

Climate Change and Wildlife Refuges: Managing for Resilience in the Face of Uncertainty

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The U.S. National Wildlife Refuge System (NWRS) is the largest system of protected areas in the world. It encompasses over 93 million acres (37.6 M ha) and is composed of 547 refuges. Compared to other protected areas, the units are relatively small, typically embedded in a matrix of developed lands and situated at low elevations on productive soils. Projected changes in precipitation, temperature and sea level rise associated with climate change will vary substantially throughout the system and will have NWRS-wide effects on species and their habitats. Climate related changes in the distribution and timing of resource availability may cause species to become decoupled from their resource requirements. The impacts of most concern are those that may occur on NWRS trust species that have limited dispersal abilities or occur on refuge at the extremes of their geophysical, ecological or geographical distributions. Projected sea level rise has substantial negative implications for 161 coastal refuges, particularly those surrounded by human developments or steep topography. Managing the “typical” challenges to the Refuge system requires accounting for the interaction of climate change with other stressors in the midst of substantial uncertainties about how stressors will interact and systems will respond. Climate change adds a known forcing trend in temperature and other environmental variables to all other stressors that likely will result in complex non-linear challenges to species and ecological processes that will be exceptionally difficult to understand and mitigate. The historic vision of refuges as fixed islands of safe haven for species met existing needs at a time when the population of the United States was less than half its current size and construction of the first interstate highway was decades in the future. We will discuss the new tools, new partnerships and new ways of thinking that will be required to maintain the integrity, diversity, and health of the refuges in the face of climate change and expanded human populations and economies.

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