

CONSERVATION IN A CHANGING WORLD

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In nature, nothing stays the same. It has always been so. But now changes in climate and land use are accelerating the *rates* of change beyond those seen in recent history. While the changes may be gradual, the responses of biological systems – individuals, populations, ecological communities, and ecosystems – are not. There are *thresholds* in responses, and once these thresholds are passed the biological systems may be fundamentally altered. The rules of the game of nature have changed, and the changes are not easily reversed.

These thresholds exist because all organisms and species have limits to their environmental tolerances. The physiological tolerances of individuals to heat, moisture, salinity, soil nutrient levels, and the like determine the conditions in which they can function normally. Outside these zones, their performance suffers – thresholds have been passed. These effects on individuals influence population dynamics, in some cases promoting population declines beyond sustainable levels. Individuals and populations have the options to move elsewhere, adapt, or die. Unchecked, such declines can lead to extinction – the ultimate threshold.

This is the challenge that confronts conservation: **How can we retain biodiversity and maintain functioning ecosystems that provide important goods and services in the face of the population changes and distributional shifts that will occur (and are already occurring) with climate change?** As more species encounter thresholds, community composition -- and the tenuous balances between predators and prey, pathogens and hosts, pollinators and plants – will pass thresholds that lead to fundamental reshufflings and rearrangements. Many of these changes will be sudden and unanticipated. Many surprises await us, and conducting conservation as “business as usual” or even following trends will not prepare us to deal with these surprises.

So what can we do? In general, there are four ways of dealing with thresholds: resist the changes, mitigate the stresses, buffer the effects, or accept that we will pass thresholds and move on. Given the magnitude and pervasiveness of climate change and its impacts, the first option is really no option at all. The other three entail planning, which requires that we be able to *anticipate* thresholds. To position conservation to be effective in a world of surprises, we can:

- Develop early-warning systems to detect oncoming thresholds; for example, the *variance* in environmental measures may increase as systems approach a threshold;
- Maintain and mine long-term data sets (e.g. fisheries data, bird-monitoring data) to determine what they tell us about trends and thresholds and their environmental causes;
- Develop management practices to forestall thresholds or soften the transitions, through maintaining habitat refugia, protecting buffer habitats, or creating “stepping stones” of protected areas to facilitate distributional shifts;
- Recognize that, despite our best efforts, some thresholds will be passed – species will be lost and systems altered to different states. We need to plan *now* for life beyond the thresholds.
- **Make the options and consequences clear to the public and decision-makers.**