle and horse grazing within 20-50 m of talus may negatively influence pikas, particularly because pikas are central-place foragers that graze most intensely nearer to talus to reduce energetic costs and predation risk. Beever (2002) also noted that "pika population size is related to the presence of livestock grazing in some cases" and that habitat degradation by livestock may interact with other stressors to affect pika population persistence.

Dr. Connie Millar gave a presentation at the 2011 CPC meeting that indicated that livestock grazing bordering talus patches may negatively affect pika populations. In the Great Basin, Millar observed that pika haypiles were located farther from the talus edge and higher in the talus where talus forefields were grazed by livestock, compared to ungrazed areas where haypiles were typically located along the talus/vegetation border. In grazed areas, haypiles typically consisted of lower quality vegetation from within the talus compared to haypiles in ungrazed areas that were comprised of vegetation from the talus and forefields. Millar hypothesized that grazing may have negative effects on pikas by resulting in low-quality and low-abundance forage for winter haypiles, low abundance of forage for summer consumption, and less favorable summer and winter thermal conditions in the higher talus locations compared to talus borders. A manuscript describing this work entitled "Influence of Domestic Livestock Grazing on American Pika (*Ochotona princeps*) Haypiling Behavior in the Eastern Sierra Nevada and Great Basin" is accepted in final review in the Western North American Naturalist.

High-elevation grazing is occurring in the pika range in California on mid-to-high elevation US Forest Service (USFS) and Bureau of Land Management (BLM) lands. An examination of high-elevation grazing allotments in California indicates that at least 118 USFS allotments allowing cattle, sheep, and/or horse grazing and 49 BLM allotments may overlap with occupied pika habitat (Figure 7). A list of these allotments is provided in Tables 1 and 2.

Figure 7. USFS and BLM livestock grazing allotments in the range of the American pika.

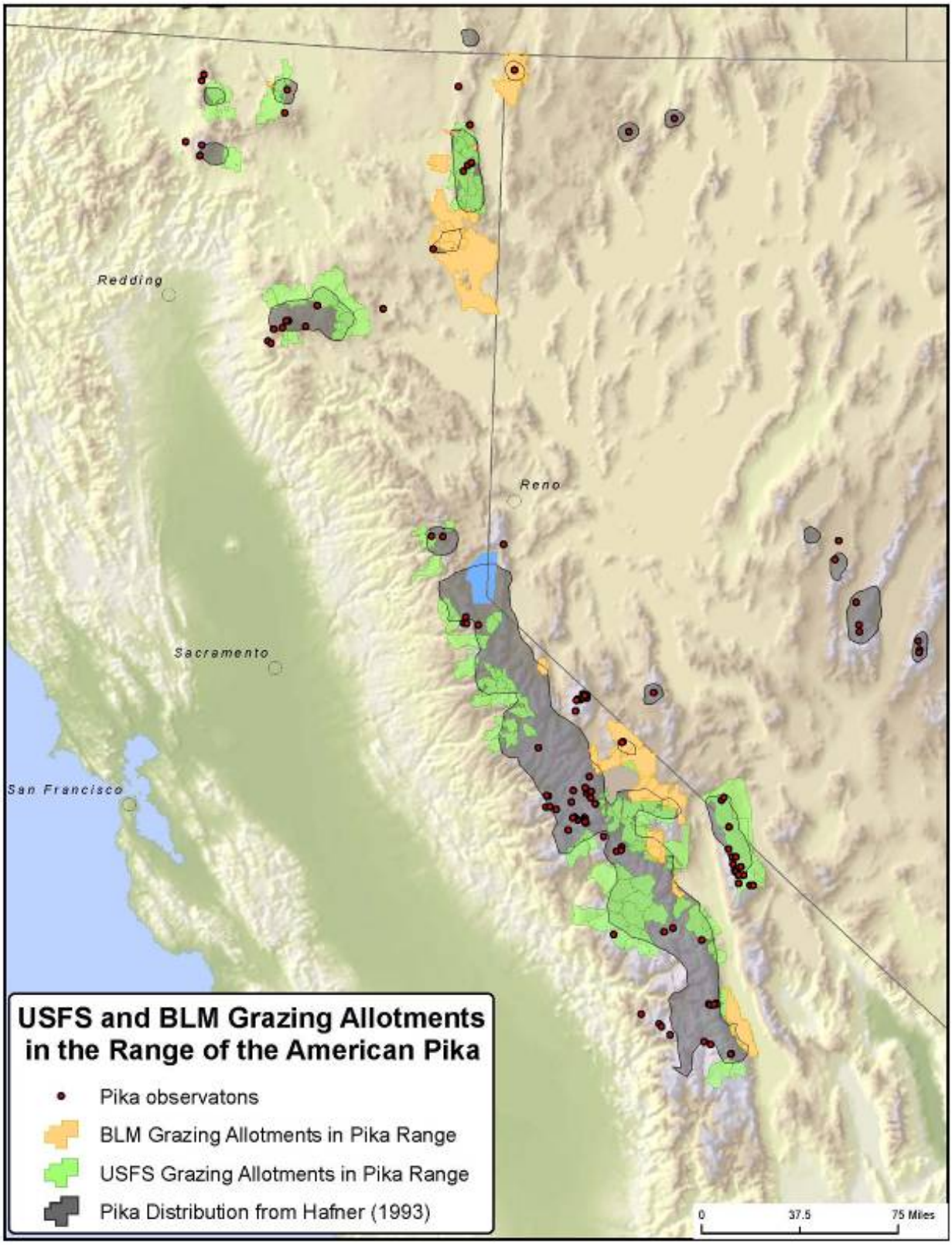


Table 1. US Forest Service grazing allotments at mid-to-high elevations in California. USFS allotments were downloaded from USFS Region 5's website: http://www.fs.fed.us/r5/rsl/clearinghouse/gis-download.shtml

USFS grazing allotments

UNIT_NO	UNIT_NAME	RMU_STATUS	CATTLE	SHEEP	HORSES
LTB01	Baldwin	VACANT	NO	NO	NO
00005	Benner Creek	ACTIVE	YES	NO	NO
LTB02	Cold Creek	VACANT	NO	NO	NO
A5302	Bear Camp	ACTIVE	YES	NO	NO
LTB03	Trout Creek	ACTIVE	YES	NO	NO
LTB04	Meiss	VACANT	NO	NO	NO
A5304	Blue Lake	ACTIVE	YES	NO	NO
A5305	Blue Lake Sheep	ACTIVE	NO	YES	NO
A5307	Cedar Canyon	ACTIVE	YES	NO	NO
A5308	Coyote	ACTIVE	YES	NO	NO
00008	Chipmunk	ACTIVE	YES	NO	NO
A5310	Eagle Peak-Barber	COMBINED	NO	NO	NO
00016	Clover Valley	ACTIVE	YES	NO	NO
A5312	Henderson Meadow	ACTIVE	YES	NO	NO
00011	Devils Peak	VACANT	NO	NO	NO
00014	Euer Valley	VACANT	NO	NO	NO
A5316	North Creek	ACTIVE	YES	NO	NO
A5317	North Parker	ACTIVE	YES	NO	NO
A5319	Parsnip	ACTIVE	YES	NO	NO
00029	Grays Valley	ACTIVE	YES	NO	NO
A5320	Selic	ACTIVE	NO	YES	NO
A5321	Thoms Creek	ACTIVE	YES	NO	NO
A5323	Yankee Jim	ACTIVE	YES	NO	NO
00038	Morgan Springs	ACTIVE	YES	NO	NO
A5325	Emerson	VACANT	NO	NO	NO
00045	Poison Lake	ACTIVE	YES	NO	NO
00048	Robbers Creek	ACTIVE	YES	NO	NO
00049	Silver Lake	ACTIVE	YES	NO	NO
00047	Rice Creek	VACANT	NO	NO	NO
R5201	Bear Valley	ACTIVE	YES	NO	NO
R5202	Highland Lakes	ACTIVE	YES	NO	NO
R5206	Pacific Valley	ACTIVE	YES	NO	NO
00031	Hat Creek	VACANT	NO	NO	NO
R5210	Stanislaus Meadow	ACTIVE	YES	NO	NO
00042	North Battle Creek	ACTIVE	YES	NO	NO
R5301	Bell Meadow-Bear Lake	ACTIVE	YES	NO	NO
R5302	Clark Fork	ACTIVE	YES	NO	NO
R5303	Cooper	ACTIVE	YES	NO	NO
R5304	Herring Creek	ACTIVE	YES	NO	NO
R5305	Kennedy Lake	ACTIVE	YES	NO	NO
R5306	Long Valley - Eagle Meadow	ACTIVE	YES	NO	NO
R5307	Red Peak	VACANT	NO	NO	NO
00057	Horsethief	ACTIVE	YES	NO	NO
00060	Mount Hebron	ACTIVE	YES	NO	NO
00065	Three Sisters	ACTIVE	YES	NO	NO
A5603	Crumes	VACANT	NO	NO	NO
A5609	Mt. Dome	ACTIVE	YES	NO	NO
A5311	Granger	ACTIVE	YES	NO	NO
00053	Deer Mountain	ACTIVE	YES	NO	NO

00054	Dry Lake	ACTIVE	YES	NO	NO
05315	Kaiser	ACTIVE	YES	NO	NO
05317	Blasingame	ACTIVE	YES	NO	NO
05318	Mono	ACTIVE	YES	NO	NO
05319	Cassidy	ACTIVE	YES	NO	NO
00612	Bartle	ACTIVE	YES	NO	NO
05320	Hot Springs	ACTIVE	YES	NO	NO
05338	Upper Mono		NO	NO	NO
05339	Bear		NO	NO	NO
05340	Piute		NO	NO	NO
05341	Florence		NO	NO	NO
00074	Three Sisters				
05409	Helms		NO	NO	NO
05442	Red Mountain		NO	NO	NO
001IV	Indian Valley	VACANT	NO	NO	NO
05445	Post Corral		NO	NO	NO
001PA	Pardoe	ACTIVE	YES	NO	NO
005PE	Pearl Lake	VACANT	NO	NO	NO
005TP	Tells Peak	VACANT	NO	NO	NO
005WL	Wrights Lake	VACANT	NO	NO	NO
006BM	Bryan Meadow	VACANT	NO	NO	NO
006CM	Cody Meadow	ACTIVE	YES	NO	NO
05546	Dike Creek		NO	NO	NO
05337	Minnow		NO	NO	NO
05449	Black Cap		NO	NO	NO
05547	North Jackass	VACANT	NO	NO	NO
00407	Mulkey	ACTIVE	YES	NO	YES
00412	Whitney	VACANT	NO	NO	NO
00102	Alger Lake	VACANT	NO	NO	NO
00103	Alpers Canyon	ACTIVE	YES	NO	NO
00104	Black Canyon	VACANT	NO	NO	NO
00105	Bloody Canyon	VACANT	NO	NO	NO
00107	Dexter Creek	ACTIVE	NO	YES	NO
00108	Horse Meadow	VACANT	NO	NO	NO
00109	June Lake	ACTIVE	NO	YES	NO
00109	June Lake (Closed to sheep grazing)	ACTIVE	NO	YES	NO
00109	June Lake	ACTIVE	NO	YES	NO
00109	June Lake (Closed to sheep grazing)	ACTIVE	NO	YES	NO
00111	Long Valley	ACTIVE	YES	NO	NO
00112	Mono Mills	ACTIVE	NO	YES	NO
00115	Clark Canyon	ACTIVE	YES	NO	YES
00120	Mono Sand Flat	ACTIVE	YES	NO	NO
00201	Hot Creek	ACTIVE	YES	NO	NO
00202	Antelope C&h	ACTIVE	YES	NO	NO
00203	McGee	ACTIVE	NO	YES	NO
00204	Sherwin/Deadman	ACTIVE	NO	YES	NO
00205	Tobacco Flat	ACTIVE	YES	NO	NO
00303	Buttermilk	ACTIVE	YES	NO	NO
00304	Casa Diablo	ACTIVE	NO	YES	NO
00307	Cottonwood	VACANT	NO	NO	NO
00308	Crooked Creek	ACTIVE	YES	NO	NO
00309	Davis Creek	ACTIVE	YES	NO	NO
00312	Indian Creek	ACTIVE	YES	NO	NO
00314	McMurray Meadows	ACTIVE	YES	NO	NO
00315	Perry Aiken	ACTIVE	YES	NO	NO
00316	Coyote	ACTIVE	YES	NO	NO
00317	Rock Creek	ACTIVE	NO	YES	NO

00319	Shannon Canyon	ACTIVE	YES	NO	NO
00320	Taboose Creek	ACTIVE	YES	NO	NO
00321	Trail Canyon	ACTIVE	YES	NO	NO
00321	Tres Plumas	VACANT	NO	NO	NO
00328	Queen Valley	ACTIVE	YES	NO	NO
00401	Alabama Hills	ACTIVE	YES	NO	NO
00403	George Creek	ACTIVE	YES	NO	NO
00404	Independence	ACTIVE	YES	NO	NO
00300	White Mountain				
A5330	Wilderness Sheep	ACTIVE	NO	YES	NO
00007	Bridge Creek	ACTIVE	YES	NO	NO
00057	Upper Pine Creek	ACTIVE	YES	NO	NO

Table 2. Bureau of Land Management grazing allotments at mid-to-high elevations in California. The BLM allotments were downloaded from the BLM's California website: http://www.blm.gov/ca/gis/

BLM grazing allotments

ALLOT_NO	ALLOT_NAME	GIS_ACRES
01113	Nevada Cowhead	42503
01101	Bally Mountain	5335
01119	East Balley	5006
01110	Gravelly	3853
01107	Crooks Lake	44230
01311	West Panhandle	1435
00134	Prock	2423
00150	Corbie Field	256
00310	Tule Mountain	63359
00800	Selic-Alaska	9641
00306	Dry Cow	6326
00320	Mcdonald Mountain	20122
00703	Observation	244788
00307	Cold Springs	19214
00329	Brockman	6107
00330	Coffin	2295
06066	Slinkard	12531
06071	Bodie Mountain	56426
06084	Mount Biedeman	4953
06072	Mono Sand Flat	63085
06076	Green Creek	4384
06059	Rancheria Gulch	26237
06058	Dog Creek	7674
06057	Copper Mountain	3599
06055	Mono Mills	34180
06054	Mono Lake	8841
06027	Adobe Valley	25419
06034	Granite Mountain	21214
06037	Symons	3898
06026	Mathiew	1978
06018	Hot Creek	10292
06022	Wilfred Creek	13260
06081	Casa Diablo	3163
06044	Long Valley	13092
06045	Tobacco Flat	603

06020	Little Round Valley	1843
06051	Wells Meadow	1522
06046	Alabama Hills	78012
06082	George Creek	3190
06061	Mono Settlement	572
06003	Frazier Canyon	8425
06032	Sherwin	2035
06008	Round Valley	5515
00305	South McDonald	12888
01013	Granger	0
00302	Cold Springs	18775
00321	South Mitchell Hill	3875
00137	North Tablelands	26875
00304	Cramer	1077

3. Mining

Gold mining operations pose a threat to already vulnerable pika populations in the Bodie Hills of Mono County. In 2009 the BLM permitted exploratory mineral drilling by Cougar Gold at the abandoned Paramount Mine site in the Bodie Hills. Eleven drill holes at eight locations within the Bodie Wilderness Study Area (WSA) were permitted (BLM 2009b) despite an inadequate Environmental Assessment that failed to properly address and mitigate threats to pikas. The *Cougar Gold Paramount Exploration Proposal Environmental Assessment* dated May 1, 2009 mentioned American pikas only once (page 12) and never mentioned or analyzed potential impacts to pikas even though pikas are likely to be directly impacted by exploratory drilling (BLM 2009a). Proposals to open the Bodie Hills, including the WSA, to gold mining are ongoing.

As noted above in the Population Status section, the Bodie Hills has experienced region-wide pika population losses, making pikas in this region particularly vulnerable to additional anthropogenic stresses like mining. The remaining known pika populations in the Bodie Hills occupy historic ore dumps at Bodie SHP and New York Hill. Dr. Lyle Nichols expressed his concerns regarding the Paramount Mine project in a 2009 letter to the BLM stating that (1) the ore dumps of Paramount Mine could contain extant pika populations; (2) mining activity (exploratory or otherwise) on or near ore dumps at the abandoned Paramount Mine site would be deleterious for resident and nearby pikas by disturbing or destroying their habitat and creating disturbance due to increased human activity and noise pollution; and (3) even if Paramount Mine ore dumps are not currently occupied by pikas, they represent important habitat for any potential management actions that might be required to recover pikas in this region. Thus mining activity must be considered a threat to pikas in California.

I. Degree and immediacy of threat

As described in the Petition and May 2009 letter, climate change poses the most serious long-term threat to the survival of the American pika. Numerous studies documenting climate change in California's mountain regions over the past century indicate that there has been rapid warming, an increase in heat waves, and a shift in the character of mountain precipitation, with more winter precipitation falling as rain instead of snow, earlier snowmelt, and earlier stream flow. Climate models project that climate change impacts will worsen in California in this

century. Of concern for the pika, four independent modeling studies indicate that the pika will lose much of its suitable habitat and face a high probability of extirpation across much of its range in California within this century due to climate change.

As highlighted in the Petition, American pikas have characteristics expected to make them particularly sensitive to climate change, including low fecundity, poor dispersal capability, high energetic requirements, a narrow thermoneutral zone, mountaintop endemicity, and an obligate relationship to a naturally patchy habitat (Beever et al. 2011). As discussed on pages 30-34 of the Petition, warmer conditions, increased heat wave activity, and loss of snowpack in the pika's range in California due to climate change increase thermal stress on the pika through four mechanisms discussed by Smith (1978) and Beever et al. (2003, 2010, 2011): (1) exposing pikas to higher heat stress during the summer; (2) reducing the pika's ability to forage midday; (3) reducing the dispersal success of juveniles; and (4) exposing pikas to increased cold stress and cold extremes during the winter by reducing the insulating snowpack. Additionally, rising summer temperatures coupled with increasing summer dryness may lead to the earlier desiccation of vegetation and curtail the pika's ability to accumulate a sufficient summer haypile for surviving winter months (Hafner 1994). In hotter, low-elevation portions of the pika's range in California, summer desiccation already limits the length of the summer season when hay can be collected (Smith 1974). Thus, these studies on observed and projected climate change in California are relevant and important to assessing the degree and immediacy of the threat of climate change to the pika.

1. New research on observed climate change in California

The Petition reports the findings of numerous published studies documenting observed climate change (pages 18-21) and projecting future climate change (pages 27-30) in the range of the pika in California. The Center's May 2009 letter provides an overview of three studies on observed climate change in California which indicate that temperatures have increased (Bonfils et al. 2008a), heat wave activity has increased (Gershunov and Cayan 2008), and snow accumulation in the Sierra Nevada has decreased (Kapnick and Hall 2009). Detection and attribution studies that analyze whether climatic changes have occurred due to natural climatic variations or human influence from greenhouse gas pollution have found that these climatic trends were unlikely to have arisen exclusively from natural internal climate variability, and are attributable in large part to greenhouse gas forcing. As detailed below, new scientific studies supplement and support these findings and indicate that these climate change trends in California will accelerate in this century.

a. Temperature increases in California's mountains

Temperatures have risen significantly across California in recent decades. Across the western U.S. during 1950-1999, daily maximum and minimum temperatures in winter (January to March) increased by 1.83°C and 1.54°C (Bonfils et al. 2008b). In concert with rising temperatures, the number of frost days in winter decreased by 7.6 days, while the number of degree-days above 0°C increased between 1950 and 1999 (Figure 8) (Bonfils et al. 2008b). These trends were significant at the 5% level even after the removal of effects from El Niño Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO) variability. Importantly,

temperature trends showed spatially and elevationally coherent patterns of warming, meaning that these trends were observed across mountainous regions, including the Sierra Nevada, White Mountains, and southwest Great Basin (Figure 8).

Figure 8. Observed and simulated 1950-99 changes in (a) JFM Tmin, (b) Tmax, (c) FD, and (d) DD>0 over the western United States. Frost day trends are large except where frost occurrences are rare (desert and Central Valley), and degree-day trends are small or zero at high elevations where temperatures are too low to exceed the 0°C threshold.
Source: Bonfils et al. (2008b): Figure 4.

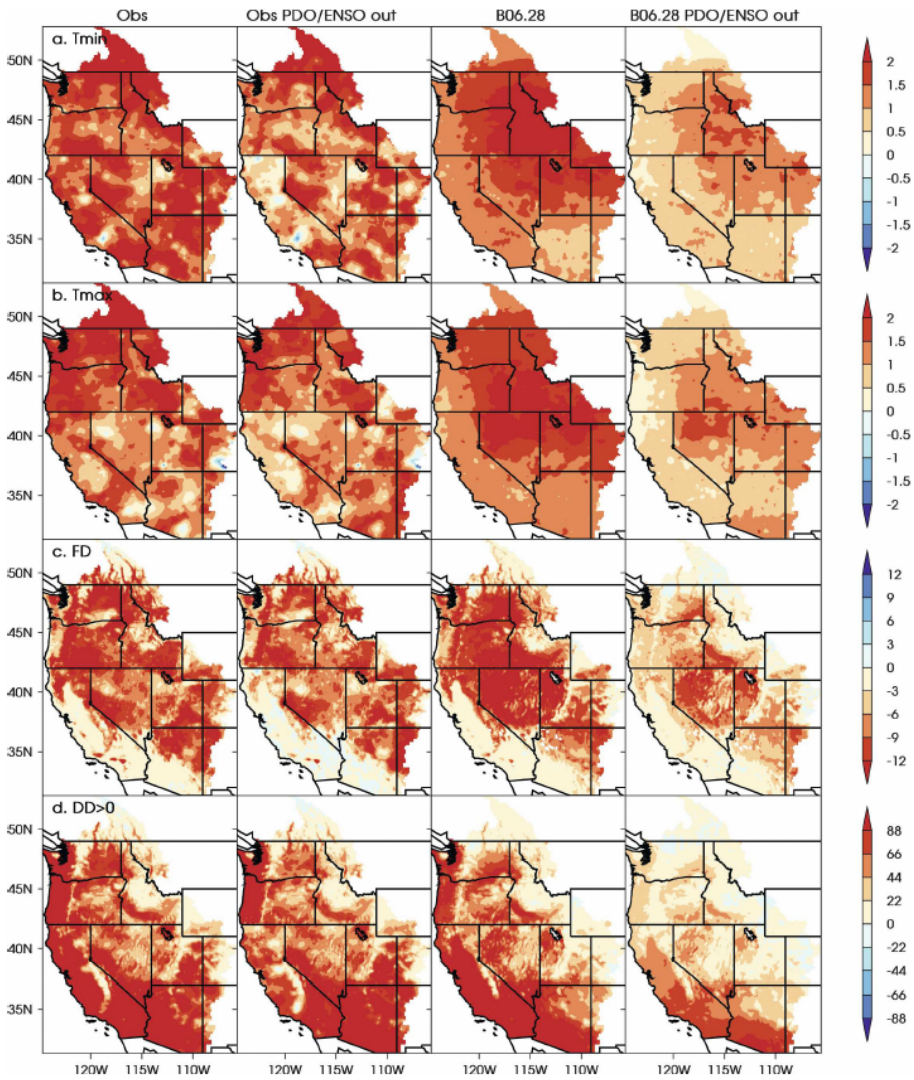


FIG. 4. Observed and one example of simulated 1950–99 changes in (a) JFM T_{min}, (b) T_{max}, (c) FD, and (d) DD > 0 over the western United States. Trends have been computed from the UW and one PCM-ANTH1 realization (B06.28), using raw data (columns 1 and 3) and data in which observed or simulated PDO and ENSO are regressed out (columns 2 and 4). The color scale is chosen such that red indicates an increase in T_{min} and T_{max}, an increase of DD > 0, and a decrease in FD.

In a California-specific analysis, Bonfils et al. (2008a) found that mean and maximum daily temperatures increased in late winter and early spring between 1915 and 2000, and that

minimum daily temperatures increased from January to September. Bonfils et al. (2008a) concluded that "the warming of Californian winters over the twentieth century is associated with human-induced changes in large-scale atmospheric circulation."

b. Increased drought duration and severity and lower soil moisture

A study of 20th century trends in soil moisture, runoff, and drought characteristics over the conterminous U.S. detected trends toward increased drought duration and severity and lower soil moisture in California including the Sierra Nevada region (Figures 9, 10) (Andreadis and Lettenmaier 2006).

Figure 9. Trends in drought severity. Upward trends shown in red triangles and downward trends shown in blue triangles.
Source: Andreadis and Lettenmaier (2006): Figure 4.

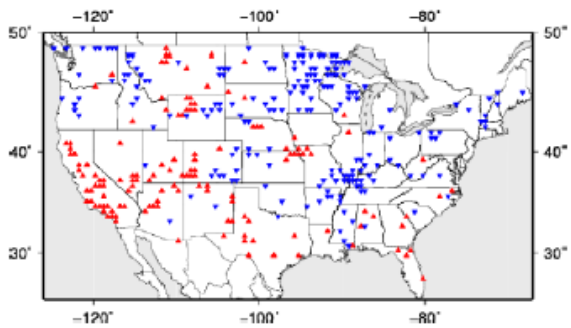
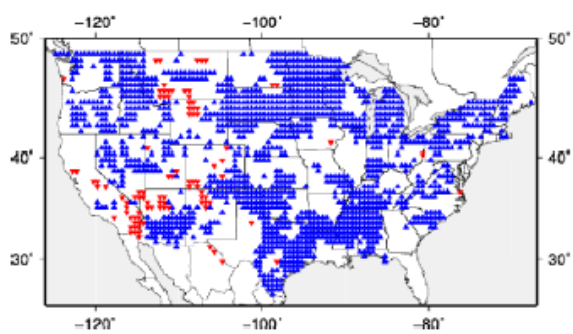


Figure 10. Annual trends in soil moisture. Blue triangles show upward trends, while red triangles show downward trends.
Source: Andreadis and Lettenmaier (2006): Figure 1.



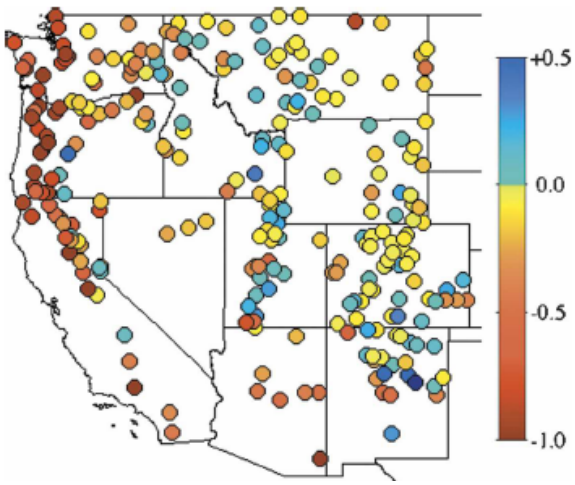
c. Reduced snowpack in California mountains

In the western U.S. and California, more winter precipitation is falling as rain instead of snow and snowpack is decreasing (Hamlet et al. 2005, Mote et al. 2005, Knowles et al. 2006, Mote 2006, Pierce et al. 2008). Hamlet et al. (2005) detected downward trends in spring snowpack, measured as the 1 April snow-water equivalent (SWE), across the western United States between 1916 and 2003. Hamlet et al. (2005) showed that large-scale, long-term declines

in snowpack are primarily attributable to rising temperatures rather than changes in precipitation or PDO variability.

Knowles et al. (2006) detected a trend toward reduced winter-total snowfall water equivalent (SFE) to winter-total precipitation (*P*) during the period 1949–2004. Trends toward reduced SFE are a response to warming across the region, with the most significant reductions occurring where winter wet-day minimum temperatures were warmer than -5°C. As indicated by Figure 11, downward trends in SWE were observed in the Sierra Nevada and southern Cascades regions.

Figure 11. Fractional change in winter snowfall water equivalent after removing the effects of trends in precipitation.
Sources: Knowles et al. (2006): Figure 7.

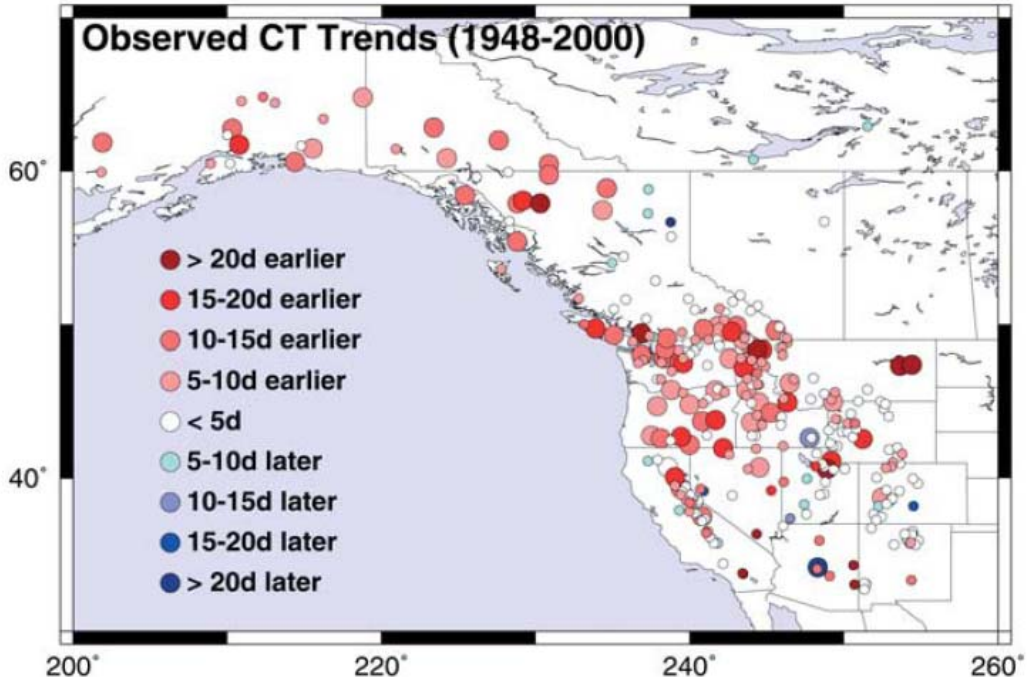


Das et al. (2009) detected trends across the western U.S. toward a decrease in winter-total snowy days as a fraction of winter-total wet days, a decrease in the spring snow water equivalent (1 April snow water equivalent as a fraction of October–March precipitation), and an increase in winter accumulated runoff as a fraction of water-year accumulated runoff.

d. Earlier timing of streamflow and runoff

Stewart et al. (2004) detected an earlier shift in timing of streamflow due to earlier springtime snowmelt during 1948–2000 across the western U.S., including the Sierra Nevada region (Figure 12).

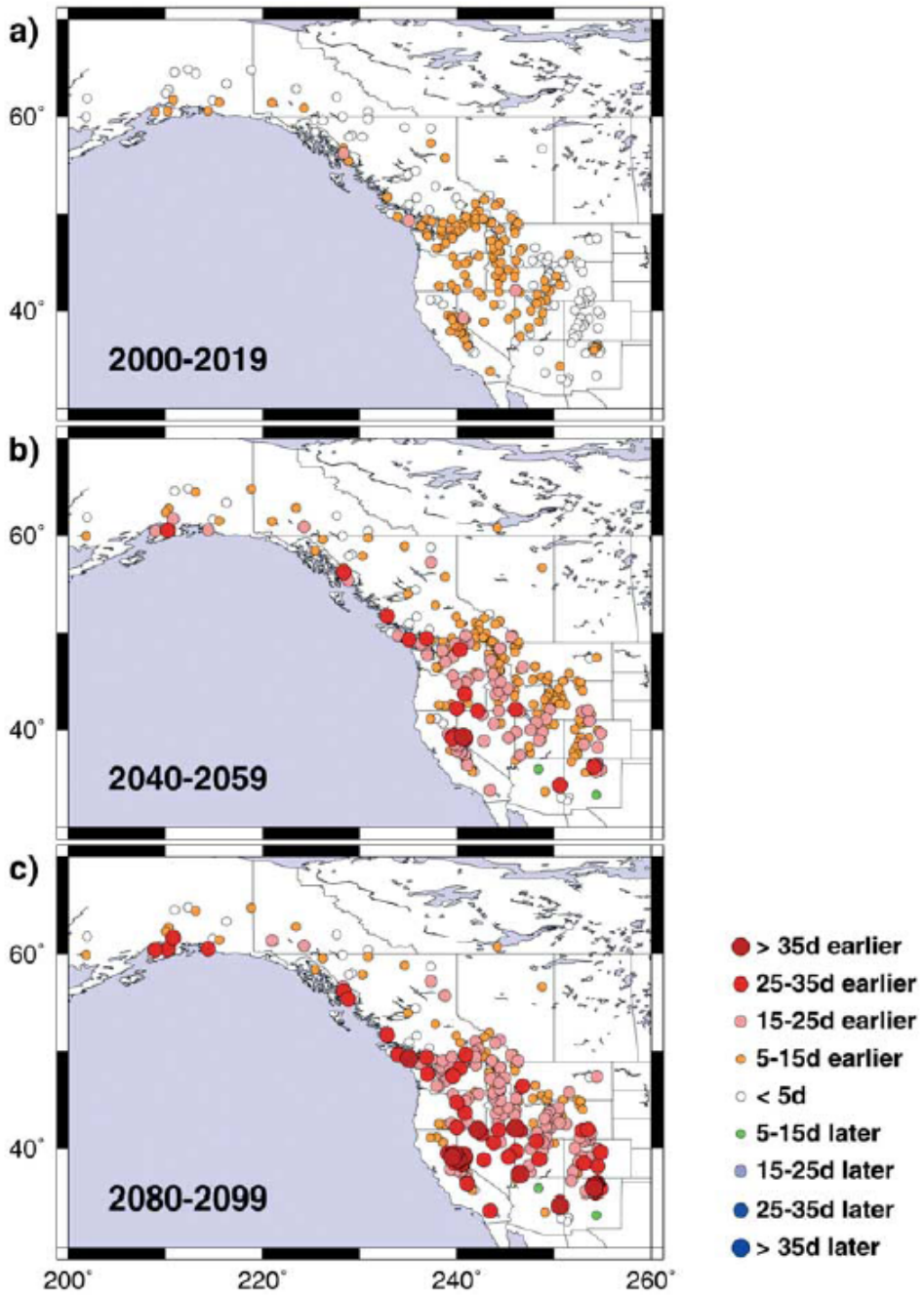
Figure 12. Observed changes in the timing of the center of mass of flow (CT), 1948-2000. Larger circles indicate statistically significant trends at the 90% confidence level; smaller circles correspond to trends that do not meet statistically significant thresholds at the 90% level.
Source: Stewart et al. (2004): Figure 2.



2. New research on projected climate change in California

Climate projections indicate that the western United States will continue to become warmer, snowpack will continue to decline, and the timing of snowmelt runoff in most snowmelt-dominated basins in the West will consistently shift earlier in spring, up to 60 days earlier in some areas, leading to increased winter runoff and reduced summer streamflow volumes (USGCRP 2009). As detailed in the Center's May 2009 comment letter, in California, temperatures will continue to rise; hot events and extreme precipitation events will become more frequent; snowpack will continue to decrease; and snowmelt and streamflow will continue to shift earlier (Cayan et al. 2008, Rauscher et al. 2008). Stewart et al. (2004) also found that streamflow would continue to get earlier across the western U.S., including within the pika range in California, with many rivers running 30-40 days earlier by the end of the century (Figure 13).

Figure 13. 20-year averages of projected changes in CT [days] averaged over (a) 2000-2019; (b) 2040-2059; and (c) 2080-2099.
Source: Stewart et al. (2004): Figure 8.

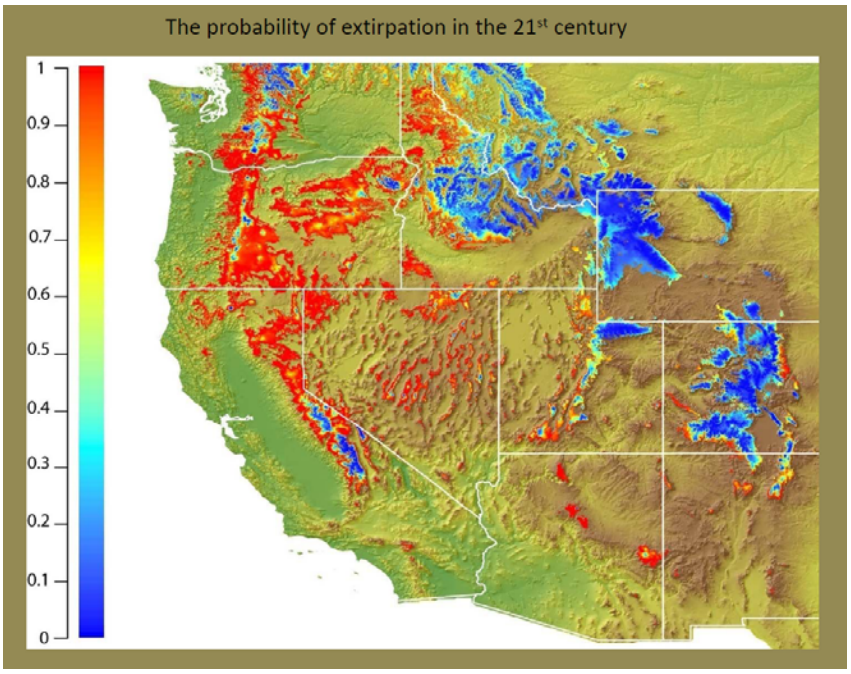


3. Research modeling changes in pika population persistence and habitat suitability under changing climate conditions

Four studies using two different analytical approaches have modeled pika population persistence or habitat suitability under changing climate conditions and have concluded that pikas will have a high probability of extirpation and greatly reduced habitat suitability across much of its range in California within this century.

Loarie et al. (submitted) modeled the persistence of pika populations under historic climate conditions in the Sierra Nevada, Great Basin, Cascades, and Rocky Mountain regions. Loarie then modeled persistence probabilities for pikas under projected climate conditions during the interval 2010-2099 and found that the probability of extirpation for pikas was very high (90-100%) across a large portion of the range, especially in California, Nevada, Oregon, and Washington (Figure 14). In California, the pika is predicted to have a high probability of disappearing from the entire southern Cascades region, the entire northern Sierra Nevada region, and all but the highest elevations of the southern Sierra Nevada and White Mountains regions. We note that the regions where pikas have a high extirpation probability as modeled by Loarie show strong concordance with the regions where pikas are projected to lose suitable habitat as modeled by Galbreath et al. (2009).

Figure 14. The probability of pika extirpation in the 21st century.
Source: Loarie (2010).

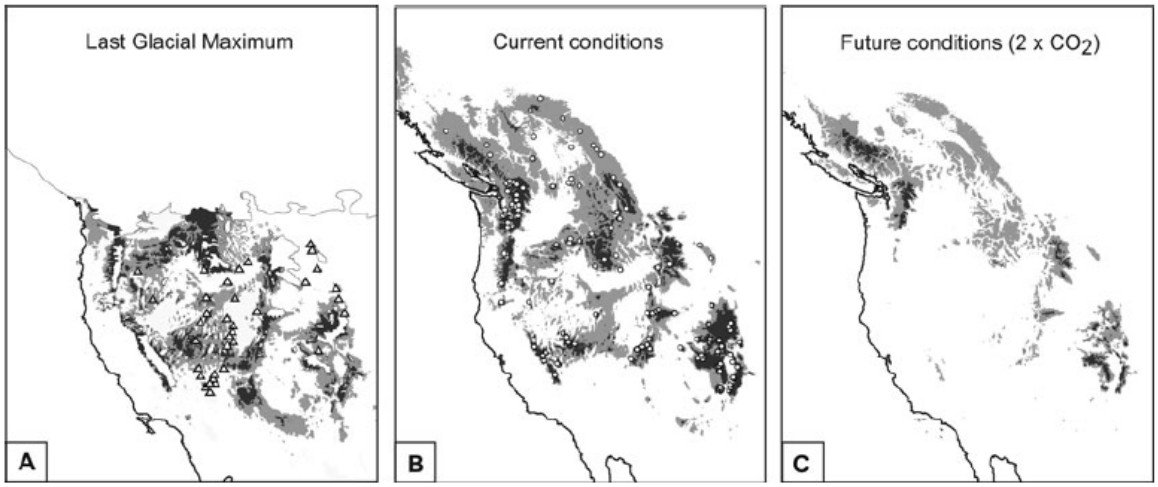


Galbreath et al. (2009) developed an ecological niche model for the American pika under climate conditions during the Last Glacial Maximum, the present-day, and the future (when atmospheric CO_2 concentration is double the current level) to quantify climate-driven changes in range. The study found that the American pika's projected distribution under future climate conditions would be "greatly restricted, with particular losses in the Sierra Nevada and throughout the southwestern portion of the species range" (p. 2857). See Figure 15 below. The study further found that the Sierra Nevada lineage of pikas in California and the Great Basin is at particular risk of extinction due to climate change: "our projection of the distribution of *O. princeps* under simulated future climatic conditions suggests that the Sierra Nevada lineage may be at risk of extinction if anthropogenic climate change continues unabated; the ENM predicted that nearly all patches of suitable habitat in the southwestern part of the Intermountain West will

be lost if atmospheric CO_2 levels double." (p. 2860). Further, the researchers noted that the Sierra Nevada lineage has already been greatly reduced due to loss of Great Basin populations and that ongoing extinctions due to climate change threaten the future of this lineage and the evolutionary potential of American pikas:

> Even if complete lineage extinction does not occur, the distribution of diversity across the region will change considerably if local population extinction continues. For example, loss of Great Basin populations since the end of the LGM has already restricted the Sierra Nevada lineage to a small number of relictual populations scattered between California and Utah (Grayson 2005) (Fig. 3). Ongoing extinction of Great Basin populations threatens to extinguish these relicts (Beever et al. 2003), causing the loss of potential sources for recolonization of the region during future periods of climate cooling. Their disappearance would yield a dramatic range reduction with important implications for the long-term distribution of the Sierra Nevada lineage.
>
> Demographic retraction, population fragmentation, and lineage extinction can affect the evolutionary potential of American pikas (Myers and Knoll 2001), reducing the likelihood that the species will adapt to future environmental perturbations (Mace and Purvis 2008). Furthermore, the evidence for climatic effects on pika populations highlights the sensitivity of alpine communities to ongoing climate change (Sala et al. 2000), and offers a warning that other alpine species may be at risk.
>
> (Galbreath et al. 2009: 2860).

Figure 15. Ecological niche models (ENM) showing the predicted distribution of *Ochotona princeps* under (A) last glacial maximum (LGM), (B) current, and (C) future climatic conditions. Distributions are shown at 0.1 (light gray) and 0.5 (dark gray) probability thresholds. The visible area in all maps is 103◦ to 130◦ W and 30◦ to 60◦ N. Note that the continental margin depicted on the LGM map differs from the others because sea levels were lower during glacial periods. On the LGM map, the approximate extent of the continental ice sheet and montane glaciers (P ´ew´e 1983; Porter et al. 1983) and full-pluvial lakes (Baker 1983; Smith and Street-Perrott 1983) are masked in white. Open triangles indicate fossil pika localities that date to the Late Pleistocene and Holocene (Mead 1987; Hafner 1993; Grayson 2005). On the current conditions map, open circles indicate localities used to train and test the ENM.
Source: Galbreath et al. (2009): Figure 5.



Master's theses by (2009) and Calkins (2010) which also used ecological niche modeling approaches found similar results to Galbreath et al. (2009). We note that ecological niche modeling and climate envelope modeling approaches to forecasting climate change impacts on species are widely accepted analyses in the published scientific literature. In addition, projects using these modeling approaches have been supported by funding from California's Public Interest Energy Research (PIER) program.

J. Impact of existing management efforts

As described in the Petition, May 2009 comment letter, and the comments below, existing management efforts to address climate change, grazing, and mining threats are inadequate to protect the American pika from declines and extinction. As acknowledged by the USFWS, the pika's Species of Special Concern Status in California provides little protection: "Because SSC designation carries no legal status, it does not require mitigation where impacts are found to occur and as such would not protect pika habitat with certainty" (Fed Reg 75: 6460).

1. Climate change

Greenhouse gas emissions pose a primary threat to the continued existence of the American pika, and yet are among the least regulated threats. Regulatory mechanisms at the state, national and international level do not require the greenhouse gas emissions reductions necessary to protect the pika from extinction.

a. National and international emissions reductions needed to protect the American pika

The best-available science indicates that atmospheric CO_2 concentrations must be reduced to at most 350 ppm to protect species and ecosystems (Warren 2006, Hansen et al. 2008, Lenton et al. 2008, Jones et al. 2009, Smith et al. 2009). In order to reach a 350 ppm CO_2 target or below, global CO_2 emissions must peak before 2020, and likely by 2015, followed by rapid annual reductions bringing emissions to or very close to net zero by 2050 (CBD and 350.org

2010, UNEP 2010). The IPCC found that to reach a 450 ppm CO_2eq target, the emissions of the United States and other developed countries should be reduced by 25 to 40% below 1990 levels by 2020 and by 80-95% below 1990 levels by 2050 (Gupta et al. 2007); thus reductions to reach a 350 ppm CO_2 target must be more stringent. Baer et al. (2009) outlined a trajectory to reach 350 ppm CO_2 target by 2100 that requires 2020 global emissions to reach 42% below 1990 levels, with emissions reaching zero in 2050. They concluded that Annex I (developed country) emissions must be more than 50% below 1990 levels by 2020 and reach zero emissions in 2050 (Baer and Athanasiou 2009).

b. State climate initiatives are insufficient

California is the world's sixth largest economy and the twelfth largest polluter in its own right, and is also a leader in climate change response, with a number of laws and policies that aim to reduce the state's greenhouse gas emissions. Foremost among these is the Global Warming Solutions Act of 2006 (AB 32) which requires the reduction of greenhouse gas emissions to 1990 levels by the year 2020. (Cal. Health and Safety Code § 38500 et seq.) The Global Warming Solutions Act is supplemented by other laws such as the California Environmental Quality Act, (California Public Resources Code §21000 et seq., "CEQA"), which requires state and local agencies to assess and reduce to the extent feasible all significant environmental impacts from new project approvals. State and local agencies are not currently fully implementing CEQA with regard to greenhouse gas emissions, but were they to do so this would greatly assist the state in meeting or surpassing the reductions required under the statewide cap by sharply limiting emissions from new development. In addition, Governor Schwarzenegger's Executive Order S-3-05 sets a goal of reducing greenhouse gas emissions as follows: by 2010, reduce emissions to 2000 levels; by 2020, reduce emissions to 1990 levels; and by 2050, reduce GHG emissions to 80 percent below 1990 levels. Executive branch agencies including California EPA and the California Resources Agency have ongoing programs aimed at meeting these targets. Progress to date, however, has been slow under all of these authorities, and even if all legal mandates were fully and successfully implemented, existing California law provides only a fraction of the emissions reductions needed to prevent the extinction of the pika.

c. United States climate initiatives are ineffective

The United States is responsible for approximately 20% of worldwide annual carbon dioxide emissions (U.S. Energy Information Administration 2010, http://www.eia.gov), yet does not currently have adequate regulations to reduce greenhouse gas emissions. This was acknowledged by the Department of Interior in the final listing rule for the polar bear, which concluded that regulatory mechanisms in the United States are inadequate to effectively address climate change (73 Fed. Reg. 28287-28288). While existing 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., these agencies are either failing to implement or only partially implementing these laws for greenhouse gases. For example, the EPA has issued a rulemaking regulating greenhouse gas emissions from automobiles (75 Fed. Reg. 25324, Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule), has initiated a process for issuing rules for greenhouse gas emissions

from power plants and oil refineries (*see, e.g.* 75 Fed. Reg. 82392, Proposed Settlement Agreement, Clean Air Act Citizen Suit), and on January 2, 2011 began implementing, in a slow, cautious, and phased manner, the new source review program for greenhouse gases (75 Fed. Reg. 17004, Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs). However, the EPA has as yet failed to implement the critically important criteria air pollutant/national ambient air quality standards program for greenhouse gases, has failed to issue any greenhouse rules for many other stationary and mobile sources, and there is no evidence that existing and currently proposed rulemakings would provide anything close to the greenhouse reductions needed to avert the warming that imperils the pika. While full implementation of the nation's flagship environmental laws, particularly the Clean Air Act, would provide an effective and comprehensive greenhouse gas reduction strategy, due to their non-implementation, existing regulatory mechanisms must be considered inadequate to protect the pika from climate change.

d. International climate initiatives are insufficient

The primary international regulatory mechanisms addressing greenhouse gas emissions are the United Nations Framework Convention on Climate Change and the Kyoto Protocol. As acknowledged by the Department of Interior in the final listing rule for the polar bear, these international initiatives are inadequate to effectively address climate change (73 Fed. Reg. 28287-28288). The Kyoto Protocol's first commitment period only sets targets for action through 2012. Importantly, there is still no binding international agreement governing greenhouse gas emissions in the years beyond 2012. While the 2009 U.N. Climate Change Conference in Copenhagen called on countries to hold the increase in global temperature below 2°C (an inadequate target for avoiding dangerous climate change), the *non-binding* "Copenhagen Accord" that emerged from the conference failed to enact binding regulations that limit emissions to reach this goal. Even if countries did meet their pledges, analyses of the Accord found that collective national pledges to cut greenhouse gas emissions are inadequate to achieve the 2°C, and instead suggest emission scenarios leading to 2.5 to 5°C warming (Rogelj et al. 2010, UNEP 2010). Thus international regulatory mechanisms must be considered inadequate to protect the pika from climate change.

2. Grazing.

As detailed in the section on "Factors affecting the ability to survive and reproduce," the permitting of grazing allotment at mid-to-high elevations on public lands in the range of the pika to not appear to evaluate impacts to pikas.

3. Mining

As detailed in the section on "Factors affecting the ability to survive and reproduce," the permitting of exploratory mining that has recently occurred in the Bodie Hills region has not adequately evaluated impacts to pikas.

J. Suggestions for future management

Current management has been inadequate to prevent the extirpations of the American pika in California, and is inadequate to ensure this species' survival in the wild. Management actions for the pika in California are needed in the following areas: (1) mitigation of greenhouse gas pollution to levels that do not endanger the pika, (2) management to facilitate adaptation to climate change, and (3) statewide monitoring and research on pika populations and their habitat. As detailed above, mitigation of greenhouse gases is essential to slow global warming and ultimately stabilize the climate system while there is still suitable pika habitat remaining. Adaptation actions are necessary to reduce threats to pikas to provide them a better chance of surviving climate change impacts that are already committed while we work to implement greenhouse gas mitigation measures. As described above, non-climate threats including grazing and mining should be mitigated.

The CDFG should implement a statewide monitoring program for pikas to track the status of pika populations over time and across regions, especially given that the pika has been widely identified as an indicator species for climate change and is already experiencing significant population extirpations in California. Long-term monitoring of pika occupancy, density, and (where possible) demography should be conducted at a statewide network of sites, including historic sites with known past pika occupancy and across regions with varying vulnerability to climate change impacts (i.e. higher vulnerability expected at hot, arid, and/or low elevation sites; lower vulnerability expected at cooler, moister, and/or higher elevation sites). Standard monitoring techniques have been developed by pika researchers and provide a template for a statewide monitoring program; the Grinnell Resurvey Project has identified a network of historic sites for monitoring across the pika range in California. On State lands, monitoring in and around Bodie State Historic Park should be a high priority given the evidence of significant extirpations in this region. Given the serious threat that climate change poses to the pika and other high-elevation species, these monitoring studies could be conducted as part of a larger program to measure and detect changes in the population status of a suite of high-elevation species including the pika. The CDFG should also support research examining the mechanisms affecting pika persistence, similar to the studies of Beever et al. (2003, 2010, 2011) in the Great Basin, including climate variables (both surface and inter-talus metrics), vegetation composition, community composition, disease, and other anthropogenic stressors (grazing activity, mining activity, human activity). Mechanistic studies on pikas in California are lacking and should be a high conservation priority.

IV. The USFWS 12-Month Finding That the American Pika Is Not Threatened By Climate Change Is Not Based On the Best-Available Science

The U.S. Fish and Wildlife Service ("USFWS") made a positive 90-day finding for the American pika, determining that the American pika may be warranted for listing under the U.S. Endangered Species Act due to the effects of climate change. In making this determination, the USFWS agreed with the Petitioner that climate change is likely to decrease the pika's range and habitat. However, the USFWS made a negative 12-month finding determining that the pika is not warranted for listing due to climate change or other threats.

As detailed below, the USFWS 12-month finding has significant flaws, including its failure to use the best-available science to evaluate climate change threats to the pika and its reliance on a problematic "rapid response" report to assess the impacts of future climate change

on the pika. The significant flaws in the 12-month finding undermine its conclusions that the pika is not threatened by climate change. Below we discuss the problematic aspects of the 12-month finding that are relevant to the Department's evaluation of climate change threats to the pika in California. We note that the finding did not consider important new information documenting significant pika extirpations in California, made unfounded statements about the adaptive capacity of the pika, wrongly dismissed modeling studies that indicate that the pika in California is threatened by climate change, and did not consider new information on pika status and threats from 2010 and 2011, all of which make the finding of limited or questionable utility in informing the listing decision for the pika in California.

A. The USFWS finding ignored studies on pika population status in California that documented significant population extirpations

In reviewing pika population status in California, the USFWS finding ignored studies by Dr. Lyle Nichols documenting the virtual extirpation of pika populations from the Bodie Hills. The USFWS also discounted data showing that pika populations in the southern and middle population networks in Bodie State Historic Park have collapsed in the past decade. Furthermore, USFWS ignored data from Dr. John Perrine documenting significant extirpations of historic pika populations in northern California.

B. The USFWS finding made unfounded statements about the pika's adaptive capacity

The USFWS relied heavily on unfounded statements that the pika will be able to "adapt to increasing temperature" to justify its conclusion that the pika is not threatened by climate change (see, for example, statements in Fed. Reg. 75 at 6442, 6443, 6446, 6447, 6453, 6456, 6463), including the following conclusion:

> American pika can tolerate a wider range of temperatures and precipitation than previously thought (Millar and Westfall 2009, p. 17). The American pika has demonstrated flexibility in its behavior and physiology that can allow it to adapt to increasing temperature (Smith 2009, p. 4). Based on all these lines of evidence, we determine that climate change is not a threat at the species level or the subspecies-level now or in the foreseeable future. (Fed. Reg. 75: 6453).

The USFWS based its conclusion that pikas can adapt to increasing temperature on two primary sources: Millar and Westfall (2010) and unpublished comments by Smith (2009). As discussed above and in Wolf (2010), Millar and Westfall (2010)'s study does not support the conclusion that pikas can tolerate a wider range of temperatures and precipitation than previously thought. Indeed, Millar and Westfall's (2010) findings suggest that pikas in California are not tolerating warmer and drier conditions. For example, climate conditions at old pika sites (i.e., those with old pika sign) were significantly warmer and drier than at recently occupied sites, and non-occurrence sites (those with no pika sign) were also significantly warmer and drier than occurrence sites (those with pikas or pika sign) (Millar and Westfall 2010).

Similarly, comments by Smith (2009) do not support the conclusion that pikas can "adapt to increasing temperature," nor do published pika studies. Although pikas may alter their behaviors in response to warming temperatures (i.e. pika might spend less time foraging mid-day), such behavioral responses have limited capacity to buffer pikas from the effects of rapid temperature rise and loss of snowpack due to climate change. Certainly the accelerating population extirpations and unprecedented upslope range retractions of pikas in the Great Basin provide direct and compelling evidence that pikas have a limited capacity to cope with rapid climate change. In addition, as highlighted by many researchers, the pika has characteristics that make it particularly sensitive to climate change (Smith et al. 2004, Grayson 2005, Beever et al. 2011).

C. The USFWS did not consider the best available science in projecting climate change impacts to the pika

As discussed above and acknowledged in part by the USFWS (Fed. Reg. 75: 6448-6449), three studies (Loarie submitted, Galbreath et al. 2009, Trook 2009) using two different modeling approaches have projected significant losses of pikas in California due to climate change. These studies represent the best-available science on habitat suitability and pika persistence under projected climate conditions. However, the USFWS finding dismissed these three studies based on several criticisms: (1) the studies provide projections beyond 2050 and conditions after 2050 are unforeseeable; (2) the studies used "relatively few explanatory (climate) variables in modeling current and future suitable habitat; none of the variables included those which are known to be important predictors of pika persistence, such as land-cover type (e.g., talus), microclimate, or other physical habitat features"; (3) bioclimatic envelope models base persistence projections on surface temperatures, although USFWS determined that "temperatures below the habitat surface, such as in talus crevices, are more important for survival of individual pikas and are a better predictor of persistence"; and (4) "none of the models factor in the pika's documented behavioral ability to avoid warmer temperatures during the hottest part of the day" (Fed. Reg. 75: 6449).

As detailed below, these criticisms are unfounded and do not provide sufficient basis for USFWS to dismiss the three modeling studies. Moreover, in place of these studies, the USFWS relied on its own rushed "rapid response assessment" conducted in collaboration with NOAA, to project climate change impacts to the pika. This USFWS/NOAA study did not overcome most of the above-cited criticisms that USFWS used to dismiss the three modeling studies.

(1) The USFWS dismissed the three modeling studies based on the unfounded argument that climate conditions after 2050 are "unforeseeable." Foreseeability means that which "can or should be anticipated" (citing Merriam-Webster's Dictionary of Law) or "[t]he quality of being reasonably anticipatable" (citing Black's Law Dictionary). The IPCC, the world' foremost authority on climate change, has provided climate change projections through 2100 under a range of plausible emission scenarios, and provides quantification of the mean and range of climate conditions expected through 2100 under these emissions scenarios. As stated by the IPCC itself, climate projections run through the end of the 21st century under different emissions scenarios, and accompanied by the range of uncertainty, were provided in their 2007 Fourth Assessment Report specifically because of their policy relevance (IPCC 2007: 13). These

projections through 2100 have been used in countless studies that assess future risks from climate change, including studies assessing the vulnerability of species and ecosystems to future climate conditions. Clearly, the foreseeable future for assessing climate change impacts on the pika should extend through 2100 based on internationally accepted IPCC climate projections.

In support of a foreseeable future through 2100 in assessing species' vulnerability to climate change impacts, NOAA in its December 2010 12-month finding for the ringed and bearded seals determined that the foreseeable future for assessing impacts from climate change for these species is the end of the 21st century:

> [N]MFS scientists have revised their analytical approach to the foreseeability of threats and responses to those threats, adopting a more threat specific approach based on the best scientific and commercial data available for each respective threat. **For example, because the climate projections in the Intergovernmental Panel on Climate Change's (IPCC's) *Fourth Assessment Report* extend through the end of the century (and we note the IPCC's *Fifth Assessment Report,* due in 2014, will extend even farther into the future), we used those models to assess impacts from climate change through the end of the century.** We continue to recognize that the farther into the future the analysis extends, the greater the inherent uncertainty, and we incorporated that limitation into our assessment of the threats and the species' response. For other threats, where the best scientific and commercial data does not extend as far into the future, such as for occurrences and projections of disease or parasitic outbreaks, we limited our analysis to the extent of such data. We believe this approach creates a more robust analysis of the best scientific and commercial data available. (75 Federal Register: 77477, 77497; emphasis added)

The 12-month finding further concluded that climate projections through the end of the 21st century "currently form the most widely accepted version of the best available data about future conditions":

> In this review of ringed seal population status, the BRT recognized that the physical basis for some of the primary threats faced by the species have been projected, under certain assumptions, through the end of the 21st century, and that these projections currently form the most widely accepted version of the best available information about future conditions. **Therefore, in the risk assessment that follows, the BRT used the full 21st-century projections as the basis for the foreseeability of threats stemming from climate change**. (Kelly et al. 2010: 43; emphasis added).

(2) The USFWS dismissed the three modeling studies based on the claim that they used "relatively few explanatory (climate) variables in modeling current and future suitable habitat," which fails to acknowledge that the USFWS/NOAA study used only <u>one</u> explanatory climate variable; the criticism that "none of the variables included those which are known to be important predictors of pika persistence, such as land-cover type (e.g., talus), microclimate, or other physical habitat features" is also unfounded since the best-available science indicates that

climate variables (not land-cover type or physical habitat features) are the best predictors of pika persistence. Specifically, the long-term, comprehensive studies by Beever et al. (2003, 2010, 2011) found the best predictors of pika extirpations in the Great Basin ecosystem are climate variables rather than biogeographic factors (i.e. size of talus, isolation) or anthropogenic factors (i.e. grazing, distance to road). Metrics of acute cold stress (number of days below a threshold temperature), acute heat stress (number of days above a threshold temperature), chronic heat stress (average summer temperature), and latitude-adjusted elevation proved to be the best predictors of pika persistence. Consistent with these findings, the three modeling studies used relevant and appropriate climate-related variables to model future pika habitat suitability and/or probability of persistence. For example, Galbreath et al. (2009) used 19 standard bioclimatic parameters that included indices of acute and chronic heat and cold stress. In contrast, the USFWS/NOAA modeling study used only one predictor variable—average summer surface temperature--and therefore was more simplistic and less comprehensive than the three studies that the USFWS dismissed.

(3) The USFWS dismissed the three modeling studies based on the claim that these studies used surface temperatures instead of below-talus temperatures which "are more important for survival of individual pikas and are a better predictor of persistence." However, the USFWS claim that intra-talus temperatures are more important than surface temperatures to predict pika population persistence is not supported by the best-available science. The USFWS cited Beever et al. (2010) as the basis for this assertion. However, Beever et al. (2010) concluded that temperatures measured with below-talus and above-talus sensors were highly correlated (r_{avg} = 0.83), and thus above-talus temperature measurements are also useful for predicting pika population persistence (p. 171). Indeed, based on pika ecology, it is reasonable to expect that both surface temperatures and inter-talus temperatures are important for pikas, not only because they are strongly correlated, but also because pikas must use both surface and below-talus habitats for essential behaviors (i.e. surface habitats are important for foraging and many social interactions while below-talus habitat are important for wintering and resting).

(4) On a final note, the USFWS dismissed the three modeling studies based on the claim that "none of the models factor in the pika's documented behavioral ability to avoid warmer temperatures during the hottest part of the day." However, the USFWS offered no guidance on how these modeling studies should or could factor in this behavior, nor what expected outcome or benefit this hypothetical modeling exercise would produce. Moreover, the USFWS did not account for this behavior in its own study.

In sum, the USFWS wrongly dismissed three modeling studies representing the best-available science on projected climate change impacts to pikas, and replaced these analyses with its own problematic and simplistic modeling study. In dismissing these studies, the USFWS attempted to marginalize bioclimatic envelope studies, although this modeling approach is widely utilized in the published scientific literature and is supported by California's Public Interest Energy Research (PIER) program. Moreover, the Loarie (submitted) study did not use a bioclimatic envelope modeling approach and reached similar conclusions that the pika faces a high probability of extirpation across much of its range in California within this century due to climate change.

D. The USFWS relied on its own simplistic and problematic analysis to conclude that climate change does not threaten the pika

The USFWS assessed future climate change impacts to the pika based on a problematic "rapid response report"—the USFWS/NOAA study--that was more limited in scale and scope than the three modeling studies that USFWS dismissed. The study's notable limitations cast doubt on the reliability of its conclusions. The study's limitations include the following:

(1) The study's spatial scale was restricted to 22 locations across the entire pika range, limiting its realm of inference, including only three locations in California.

(2) Within those 22 locations, the analysis of observed and projected climate conditions appears to be limited to one 4-km grid cell, making the climate analysis for each location extremely spatially limited. As an example, it appears that the analysis of climate conditions in the entire "Sierras/Yosemite" region of California was restricted to one 4-km grid cell in that mountain range.

(3) The study only considered the effects of change in one climate variable--mean summer temperature—on pika population persistence. Based on long-term, comprehensive studies by Beever et al. (2003, 2010, 2011), other climate variables including acute cold stress (number of days below a threshold temperature) and acute heat stress (number of days above a threshold temperature) are also important in modeling pika population persistence, but were not considered by the USFWS/NOAA study.

(4) The USFWS/NOAA study only considered the IPCC A1B "middle of the road" emissions scenario. However, the observed emissions growth rate in the 2000s has been tracking that of the most fossil-fuel intensive IPCC emissions scenario, A1FI (Raupach et al. 2007, McMullen and Jabbour 2009, Richardson et al. 2009). Thus the A1B emissions scenario significantly underestimates actual emissions to date as well as climate change risks to the pika. As acknowledged by the USFWS, "there are no known existing regulatory mechanisms currently in place at the local, State, national, or international level that effectively address these types of climate-induced threats to pika habitat" (75 Fed. Reg. 6461). Having concluded that regulatory mechanisms are inadequate to control greenhouse gas emissions, the USFWS should have also assessed impacts to the pika under the A1FI scenario that we are currently tracking.

In sum, given the significant flaws in the USFWS 12-month finding for the pika, the Department and Commission should refrain from relying on unfounded and inaccurate conclusions in the finding in writing the evaluation report and making the listing decision.

V. Conclusion

The best available scientific evidence indicates that the American pika in California is experiencing significant population extirpations in warmer, lower elevation sites in California and faces significant threats to its continued existence from climate change, combined with cumulative threats from grazing and mining. We urge the Department to recommend the

initiation of a status review for the American pika in California and for the Commission to accept the Petition to list the American pika under the California Endangered Species Act.

Thank you for your consideration of these comments. We are submitting all new references cited in this comment letter as pdfs on the enclosed compact disk. Please contact me at (415) 632-5301 or at swolf@biologicaldiversity.org if you have any questions.

Sincerely,

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