Identifying Vulnerability of Threatened, Endangered, and At-Risk Species to Future Climate Change at the Barry M. Goldwater Range, Arizona

Project # 09-433

Background:

The warming of the global climate is expected to have broad effects on ecosystems and species. Climate change is a new challenge for natural resources managers and has the potential to exacerbate existing management issues while incurring new ones. Preservation of biological diversity is a priority of the United States government and is regulated by law through the Endangered Species Act, the Migratory Bird Treaty Act, the Invasive Species Executive Order, and the National Environmental Policy Act. In response to regulatory requirements and to prevent interruptions of military activities on military lands owing to these requirements, the Department of Defense (DoD) has focused on threatened, endangered, and at-risk species (TER-S) by soliciting expert input on important research needs through regional TER-S workshops. Inspired by these workshops, Dr. Deborah Finch of the Rocky Mountain Research Station (RMRS) concluded that a process was needed to identify which species are the most vulnerable to the wide variety of factors associated with climate change. In addition, management options to assist TER-S need to be identified.

Objective:

With funding from the DoD Legacy program, the RMRS team has developed a scientifically-based decision support tool for assessing vulnerability of individual species to declines (or increases) associated with climate change. Separate tools were designed for terrestrial vertebrates and plants. These tools score individual species on predicted changes to populations in response to projected changes in climate that are expected to affect survival or reproduction. Areas of vulnerability identified for each species will be used to identify possible management options as well as areas where more research is needed. The tools are designed to be flexible to new information and to be easily applied by managers. Information gained can then be integrated with species assessments, prioritization of management actions, and natural resource plans that do not already anticipate climate change effects. In addition, ranking of species vulnerability can be a starting point for discussion of climate change effects and solutions. Species of the Barry M. Goldwater Range (BMGR) in Arizona were targeted for assessment as large magnitude climate effects are projected for the southwestern U.S.

Species such as the desert tortoise (*Gopherus agassizii*) are vulnerable to population declines associated with future climate change and are of management concern. Photo courtesy of USGS.

Summary of Approach:

The RMRS scoring system was used to assign scores to TER-S at BMGR from synthesized information on species attributes and regional climate projections. The scoring system balances expected vulnerabilities and resiliencies from four categories or factors to facilitate comparison among species. These factors are habitat, physiology, phenology, and interactions, and although not entirely independent, can be used to quickly compare or identify important species' attributes related to climate change. For plants, phenology is integrated with the other three categories. Background information was primarily compiled from scientific literature and online natural history databases. Availability of information and predictability of effects was incorporated into an accompanying uncertainty score. Identified vulnerability traits were used to identify areas where management could target anticipated climate change effects. Accounts detailing species vulnerabilities (and resiliencies) were created along with a summary document compiling scoring results, potential climate interactions with current threats, and management themes. Findings were presented to DoD personnel at a workshop (30 August 2010). All materials including the RMRS vulnerability scoring tool and individual species assessments will be made available online in the DoD TES (threatened and endangered species) document repository.

Benefit:

In addition to providing individual assessments, vulnerability ranking, and management implications for TER-S, this vulnerability assessment also provides an example of tool application and identification of management options related to climate change. Although the provided assessment focuses on BMGR and TER-S, the tool is broadly applicable and can take advantage of the considerable knowledge of local managers. Anticipation of future population declines and implementation of targeted management is expected to reduce costs of species management and prevent disruption of military activities. Anticipating and preparing for impacts is key for ensuring ongoing and uninterrupted military operations while also providing for effective natural resource management of species protected under regulatory acts. As many of these species also occur on lands adjacent to DoD lands and climate change will have similar regional effects, identification of species management needs can be incorporated into integrative and collaborative programs between DoD and their partners. Uncertainty scores can also be used to identify research needs.

Accomplishments:

An updated version (2.0) of the vulnerability scoring tool for vertebrates species and initial version (1.0) of the plant scoring tool are available for use by managers. Using these tools, RMRS has completed an assessment of 15 vertebrate and 1 plant species for BMGR. In addition to species with federal protection, species were also assessed that are proposed for federal listing, are conservation priorities for the State of Arizona or have been identified as important components of biodiversity at BMGR. Sonoran pronghorn, an endangered species, received the highest vulnerability to declines associated with future climate and was vulnerable for all four factors. Traits related to phenology generally incurred the greatest vulnerability. Because endangered species are already protected and integrated into management plans, vulnerable species that are not currently protected or actively managed may be good targets for proactive strategies. All but one of the vertebrate species that are under review for listing were expected to be vulnerable to population declines associated with climate change (Figure 1). Actions that could potentially prevent further declines in these species, and hence listing, may be appropriate for assuring uninterrupted military activities.

Several management areas important to multiple species evaluated were identified including areas that are already a part of current management. In particular, management related to fire and invasive species, artificial waters, and landscape scale approaches will be important to future programs. Some revision of current practices may also be needed such as altering timing restrictions that protect species subject to phenological shifts.
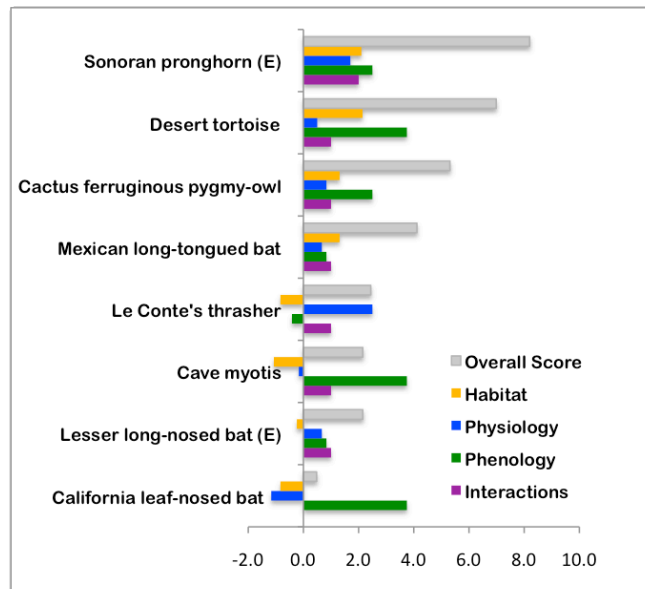

Figure 1. Vulnerability score results for endangered vertebrate species (E) and federal species of concern from the most vulnerable to declines with climate change (positive scores) to the most resilient to declines (negative scores). Overall scores are shown along with scores from the four factors or groups of predictive traits.

Climate change projections and predicting the future are inherently uncertain. The potential magnitude and scope of effects on biodiversity, however, adds urgency to developing effective management strategies to prevent population declines and extinction of species.

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