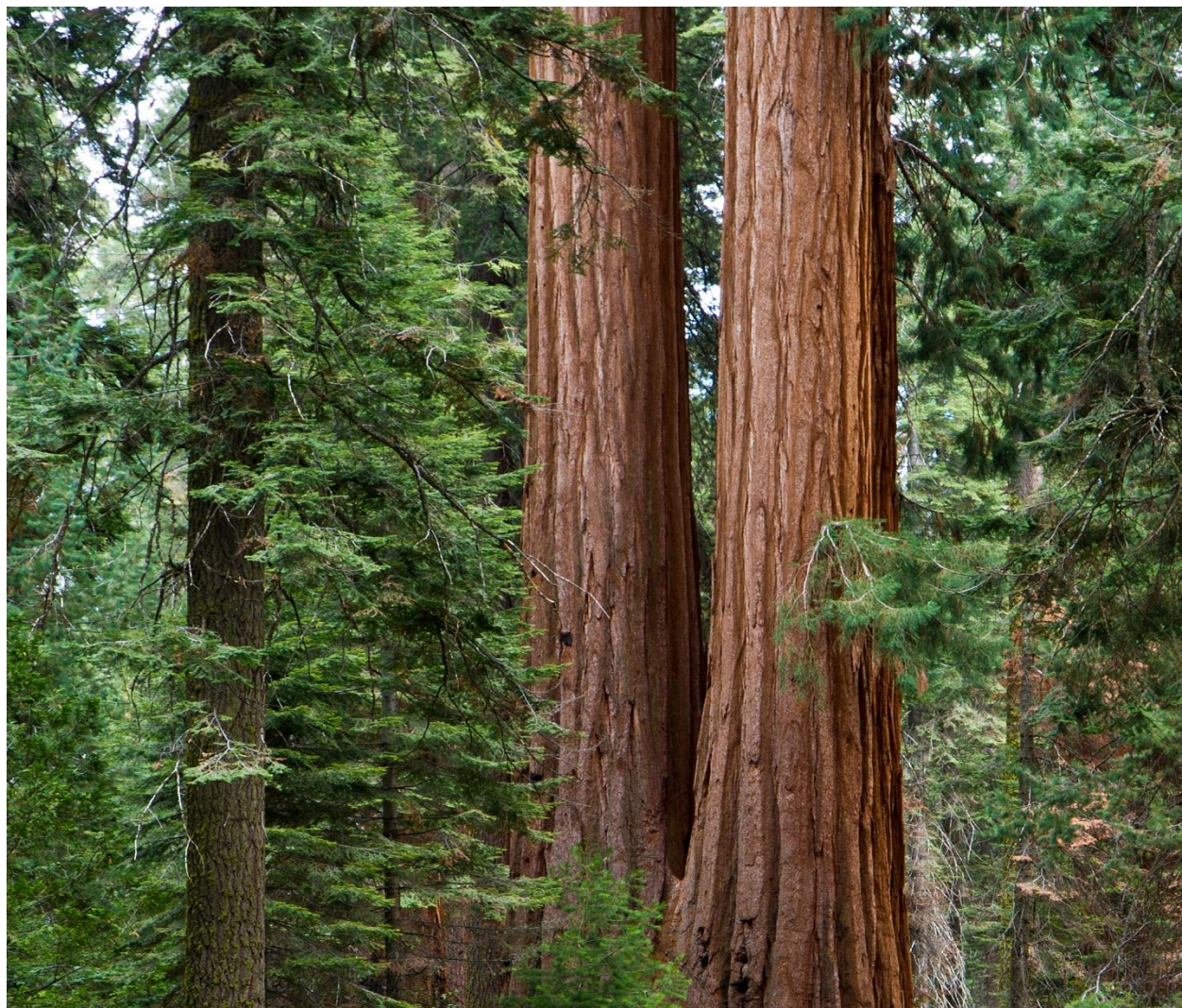




A Natural Resource Condition Assessment for Sequoia and Kings Canyon National Parks

Appendix 15a - Animals of Conservation Concern

Natural Resource Report NPS/SEKI/ NRR—2013/665.15a



ON THE COVER

Giant Forest, Sequoia National Park
Photography by: Brent Paull

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The Ecology Graduate Student Project Collective

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National Park Service

Natural Resource Stewardship and Science

Fort Collins, Colorado

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This document contains subject matter expert interpretation of the data. The authors of this document are responsible for the technical accuracy of the information provided. The parks refrained from providing substantive administrative review to encourage the experts to offer their opinions and ideas on management implications based on their assessments of conditions. Some authors accepted the offer to cross the science/management divide while others preferred to stay firmly grounded in the presentation of only science-based results. While the authors' interpretations of the data and ideas/opinions on management implications were desired, the results and opinions provided do not represent the policies or positions of the parks, the NPS, or the U.S. Government.

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Scope of analysis

This chapter is an assessment of a park-identified collection of non-native, extinct, rare, endangered, threatened, and species of conservation concern. Species of conservation concern may be such because of a perceived vulnerability to global change or because of poor ecological and taxonomic understanding. For clarity, we treat condition assessment of non-native taxa separately from the suite of sensitive native animals.

The focal non-native animals are considered because they are known to be invasive in some habitats. The concern is not for non-native species generally, but for those that are considered invasive because of their capacity to change ecosystem structure, composition and functioning.

Park biologists established the priority list of sensitive animal taxa and the UC Davis student conservation assessment team focused on these taxa (Table 1). This collection of sensitive native animals include three types of species: (a) at risk or locally extinct taxa; and (b) species for which there is relatively little knowledge, but which are considered at risk species. As a consequence of ecological similarity, native and non-native fishes were tackled simultaneously by the SEKI fishes sub-team (Table 1). A subsequent request to cover the park chipmunk taxa was also met by this team, although in less detail.

Our process for assessing sensitive animals was to commission small groups of students to conduct a stand-alone evaluation of individual taxa (Table 1). Groups overlapped in order to gain some consistency of treatment. Students met on numerous occasions to build uniformity among sub-reports. We then aggregated this information into a synthetic report with each individual report as supplemental information. There is a large range of variation in available information across these taxa. As a consequence, it was not possible to standardize approaches among taxa. Nonetheless, each assessment prioritized describing the focal taxa with respect to six critical questions: 1) taxonomic description; 2) life history; 3) distribution; 4) conservation status; 5) data gaps and research priorities; and 6) summary and recommendations.

Individual species assessments are included in their entirety under the “Supplemental Information” portion of this report. An exception is made for fishes, native and non-native, which were treated in unison. The fish constitute a single supplemental report. The main body of the report synthesizes this information into a comprehensive assessment addresses the status and condition of sensitive animals generally in Sequoia and Kings Canyon National Parks. Given that non-native taxa (where more is worse) and at risk taxa (where more is better) are substantively different, we treat these as separate groups within each section. “At risk taxa” simply refers to the aggregation of extinct, rare, threatened, or little known taxa listed in Table 1. Throughout the chapter we refer to species by their common names.

Table 1. Sensitive Animal taxa covered in this focal resource assessment.

Taxa	Author Group
A. <u>At risk or locally extinct taxa</u>	
American Pika (<i>Ochotona princeps</i>)	Z. Steel, E. Reddy, R. Green,
Sierra Nevada Red Fox (<i>Vulpes vulpes necator</i>)	R. Green
Wolverine (<i>Gulo gulo</i>)	J. Blickley, E. Reddy, S. Copeland
California Condor (<i>Gymnogyps californianus</i>)	S. Copeland, K. Dybala, Z. Steel
Brown Bear (<i>Ursus arctos</i>)	K. Holzer, S. Copeland
California Bighorn Sheep (<i>Ovis canadensis sierra</i>)	Z. Steel, J. Shields
Fisher (<i>Martes pennant</i>)	R. Green, J. Shields, J. Blickley
Mtn. Yellow-legged Frogs (<i>Rana muscosa</i> , <i>R. sierra</i>)	E. Cole, A. Steel
B. <u>Little known taxa considered possibly at risk</u>	
Kaweah slender salamander (<i>Batrachoseps kawia</i>)	M. Skaer, E. Cole
Kings River slender salamander (<i>Batrachoseps regius</i>)	E. Cole, M. Skaer
Sierra Nevada Chipmunks (<i>Tamias</i> spp.)	Z. Steel
C. <u>High Elevation Fish</u>	
	A. Steel, B. Erickson, K. Deiner, C. Mosser
Little Kern golden trout (<i>Oncorhynchus mykiss whitei</i>)	
Golden trout (<i>Oncorhynchus mykiss aguabonita</i>)	
Rainbow trout (<i>Oncorhynchus mykiss</i>)	
Brook trout (<i>Salvelinus fontinalis</i>)	
Brown trout (<i>Salmo trutta</i>)	
D. <u>Invasive Species</u>	
New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)	K. Holzer, A. Steel
Brown-headed cowbirds (<i>Molothrus ater</i>)	K. Dybala, J. Blickley
Feral pigs (<i>Sus scrofa</i>)	J. Blickley, K. Holzer
Cattle trespass	E. Wolf, J. Shields, M. Skaer
Bullfrogs (<i>Lithobates</i> (<i>Rana</i>) <i>catesbeianus</i>)	K. Holzer, E. Wolf

Critical questions

We identify condition of groups, treating non-native species and at risk animals separately, within Sequoia and Kings Canyon (SEKI) National Parks. In this assessment, we (a) place the Parks within a regional context; (b) assess temporal trends, where available, and (c) identify spatial patterns in the distribution of these two groups of organisms. Thus, our critical, synthetic questions are whether or not the taxa that are considered is a relatively large number of taxa, given the area of the Parks, whether these taxa have discernible population trends, and whether there is a spatial pattern of their distribution across the parks. We do not attempt to address the issue of whether the number of on-native or at risk taxa are increasing or decreasing.

For individual taxa, we also addressed specific critical questions. For example, the extirpated California condor and brown bear were specifically assessed regarding the issue of whether re-introduction would be feasible. For non-native species we assessed the spatial extent of the threat by examining current population status, management efforts, and the potential to control the species in the future.

Data sources and types used in analysis

The information provided here comes from several primary sources. Each sub-report speaks directly to the issue of data sources. However, there were several common sources for information. Park animal wildlife observation databases provide occurrence data for most species. For most terrestrial taxa, these observations were augmented by regional observations from California Natural Diversity database (CNDDB) and the NatureServe data explorer (NatureServe.org). Occurrence data for both native and non-native fishes come from park observations. Occurrence data for invasive species come mostly from park observations and personal communication with park staff. Occurrence information for all taxa were augmented by talking to park wildlife ecologist Harold Werner, who pointed focal resource leads to park reports and other informal information. Roland Knapp (Research Biologist, UC Natural Reserve System) also provided valuable information on high elevation fish occurrences and sanctioned the use of his data for our assessment. Data sets assessed are all cited within individual assessments, provided in the Supplemental Information section.

Reference conditions

At Risk Taxa. Defining generalized reference conditions for sensitive native animals is difficult. At risk taxa fall into one of four categories. First, species whose populations were historically low and which are now extirpated (brown bear, California condor). The second group are species whose SEKI populations are perceived to be low relative to an historical baseline because of past environmental change (e.g., fisher, wolverine, red fox, mountain yellow-legged frogs (2 species). With the exception of the mountain yellow-legged frogs, these species were also likely to have, historically, been low. The third group includes species where specific environmental change is predicted to degrade the habitat of high elevation species (e.g., pika, bighorn sheep). Both taxa in

this group contain distinct sub-species or populations within the Parks. The fourth category are species that are very poorly understood because of infrequent observation (the slender salamanders, the southern Sierra chipmunks).

Given a dearth of historical information on latter two groups (slender salamander populations, sierra chipmunks, pika and bighorn sheep) we consider current populations to be as close to a reference condition that we might legitimately claim, although bighorn sheep were likely more extensive in SEKI prior to settlement. Bighorn sheep populations were also likely more continuous and connected among populations prior to European settlement and the introduction of high elevation domestic sheep grazing. Baseline reference conditions for fisher, wolverine, red fox, might not be possible given that it has proven very difficult to even estimate current population sizes. Each of these species is wide ranging and elusive. More intensive studies have revealed more occurrences than previously thought. Nonetheless, there is general agreement that each taxa has declined. The magnitude of this decline is uncertain.

There is compelling evidence for considerable declines from reference conditions for the mountain yellow-legged frogs and native trout of SEKI. Specific reference conditions are unknown, but each of these species was thought to be a common dominant species in its habitat. Brown bear and California condor are both extirpated from SEKI, but neither was likely to have had extensive populations with SEKI as high montane habitats are marginal for both of these species.

Non-native Taxa. A simple and obvious reference condition for non-native taxa is a population size of zero.

Spatial analysis

At Risk Taxa. Maps of individual at risk native taxa are given by point distributions and maps are contained within the Supplemental Information section. Not all taxa have individual occurrence maps (e.g., brown bear, slender salamanders). We focus on synthetic patterns in the main body of the report. A map of all observations of threatened endangered, and park sensitive taxa is shown in Figure 1.

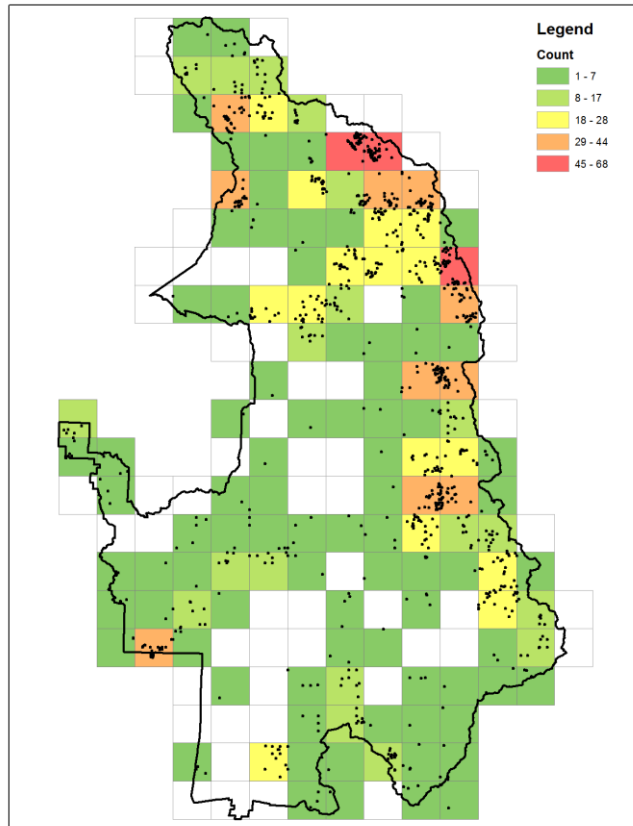


Figure 1. A dot map of rare vertebrate occurrences along with density shading in 25 m² grid cells. Observations include 102 taxa considered rare or threatened. Taxa and number of observations are listed in the Supplemental information. The figure demonstrates a high observation count at higher elevations owing to the relative ease of viewing pika and bighorn sheep compared to difficult to observe low elevation species such as the slender salamanders. The figure demonstrates that rare species occur throughout the Parks.

Non-native Taxa. Non-native species occurrences form distinct groups. The high elevation non-native fishes were historically stocked and are now dominant in ecosystems from which they were historically absent. These taxa are pervasive and cause large habitat disruption. As a consequence, programs are underway to remove these species and recreate fishless lakes, where possible.

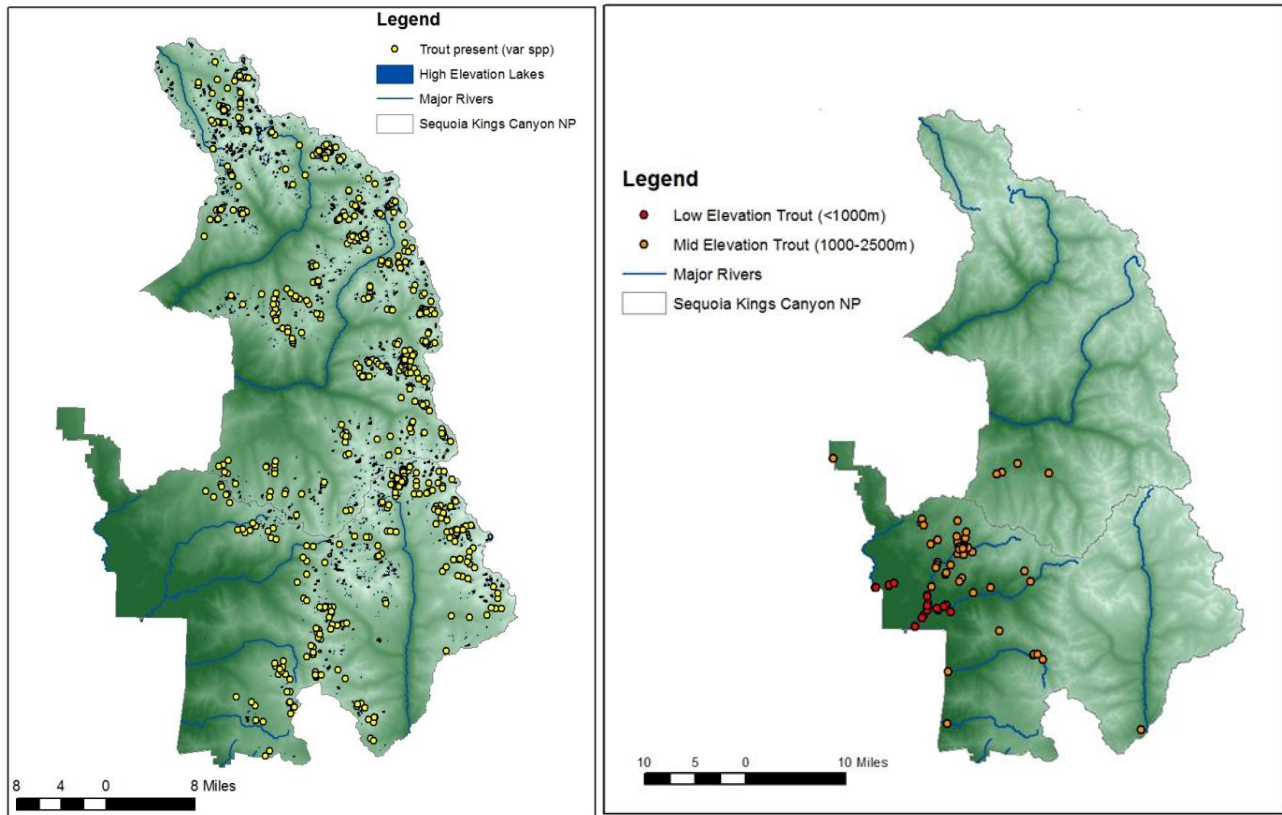


Figure 2. Occurrence records for non-native fish at high (left) and low to mid (right) elevations.

Brown headed cowbirds are most frequently found in relatively open forests and forest boundaries at low to mid elevations (Figure 3). Brown headed cowbird incursions into the Parks are considered a by-product of human habitat alteration throughout the west, giving rise to increased populations. Populations of brown headed cowbird, however are not particularly high at the time of the writing of this report (see temporal analysis below).

The remaining invading species are restricted to low elevation, and generally moist to wet habitats (New Zealand mudsnails, feral pigs, bullfrog, cattle trespass). Particularly, cattle trespass is restricted boundary locations and to specific private landowners (Figure 5). Wild pigs and bullfrog appear to have isolated and only occasional incursion into the Parks; New Zealand mudsnail is not yet confirmed within the Parks.

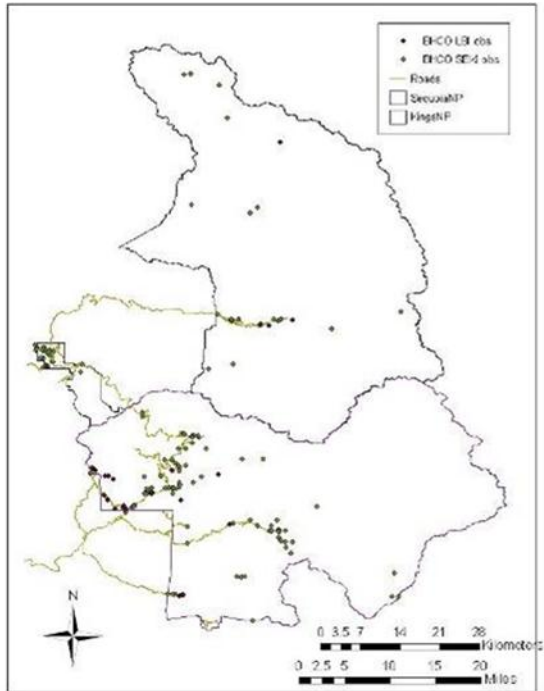


Figure 3. Map of brown headed cowbirds in Sequoia and Kings Canyon National Parks. Observations are from the Wildlife Observation Database.

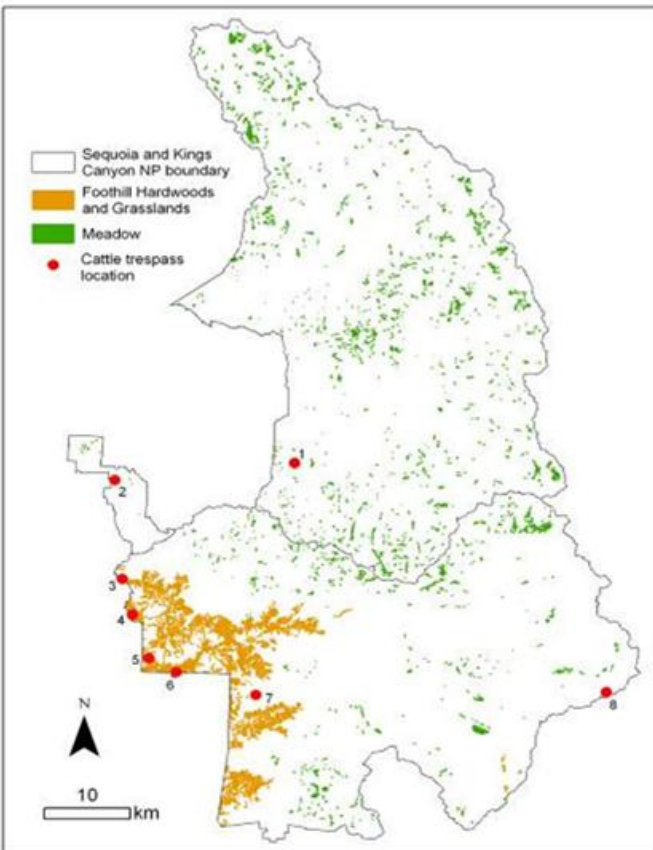


Figure 5. A map of known, recent cattle trespass incursions.

Temporal analysis

Most observation data are not sufficiently detailed to allow any temporal analysis other than simple observations such as: brown bear used to be in the park and now they are not. Pika and bighorn sheep have some of the best available data to assess temporal trends, and both taxa appear to have stable or increasing populations. Nevertheless, both remain vulnerable to future environmental change, as discussed below. Brown headed cowbirds peaked in abundance during the 1980's and have subsided over recent decades (Figure 6)

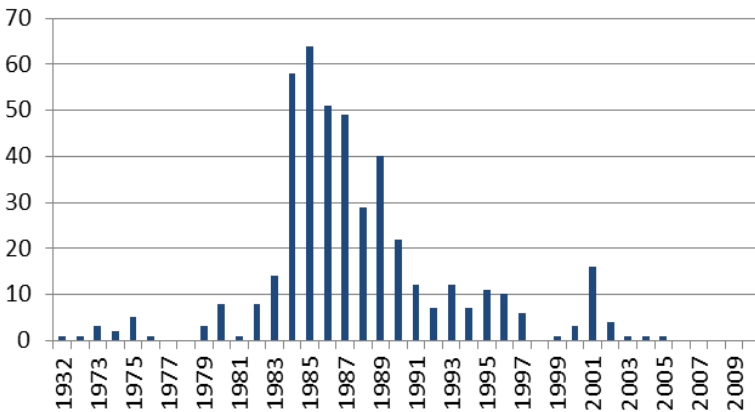


Figure 6. Recorded observations of Brown-headed Cowbirds in Sequoia and Kings Canyon (SEKI 2010)

Analysis Uncertainty

The vast majority of the information presented in these sensitive animal reports is qualitative in nature or based on occurrence data. There are no primary analyses conducted in these reports that include specific need for attention to uncertainty analysis. That said, there are recommendations within individual species reports that carry with them uncertainty. A detailed assessment of uncertainty is found within individual reports.

Interactions with other Focal Resources

All species considered here have interactions with other biological resources either through predator – prey or resource competition. These interactions are most often with resources that we generally aggregate under biodiversity. However there are a few specific interactions that merit particular attention. These include: 1) non-native fishes have a recognized adverse effect on mountain yellow-legged frogs 2) invasive stream trout interbreed with Little Kern River brown trout; 3) fisher is associated with mature coniferous forest and fire is likely to have a strong impact on fisher population stability.

Stressors

Air quality. At the present time there is no direct linkage of air quality impairment to any of the species of concern. Likewise, there is no indication that any of the invasive species are invasible as a direct consequence of air quality impairment. Although impaired air quality has many deleterious impacts on species and ecosystems, none of these sensitive species is linked to impaired air quality as a primary driver of threat.

Land Use Fragmentation. There is significant evidence that some of the large vertebrate species of special concern are at risk in part because of habitat fragmentation. For example, it is difficult to consider restoring brown bear to the parks because they are likely to require large areas outside the boundaries of the parks in low elevation habitats that would put them in conflict with human populations. The California condor, formerly resident in the parks, is being restored in areas outside SEKi, but the parks remain relatively poor habitat for condors; as they likely were prior to the decline of this species. Although this has nothing to do with habitat fragmentation within the Parks, habitat fragmentation outside the Parks is likely to play a role in whether or not condors recolonize within the Park; connectivity to condor restoration sites is not available at the present time. Populations of wolverine, Sierra Nevada red fox, and fisher in the park appears to be reduced from formerly larger populations and are part of populations that extend well outside the park. The current populations of each of these species is considered to be a partial result of habitat loss, degradation and exploitation.

Climate Change. Sensitive animals can be classified into three groups relative to the likely threats posed by climate change. First, invasive species may be cold-limited and warming may allow these species to expand further into the park. The bullfrog and the brown headed cowbird may be able to expand within park boundaries as a consequence of warming. Feral pigs are likely habitat limited in the park. Climate change driving changes in the distribution of habitats in the park may foster an expansion of potential pig habitat within the park. Cattle trespass is primarily a function of neighboring land use and climate change is expected to have minimal direct impact on these impacts. Other invasive species such as the New Zealand mudsnail appear dispersal limited and are not yet in the park. If introduced, it is unclear how far into the park they may spread. It seems likely that changing climate may increase the capacity of these 'edge' species to invade park ecosystems. Introduced trout populations are limited primarily by the distribution of lakes in the park, and it is not apparent that warming would expand this potential. Perhaps the most likely candidate to be threatened by climate change is the pika. Pika are temperature sensitive and have decreased performance as a consequence of summer high temperatures and by winter minimum temperatures when there is a lack of snow cover on talus slopes. However, there is little current evidence that (a) daytime high temperatures are increasing; (b) fall snowpack is delayed; or (c) pika are suffering a decline in the park.

Invasive species. Invasive species are described herein as threats unto themselves, and hence not separately treated as being stressed by invasive species. Among the native threatened taxa bighorn sheep, red fox, mountain yellow-legged frog and the native trout are each threatened by invasive species. Bighorn sheep are threatened by disease transmission from domestic sheep. Sierra Nevada red fox are threatened by genetic introgression with introduced eastern red fox.

Similarly, native trout are threatened by introgression with introduced trout. Mountain yellow-legged frog are threatened by a combination of introduced trout and introduced chytrid fungus.

Altered fire regimes. The intensity and frequency of wildfire is increasing in the Sierra Nevada. There is no clear evidence that any invasive sensitive species included here are adversely affected by present or altered fire regimes in the area. There is, however, concern that an altered fire regime may have adverse effects on habitat structure associated with fisher and other species dependent upon mature forest.

New disease paradigms. Mountain yellow legged frogs are well-documented to be susceptible to chytrid fungus. The slender salamanders may, similarly, be experiencing increased mortality as a consequence of chytrid, but this is largely speculative. Declines in montane frogs species appear to be a consequence of paired drivers of introduced fish populations and chytrid. A major concern going forward is the likelihood of disease transmission from domestic livestock to Sierra Nevada bighorn sheep. Wild sheep are very vulnerable to disease. Careful on-going management of both bighorn sheep and domestic livestock is required.

Summary of Condition Assessment

Assessment Summary. Based on the individual species assessments, we conclude that the overall condition of sensitive animals is poor. This, of course is a nearly entirely circular argument because we define sensitive animals because they are in poor condition, and then assess them. In contrast, however, there are exceptions. Sierra Bighorn sheep and pika appear to be in relatively good shape. Bighorn sheep remain at low population size and vulnerable to stochastic events. However, populations have increased in size and management appears effective at keeping existing herds relatively large. In addition, recent observations of red fox and fisher suggest that populations may be more robust in the region than previously thought.

The condition assessment of non-native taxa revealed that the majority of non-native animals are not in a chronic state within the park. This is very fortunate. Some of these species (e.g., New Zealand mudsnail, pigs) are very difficult to control and can have major deleterious impacts on natural lands.

Table 2. Species Vulnerabilities. For rare species, condition reflects an assessment relative to persistence of a healthy population. With respect to non-native species, condition refers to the degree to which the invasive species is well managed.

Metric	Integrity Measure	Condition	Summary Comments
Pika	Distribution	Moderate	Assessments have been concerned about declining pika abundances, but recent reports do not suggest a detectable decline in the southern Sierra Nevada
Sierra Nevada Red Fox	Distribution	Poor	A few recent sightings further north in the Sierra have given biologists hope that a remnant population may also still persist in the southern part of the range. Greatest risks are likely potential loss of snow pack due to change in precipitation patterns and possible risk of introgression with introduced red fox.
Wolverine	Distribution	Poor	Park populations are likely to be at or near zero. Even under good condition, Park populations are likely to be near zero.
Little Kern Golden Trout <i>O. mykiss whitei</i>	Distribution	Poor	Likely introgression with invasive trout, and loss of habitat severely threatens this unique lineage.
Kern River Golden Trout. <i>O. mykiss gilberti</i>		Poor	Populations adjacent to park and in poor condition.
California Condor	Distribution	Poor	Extirpated from the park
Brown Bear	Distribution	Poor	Extirpated from the park
California Bighorn Sheep	Distribution	Moderate	Stable to growing herds within the park, but populations remain well below historic population sizes, with potential to increase herd sizes as well as the number of herds.
Fisher	Distribution	Moderate	Although fishers still persist in the parks, habitat loss due to catastrophic fire, continued range reductions, or increased mortality could put this isolated population at risk.
Yellow Legged Frog <i>Rana muscosa</i>	Distribution	Poor	Severe declines in populations continue.

Table 2. Species Vulnerabilities (continued). For rare species, condition reflects an assessment relative to persistence of a healthy population. With respect to non-native species, condition refers to the degree to which the invasive species is well managed.

Metric	Integrity Measure	Condition	Summary Comments
Yellow Legged Frog <i>Rana sierrae</i>	Distribution	Poor	Severe declines in populations continue.
Slender salamander <i>Batrachoseps kawia</i>	Distribution	Moderate	Little is known of this taxa's population status or trend.
Slender Salamander <i>Batrachoseps regius</i>	Distribution	Moderate	Little is known of this taxa's population status or trend.
Sierra Chipmunks <i>Tamias alpinus</i> , <i>T. merriami</i> , <i>T. speciosus</i> , <i>T. senex</i> , <i>T. umbrina</i>	Distribution	Moderate	Relatively little is known of these taxa. There are few records in the parks' wildlife observations database.
Invasive Trout	Distribution	Poor	Although there is a slowly increasing number of fish-free lakes due to eradication, invasive trout continue to impact the integrity of many aquatic systems.
New Zealand Mudsail	Distribution	Moderate	This highly invasive species is not yet found in the parks, but may spread rapidly if introduced.
Brown Headed Cowbird	Distribution	Moderate	Populations appear to be at moderately low numbers, but spread is possible with habitat alteration.
Feral Pigs	Distribution	Moderate	Populations are problematic, but localized
Cattle Trespass	Distribution	Moderate	Trespass problems remain damaging, but localized.
Bullfrog	Distribution	Moderate	This highly invasive species is found in one park location..

Level of confidence in assessment

The level of confidence in the individual assessments are reported for each individual species report. As an over-arching condition assessment, we can make three observations with respect to at-risk species. First, this is not likely a comprehensive list of vertebrate taxa at risk within the Parks. Other species may be both rare and infrequently observed within the Parks (e.g., several species of bats). Little is known about the ecology of many of these taxa. Thus, it is difficult to assert the role of SEKI in providing habitat for these taxa. This is also certainly true for invertebrates, about which we know very little. Second, with little habitat fragmentation, and no exploitation of rare animals within the Parks, threats to the biodiversity are largely either largely historic (e.g., brown bear, California condor), related to the broader condition of the Sierra Nevada (e.g., fisher, Sierra Nevada red fox, wolverine). Exceptions to this pattern include the mountain yellow-legged frogs which have declined significantly throughout the 20th century and continued to be at risk. Finally, the slender salamanders represent a group that are known well enough to recognize the risk to these taxa, but are not known well enough to ascertain what factors may affect the future of these species within SEKI.

Our level of confidence with respect to non-native species is much higher. We have a very clear recognition of the threats posed by these species, as witnessed by their invasions in other regions. We have a very good idea of population sizes, population trends, and vulnerable locations of the Parks. For bullfrog and New Zealand mudsnail, however, we understand considerably less about the potential for climate change to alter their impact on Parks ecosystems.

Gaps in understanding

SEKI is reasonably well studied. Despite this, there is very little trend analyses available because the data are simply not sufficiently dense from which to make an accurate assessment. This does not bode well, as the capacity for park biologists to collect data, if anything, is decreasing. The result is that it will take a very long time before trends are detected. This argues for careful thought into strategic monitoring of the most vulnerable resources.

Recommendations for future study/ research

Recommendations are imbedded in the individual species reports. In general, however, there is very little known about population sizes for a variety of little known taxa within the Parks.

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