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FOUNDATIONS FOR RECOVERY PLAN REVISION  
January 4, 2007

This document describes the foundations for revising the 1994 desert tortoise recovery plan. The general scientific basis, assumptions, and conclusions relative to the desert tortoise listing decision, 1994 recovery plan, and current status of desert tortoise recovery efforts, as documented in four major reviews, are summarized below. These reviews also provide specific recommendations applicable to revising the recovery plan. The Fish and Wildlife Service (Service) will use these foundations to develop regional recovery actions in coordination with the Desert Tortoise Management Oversight Group. In addition, the revised recovery plan will explicitly address key uncertainties surrounding desert tortoise recovery and address these uncertainties with specific actions.

General Accounting Office. 2002. Endangered species: research strategy and long-term monitoring needed for the Mojave desert tortoise recovery program. GAO-03-23. United States General Accounting Office, Washington, D.C.

- The 1990 listing, the critical habitat designation, and recommendations in the recovery plan were reasonable, given the available information.
- Federal agencies and others have taken a variety of actions to benefit desert tortoises, but the effectiveness of these actions is unknown.
- The Service depends on other agencies and organizations to assist with funding and monitoring, but these agencies and organizations cannot guarantee assistance from year to year because of other priorities.
- The Service should develop and implement a coordinated research strategy for linking land management decisions with research results. The Secretary of the Interior should identify and assess options for funding long-term rangewide population monitoring.
- Because much was still unknown about the severity of specific threats to desert tortoises at the time the plan was developed, its recommendations were made without establishing priorities that would reflect differences in the seriousness of the threats.

Boarman, W.I. 2002. Threats to desert tortoise populations: a critical review of the literature. Unpubl. report to the West Mojave Planning Team and the Bureau of Land Management. U.S. Geological Survey, Western Ecological Research Center, San Diego, CA.

- Lack of scientific evidence supporting a purported impact should not be confused with automatically supporting the alternative, that there is no impact, and vice versa. "Absence of evidence is not evidence of absence."
- The rating of relative importance of different threats is challenging for several reasons:

- It is very hard to determine the cause of death of animals, and it is even harder to determine how much decline is really attributable to the various indirect causes of mortality (e.g., habitat alteration).
- Not enough is known about several potential threats to evaluate their absolute or relative impact (the report reviews the available information relative to a list of specific threats).
- Which mortality factors are functioning is very site specific.
- Factors that caused the declines (e.g., disease) may not be the same factors that are preventing recovery (e.g., genetic or demographic consequences of small populations, fragmentation, raven predation).

Tracy, C.R., R. Averill-Murray, W.I. Boarman, D. Delehanty, J. Heaton, E. McCoy, D. Morafka, K. Nussear, B. Hagerty, and P. Medica. 2004. Desert Tortoise Recovery Plan Assessment. Report to U.S. Fish and Wildlife Service.

- The original Recovery Plan was fundamentally strong but could benefit substantially from modification, including:
  - recognition of new patterns of diversity within the Mojave desert tortoise population
  - greater appreciation of the implications of multiple, simultaneous threats facing tortoise populations
- Desert tortoises face a vast array of threats, and these threats may interact with one another in highly complex ways that vary from place to place within the historic range of the tortoise. The complex nature of many threats is likely to make them difficult to both document and address in recovery plans.
- On-the-ground knowledge of land managers is important to developing management responses to threats. We need to account for the true complexity of formulating management actions for populations that face multiple, simultaneous, interacting threats.
- If population size is small enough to threaten extinction, the recovery goal is to increase population size ( $\lambda > 1.0$ ) until the population is sufficiently large to ensure persistence. Then the population can be managed for a long-term  $\lambda$  of 1. Population increase can be achieved through actions that increase natality, increase recruitment, increase fecundity, decrease mortality, or some combination of these. Because the management actions taken depend in part upon the factors responsible for population declines, it is important to know what forces are causing population declines or are preventing small populations from rebounding to stable population sizes.
- Virtually nothing is known about the demographic impacts of any of the threats on tortoise populations or the relative contributions each threat makes to tortoise mortality.
- An individual threats approach generally does not account for compensatory mortality in which one mortality factor takes tortoises that were “saved” from another mortality factor.
- Effects of some threats may have time lags that make the effects hard to discern early.

- Tortoise populations and habitats may respond to threats emanating from areas outside of areas designated for management action.
- Cumulative or indirect effects caused by modification of ecosystems may occur.
- Threats may have different effects in different areas.
- The magnitude of various threats may depend upon the initial condition of the landscape and its changes through time.
- The degree of threat by any one factor almost certainly changes in different combinations of interacting threats.
- Management actions to recover or protect individual tortoise populations likely will have to be custom designed for those populations and be based on the suite of threats and their interactive effects facing that population.
- Research and management should, through a hypothesis-based approach, focus first on those sets of actions and threats that contribute to a greater number of mortality mechanisms or that affect size structure or fecundity.
- The relative strengths of hypothesized connections between threats and mortality should be assessed (some individual linkages may be more important than multiple linkages from other individual threats). This assessment should be based on data from research designed specifically to elucidate relationships between threats and mortality.
- A new definition of recovery should be based upon achievable assessment of progress toward recovery as assessed in the status and trends of threats, habitats, and population distribution and abundance.
- Scientists need to emphasize research that will address urgent management needs, and their efforts will benefit from consulting with managers on their “on-the-ground knowledge” of tortoise populations.

Boarman, W.I., and W.B. Kristan. 2006. Evaluation of evidence supporting the effectiveness of desert tortoise recovery actions. U.S. Geological Survey Scientific Investigations Report 2006–5143.

- Relatively few studies have been conducted to evaluate the effectiveness of recovery actions.
- Studies of threats are useful for directing recovery efforts, but they may not be helpful for selecting the best recovery action to implement.
- Although it may be possible to isolate the single effects of threats through careful experimental design, recovery actions usually have multiple effects and may be exposed to multiple confounding variables that prevent tortoise population response. Because of these

complicating factors, studies of threats may not provide much guidance to managers seeking the best way to recover tortoise populations.

- Recovery actions must be done in the face of uncertainty about which threats are limiting. Although removal of a single threat does not guarantee recovery, it is most conservative to assume that a population cannot recover until all known threats are removed. Short of removing all threats, as many known threats as possible should be eliminated. In this sense, removal of each known threat is supported as a necessary condition for recovery, although removing single threats may prove to be insufficient.
- There are few examples of assessment of population-level responses to recovery actions, probably because a reduction in threat often can be assessed immediately following implementation of an action, whereas population responses can be assessed only over longer time periods. There may be no easy solution to this problem because the final test of effectiveness of recovery actions is whether these actions result in an increase in population size, which is a slow process for this long-lived species.
- Most of the previous studies of effectiveness took place in concert with construction activities or recreational vehicle racing events or after area fencing of tortoise habitat.
- Desert tortoise recovery actions are based on logical applications of principles of ecology and population biology, and, although recovery actions can improve with better information, current practices should not be considered baseless.
- We need to implement more scientifically-based monitoring of recovery actions. Greater emphasis on population-level responses will ultimately yield the most definitive answers, although these studies are the most difficult, require the greatest commitment of time and money, and have the greatest chance of failure. The need for ongoing effectiveness monitoring may decline as certainty of an action's effectiveness increases.
- To make maximal use of effectiveness-monitoring information, it should be collected using standardized methods and then submitted to a central location where it can be incorporated into formal statistical analysis using meta-analysis methods.
- Studies should be commissioned that specifically address the effectiveness of protective measures in recovering desert tortoise populations in question.

#### Additional Fish and Wildlife Service policy and guidance.

- The concept of recovery units is important in the conservation biology of widely distributed species, such as the desert tortoise. "A recovery unit is a special unit of the listed entity that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity, i.e., recovery units are *individually necessary* to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the *entire listed entity*. ... [E]stablishment of recovery units can be a useful recovery tool, especially for species occurring across wide ranges with multiple

populations or varying ecological pressures in different parts of their range” (NMFS. 2006. Interim Endangered and Threatened Species Recovery Planning Guidance).

- For the desert tortoise, recovery units do not change the entity listed under the Endangered Species Act (ESA) (i.e., the Mojave population), but they may be important for genetic and/or demographic robustness and may contain different suites of threats or management actions.
- The Science Advisory Committee (SAC) will review the current recovery units and make recommendations for revision based on new data available since 1994.
- Distinct Population Segments (DPSs) must be designated through formal rule-making procedures pursuant to Section 4 of the ESA (FWS and NOAA. 1996. Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act. Federal Register 61:4722-4725).
  - Reference to DPSs in the 1994 recovery plan, which preceded the formal 1996 DPS policy, are inaccurate. Recovery units are not individually delistable as such.
  - Under current policy, delisting the desert tortoise by recovery unit as recovery criteria are achieved will only be possible if that recovery unit meets the criteria of a DPS and is formally designated as such through rule-making procedures.
- Desert Wildlife Management Areas (DWMAs) were recommended for reserve-level protection in the 1994 recovery plan. Several land management plans have since formally recognized and delineated these areas and associated recovery actions. Critical habitat largely coincides with these areas.
  - Desert tortoise habitat will be reassessed by the SAC based on the first five years of range-wide monitoring data and new habitat models, potentially leading to revised recommendations for important recovery management areas for the desert tortoise.
  - Any revision of land management agency DWMAs (ACECs, etc.) or critical habitat will depend on the nature of any new recommendations. Formal changes to current designations will be subject to management-plan amendment or rule-making procedures.
- Issuance of a section 10 permit under a Habitat Conservation Plan (HCP) must not "appreciably reduce" the likelihood of the survival *and recovery* of the species in the wild. Mitigation programs should be commensurate with the impacts they address, and they should be consistent with recovery plans. HCPs should not preclude a significant recovery option, unless they otherwise contribute substantially to the goal of recovery (USFWS and NOAA. 1996. Habitat Conservation Planning and Incidental Take Permit Processing Handbook).
- Safe Harbor Agreements are voluntary arrangements between the Service and cooperating non-Federal landowners (FWS and NOAA. 1999. Announcement of Final Safe Harbor Policy. Federal Register 64:32717-32726). This policy's main purpose is to promote voluntary management for listed species on non-Federal property while giving assurances to participating landowners that no additional future regulatory restrictions will be imposed. The agreements benefit listed species while giving landowners assurances from additional restrictions. While most recovery efforts for the desert tortoise are anticipated to occur on federal lands, establishing Safe Harbor Agreements with landowners within or adjacent to important recovery areas, and consistent with the revised recovery plan, would be desirable.