Bracing for climate change in the U.S. National Wildlife Refuge System

HOW SHOULD THE LARGEST SYSTEM OF WILDLIFE REFUGES in the world preserve its biological integrity in the face of climate change? The answer: begin adapting immediately. Glibness aside, the authors of a recent management review probe this question with genuine concern and offer many effective solutions. In a thorough exploration of the National Wildlife Refuge System's (NWRS) options, Griffith et al. (2009) suggest that the U.S. Fish and Wildlife Service, which manages 635 units in the refuge system, begin making changes on both small and large scales, organizationally and managerially.

Encompassing more than 60 million hectares (150 million acres) in tundra, wetlands, tropical rain forests, coral reefs, and many other habitats, the NWRS faces the very serious threat of climate change and all the accompanying impacts: changes in precipitation, cloud cover, diurnal temperature extremes, biome boundaries, and ocean chemistry and sea-level rise. The authors note that habitat specialists—animal and plant species that do not adapt easily to change, but are tied to a certain type of habitat—are especially vulnerable. Also likely to be affected are those populations that exist at the edge of their range, species that are hampered in colonization or dispersing, and those that occupy fragmented or restricted ranges. These kinds of species commonly come under the stewardship of the U.S. Fish and Wildlife Service at refuges created to protect them individually or as groups, and climate change could marginalize some of these specialized habitats.

As various species adapt to meet or accommodate new conditions, so must NWRS managers. Griffith et al. (2009) suggest they adjust priorities of their actions and account for uncertainties in future impacts of climate change. Developing a vision of conservation targets in a dynamic future, extending budgeting and planning horizons, and rewarding effective responses to climate change are all put forward. In particular, the authors call attention to the relatively small size of refuges and their inability to continue providing certain benefits under climate change for which they were designated. Therefore, they recommend "expanding the conservation footprint" of refuges either by increasing their number, size, and redundancy or by improving their "functional connectivity" and distribution through cooperative conservation measures. Managers should prioritize prospective land acquisitions and conservation partnerships based on models projecting where the most valuable habitats are likely to be located under a warmer climate. The goal of these approaches is to allow for increased resilience, biological integrity and diversity, and environmental health.

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In addition to climate change, challenges to refuges encompass habitat loss and fragmentation, competition for water, invasive species and species imbalances, urbanization, agricultural activities, natural disasters, transportation corridors, industrial development, and pollution. All of these factors, but especially water quality degradation and availability, disease, and nonnative species invasions, are expected to increase and become more complex under the influence of climate change. Of greatest concern for wildlife refuges are the effects of altered hydrology: precipitation and the availability of seasonal surface waters.

The authors argue for adaptation to the challenges of climate change at three operational scales: system-wide goals and strategies, ecoregional planning and coordination (tactics), and proactive and responsive management action by individual refuges. To begin, Griffith et al. (2009) urge managers to complete basic inventories of their refuges and to adjust monitoring to accommodate long-term and variable conditions presented by climate change. Considering multiple scenarios for planning and adaptive management are relevant strategies. Intensive management techniques such as prescribed burning, species translocation, and habitat restoration should also be considered. To implement goals and strategies most efficiently, the authors encourage resource managers to forge partnerships with federal, regional, and local organizations. They also note that multiscale educational training about climate change for all NWRS partners will enable effective responses. In closing, they assert that NWRS managers must refocus their vision by explicitly identifying the expected threats of climate change and adapting at multiple scales to meet the pervasive and complex conservation challenges.

Reference

B. Griffith, J. M. Scott, R. Adamcik, D. Ashe, B. Czech, R. Fischman, P. Gonzalez, J. Lawler, A. D. McGuire, and A. Pidgorna. 2009. Climate change adaptation for the U.S. National Wildlife Refuge System. Environmental Management 44:1043–1052.

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