Landscape-Level Habitat Associations and Phylogentics: Desert Tortoises (*Gopherus agassizii*)

Project # 09-385

Background:

Anthropogenic disturbances within the range of the desert tortoise have the potential to reduce habitat quality through impacts to vegetation structure and soil characteristics. While impacts to desert tortoise habitat on active military training areas can be substantial, these ranges often provide important refuges where public access is limited and military activities are restricted to specific training areas. As a result, impacts are generally limited to specific locations rather than being diffused across the landscape.

Given the possibility of future ESA listing and the challenges that such a decision would impose upon the Department of Defense (DoD), it is prudent to understand the distribution of desert tortoises on military ranges within the Sonoran Desert so that appropriate management decisions can be made to reduce conflicts while maintaining the military readiness mission.

Desert tortoise habitat on the Barry M. Goldwater Range.
Photo: Arizona Game and Fish Department

As a first step towards the development of data-driven management decisions to allow for the coexistence of desert tortoises and the military mission, research biologists from the Arizona Game and Fish Department conducted desert tortoise surveys and modeled tortoise occupancy on the Yuma Proving Ground and Barry M. Goldwater Range in southwestern Arizona.

Objective:

The primary objective of this study was to develop a landscape-level predictive habitat model for desert tortoises inhabiting the Yuma Proving Ground and Barry M. Goldwater Range in southwestern Arizona. The secondary objective of this study was to characterize the phylogenetic grouping of desert tortoises inhabiting these DoD managed lands.

Summary of Approach:

We implemented a stratified random sampling design in which random samples were selected from soil strata defined by the National Cooperative Soil Survey division of the Natural Resources Conservation Service, a branch of the United States Department of Agriculture. This approach reflected the hypothesis that desert tortoise occupancy should vary among soil designations at the landscape-scale.

Given the geographic scope of the study area and the study objectives regarding the spatial distribution, we chose tortoise occupancy as the population parameter of interest. However, unlike traditional occupancy estimation studies in which defined sampling units are visited on multiple occasions and the species of interest is either detected or not detected, the study substituted spatial replicates for temporal replicates. Under this sampling methodology, “sites” were defined as distinct soil patches with survey locations representing spatial sub-units within sites.

Biologists examining a tortoise burrow located under an exposed caliche layer in a desert wash.
Photo: Arizona Game and Fish Department

We conducted standardized surveys for tortoises and their sign (i.e., carcasses, scat, tracks, etc.) within 711 3-ha survey plots located within 219 soil patches using an area search methodology for complete coverage within the plot boundaries.

We also deployed VHF radio-transmitters and GPS tracking units to track adult desert tortoise movements within the study area as part of the habitat model validation process. GPS tracking units were programmed to collect detailed location data during peaks in daily tortoise activity. We estimated tortoise home ranges using Brownian Bridge Movement Models and examined habitat use characteristics within tortoise home ranges.

VHF and GPS tracking units deployed on a desert tortoise.
Photo: Arizona Game and Fish Department.

Finally, we collected blood samples from desert tortoises. These samples were then genotyped to determine each individual's maternal lineage and species assignment.

Benefit:

The results of this study provide natural resource managers with the necessary data to make informed management decisions and engage in collaborative efforts across range boundaries to ensure the persistence of robust desert tortoise populations while maintaining the military readiness mission.

Accomplishments:

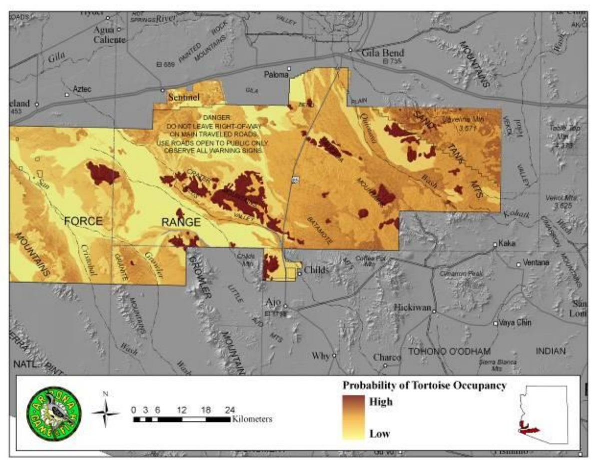
We completed 711 desert tortoise surveys within 219 soil patches and detected desert tortoise sand tortoise sign on 31survey plots within 22 soil patches. VHF transmitters and GPS tracking units were deployed on 14 desert tortoises. Blood samples were collected from 13 desert tortoises.

Occupancy analyses identified elevation, aspect, and soil group as important predictors of desert tortoise occupancy. Tortoises were more likely to occupy north- and east-facing slopes between 200 and 600 m. Similarly, tortoise occupancy was greatest within petrocalcid soils characterized by a distinct calcic horizon.

We used the most well supported occupancy models to create predictive habitat maps for the Yuma Proving Ground and Barry M. Goldwater Range. The probability of desert tortoise occupancy was generally low on the Yuma Proving Ground with higher probabilities for the southern end of the Dome Mountains and the northern extent of the Trigo Mountains. The eastern extent of the Barry M. Goldwater Range exhibited the highest probability of tortoise occupancy generally located near the Growler Mountains, the Crater Mountains and portions of the Sauceda and Sand Tank mountains.

Desert tortoise home ranges were comprised of five soil categories which roughly corresponded to the results of the predictive models. Within their home ranges, however, desert tortoises used soil groups were used in proportion to their availability.

Genetic analyses indicated that all 13 individuals included in the sample were classified as Sonoran desert tortoise and not the Federally Threatened Mohave desert tortoise.



Predictive desert tortoise habitat model for the eastern extent of the Barry M. Goldwater Range.

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