

PROTECTING SPECIES IN THE FACE OF CHANGING CLIMATE

Since the late 1980s, we have commonly heard reports that human activities are increasing the atmospheric concentrations of greenhouse gases—which tend to warm the atmosphere—and, in some regions, aerosols—which tend to cool the atmosphere. Scientists project that these changes in greenhouse gases and aerosols, taken together, lead to regional and global changes in climate and climate-related parameters such as temperature, precipitation, soil moisture, and sea level (Watson et al. 1996). However, how these changes will affect the day-to-day activities of NPS resources managers is just now coming to light.

Resource managers are faced with the significant challenge of protecting species in the face of changing climate. This challenge is particularly formidable because species conservation is generally associated with protection strategies linked to particular pieces of property such as national parks. In the United States and other nations around the world, national parks increasingly are being used to serve critical roles in species protection. However, if global climate change alters the geographic distribution of habitats

and wildlife species, the ability to retain and protect species within designated boundaries is highly uncertain.

Recent empirical studies strongly suggest that wildlife species are already responding to recent global warming trends with significant shifts in range distribution (generally northward) and phenology (e.g., earlier breeding, flowering, and migration). In response to these studies, researchers have begun to use the predictive power of general circulation models (GCMs) to anticipate large-scale and long-term effects of climate change as entire complex communities shift. In the models, predicted gains and losses of species from selected parks were strictly a function of expected vegetation shifts due to climate change (Burns et al. 2003). A species was recorded as potentially present in a park, under the future climate scenario of doubled levels of CO₂, if acceptable habitat for that species was predicted to occur within park boundaries.

Current models of global climate change indicate that eastern and western ecosystems within the United States will be impacted differentially. Therefore, researchers of this study stratified the United States into eastern and western ecoregions (divided by the Mississippi River) to ensure equitable representation of eastern and western parks. They then chose eight U.S. national parks from the larger pool of parks within these regions: Acadia, Big Bend, Glacier, Great Smoky Mountains, Shenandoah, Yellowstone, Yosemite, and Zion. Three factors constrained their choice of national parks: (1) geographic extent of climate change predictions, that is, the continental United States; (2) the regional availability of parks, that is, more western than eastern U.S. national parks; and (3) the availability of detailed mammalian species lists for each park.

Their results suggest that the effects of global climate change on wildlife communities may be most noticeable not as a drastic loss of species from their current ranges, but as a fundamental change in community structure as species associations shift because of influxes of new species. As shifting species forge new ecological relationships with one another and with current park species, the character of species interactions and fundamental ecosystem processes stands to become transformed in unforeseen ways. For example, an influx of new species may alter existing competitive interactions and influence trophic dynamics with changes in predator-prey interactions. Also, climate warming is likely to result in phenological shifts, including changes in spring breeding dates, flowering, and

bud emergence, which can further disrupt current species associations. In some cases, shifting species assemblages may lead to irreversible state changes, in which the relative abundance of species in different trophic levels can be radically altered. Moreover, the outcome of these new species interactions may be particularly difficult to predict because of the rapid pace of change expected and the potential for nonlinearities that may emerge, for example, as a consequence of altered trophic interactions. —*K. KellerLynn*

References

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