

[Incorporating climate change into systematic conservation planning.](#)

Craig R. Groves et al. 2012. *Biodiversity and Conservation* 21:1651–1671.

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Conservation planning is necessary to meet the mandates of the Fish and Wildlife Service. Indeed, it has been institutionalized in the formation of Landscape Conservation Cooperatives, the recent requirement to incorporate Landscape Conservation Design into Refuge planning, as well as other Service policies. Nevertheless, the further one looks to the future, the more climate change becomes a factor and the less certain we are of its effects. This uncertainty and the overwhelming scope of the problem make it more, not less important that managers consider climate change in their conservation planning.

This paper offers five important but not exhaustive approaches that can be integrated into existing or new biodiversity conservation plans: (1) conserving the geophysical stage, (2) protecting climatic refugia, (3) enhancing regional connectivity, (4) sustaining ecosystem process and function, and (5) capitalizing on opportunities emerging in response to climate change. All have assumptions and may require additional data to incorporate them into existing or new plans. Nevertheless, many of the concepts such as enhancing connectivity are already part of our management plans. Depending upon the scale and location of the planning effort some approaches are more appropriate and feasible than others, but they are not necessarily mutually exclusive.

For example, a coastal refuge complex may provide habitat for migrating waterfowl dependent upon estuaries. They may be concerned that sea level rise associated with climate change will overtop protective dune systems and cause the existing estuaries to become hypersaline. They may use one of several sea level rise models (e.g., SLAMM), and then consider acquisitions or further protection of areas with other physical factors that will preserve or produce appropriate geophysical factors and work to ensure appropriate fresh water is delivered to those areas in the future. If possible they can propose management that will connect these areas with the remaining climate refugia so that they ultimately contain appropriate flora and fauna to support the waterfowl. Construction or development of a new dune system to protect these areas could help sustain this critical ecosystem function.

The authors only address biodiversity, important but not the sole factor the Service considers in crafting management strategies. No doubt as our forecasting and knowledge grows, other approaches will be developed to address multiple objectives, but the authors offer a fine starting point for anyone struggling with incorporating climate change into conservation planning.