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## Protected areas in climate space: What will the future bring?

To live long and prosper, species require habitat that meets their needs for survival and reproduction. A major focus of conservation is on protecting or managing places that contain this habitat while removing or mitigating other threats. The locations of these protected places are fixed, but the environment within them may change, especially with climate change. We investigated how climate change may cause shifts in multiple climate factors of protected and unprotected lands of California.

Although there are many ways that these data might be used to describe shifts in climate, we focused on two of the most dramatic by identifying novel climates (portions of climate space that do not presently occur in California but may appear with future climate change) and disappearing climates (portions of the current climate space that may disappear from the state in the future).

We found that a relatively small proportion of the California climate space is projected to become novel or disappear as a result of climate change. However, our analysis showed that such changes in climate are likely to be disproportionately greater in areas that are currently most fully protected such as National Parks, Wilderness Areas, National Wildlife Refuges, and State Parks. Because protected areas are often more remote, more rugged, and more extreme environmentally than the places where people live and work, they are predisposed to be more vulnerable to climate changes—think of Death Valley or the iconic National Parks along the crest of the Sierra Nevada, places that are already near the fringes of the current climate space.

Clearly, changing climatic conditions pose new and challenging questions about the current network of protected areas. To date, strategies for adapting conservation plans to climate change have focused on enhancing resistance or resilience – strategies that focus on ways to maintain what is here now. Meanwhile, preparing for future ecological transformation has received less attention. The disappearance of current climatic conditions and the emergence of novel climatic conditions in California’s protected areas illustrate that management must address ecological transformation.

### Main Points

- Climate models were used to identify combinations of conditions that may no longer occur (disappearing climates) or that will be new (novel climates) in California.
- Disappearing climates represented only 0.5% of California’s land area but occurred disproportionately more often places that were fully protected.
- Novel climates (5.8% of California) also occurred disproportionately in protected places; in most cases these climates were characterized by hotter and drier conditions.
- The disproportionate occurrence of both novel and disappearing future climates in currently protected areas may create challenges to conservation of the status quo, but such areas may also be “hotspots of opportunity” for responding to the extremes of climate change.

### Paper citation:

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