

Seeking Refuge on a Changing Planet: Figuring Out Where to Go

David Morgan

Landscapes shift and ecosystems move; the world we inhabit is in flux. Anticipating likely changes is deeply important work for ecological restoration and climate adaptation planning. SNEP-funded research by ORISE Research Fellow David Morgan is investigating how climate change may affect restoration practices in the future; and how knowledge of that impact could contribute to better climate resilience practices. More specifically, Morgan is looking into “stepping-stone” refugia—pockets of climate stability that provide refuge to various species as they adapt to their changing environments by shifting their ranges.

Refugia are the places and habitats where a species’ past and future converge. They emerge through complex interactions among climate, species’ traits, geology, and other factors. Not all habitats change at the same rate. Areas that are slower to adapt can serve as safe havens that provide more time and space while species try to keep up with the changes happening around them.

Morgan’s research considers ten bird species of conservation concern in the northeast United States, chosen because they represent key habitats throughout the SNEP region. The expected effects of climate change in the Northeast include changes to air and water temperature, increased storms, and higher sea levels. The research involves mapping projected changes in their habitats from present day to 2080 and evaluating the importance of those changing habitats within the range of each species. Any habitats not expected to shift by 2080 could be considered refugia. Maps and other data developed through the research will provide some guidance as to where SNEP refugia might persist over time and help identify areas where habitat restoration could further improve the refugial capacity of those habitats. Consideration of these factors will be critical for restoration planning and SNEP’s goal to promote thriving watersheds and natural lands by preserving ecological function and species diversity.

Current projections find that species will come and go as their environments change by the end of the century—some more rapidly than others. Actions we take now about controlling greenhouse gas emissions and providing habitat protection and resilience will affect how these dynamics develop. Identifying stepping-stone refugia throughout the SNEP region can help inform regional restoration priorities and improve species’ resilience to climate change.

One key output of the research will be a model that synthesizes data produced by UMass Amherst and national Audubon, among others, to forecast potential refugia and identify which are candidates for restoration. Morgan’s research is also expected to provide analyses of ecological functions, environmental stressors, and impacts on wildlife across the SNEP region. The results are expected to inform decisions on where to implement conservation and restoration practices to protect and enhance habitat. Enhancing refugia through restoration has many co-benefits, from sequestering carbon to

WHY BIRDS?

Birds were chosen because they are less affected by barriers in the landscape than terrestrial species and so are more likely to benefit from stepping-stones as they change their ranges.

Morgan’s research focuses on potential changes to the habitats of ten bird species, selected as part of a joint effort by the University of Massachusetts, Amherst and the US Fish and Wildlife Service to identify and develop conservation plans for priority species found within the North Atlantic Landscape Conservation Cooperative study area.

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protecting against floods, and is an increasingly popular strategy that fits alongside other climate adaptation practices like low impact development and green infrastructure.

Throughout his career, the naturalist Barry Lopez often suggested that landscapes are deeper and more subtle than we can know. The study of refugia opens up a world of new possibilities. These safe harbors are like everything else in a world in flux—contingent, relative, and temporary—and their characteristics set the stage for a new landscape of ecological restoration. Restoring and enhancing refugia offer the opportunity to steward critical landscapes and species into the future; and, following Lopez, to maintain their range and variety. This ongoing work, once complete, can provide a roadmap to combine restoration efforts with species migration to ensure the health of those species and enhance their prospects of survival.

For more information about climate refugia or to serve as a research advisor, please contact David Morgan at Morgan.David@epa.gov