Desert Tortoise Populations and Current Statistics

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Updated October 2006

Gopherus agassizii - (Cooper, 1863)
Desert Tortoise
Other Related Names: *Xerobates agassizii*
Unique Identifier: ELEMENT_GLOBAL.2.106323
Element Code: ARAAF01010
Informal Taxonomy: Animals, Vertebrates – Turtles

Conservation Status:

NatureServe Status

Global Status: G4
Global Status Last Reviewed: 23Oct1996
Global Status Last Changed: 23Oct1996
Rounded Global Status: G4 - Apparently Secure
Reasons:
Range includes desert regions of the southwestern U.S. and adjacent northwestern Mexico; fairly abundant and perhaps stable in some areas but declining in others; faces many threats, including habitat loss/fragmentation/degradation, disease, and direct mortality/losses caused by humans (e.g., road kills, shooting, illegal collecting); in addition, releases of captives into wild populations may be detrimental.
Nation: United States
National Status: N4

Other Statuses

U.S. Endangered Species Act: LT, SAT: Listed threatened,listed threatened because of similar appearance (new) (02Apr1990)
IUCN Red List Category: VU - Vulnerable
Convention on International Trade in Endangered Species Protection Status (CITES): Appendix II
Comments on official statuses: Populations in California, Nevada, Utah, and Arizona north and west of the Colorado River are listed by USFWS as Threatened (Federal Register, 2 April 1990). Populations in Mexico and in Arizona south and east of the Colorado River are listed by USFWS as Threatened (similarity of appearance) when found outside said range.

NatureServe Conservation Status Factors

Global Abundance: 10,000 to >1,000,000 individuals
Global Abundance Comments: Total population estimates range from 93,000 individuals (NDOW 1985) to several hundred thousand. However, the lower figure is too conservative.For example, on the 76,800-ha Ironwood Forest National Monument in Arizona, distance sampling methods produced an estimate of 17,997 tortoises (150 mm carapace length or larger) on the monument (Averill-Murray and Averill-Murray 2005).
Global Short Term Trend: Declining (decline of 10-30%)
Global Short Term Trend Comments: Populations are declining in several areas throughout the range. A major long-term decline in abundance and distribution often has been reported since the 1980s, but Bury and Corn (1995) concluded that existing data and historical reports do not support the validity of such a decline. During the past two decades annual declines in individual populations have varied between 3% and 59%. More important, many of these losses are adults which otherwise would reproduce and incur a natural attrition of only 2% annually.

Despite protective measures, the Beaver Dam Slope population in Utah probably was at an all-time low as of 1990 (Glenn et al. 1990). Estimates made 30-40 years after the baseline study by Woodbury and Hardy (1948) indicate an 80% decline in population densities and similar decline in total population size (Minden 1980).

USFWS (1990) categorized the status of the Mojave Desert population as "declining." In California, habitat has been reduced 50-60% since the 1920s. In California's western Mojave, populations may have declined nearly 90% since 1940, and as much as 70% locally between 1976-1984 (Berry 1984; however, see Bury and Corn 1995). Demographic analyses agree with field censuses in showing rapid population decline in the western Mojave Desert (Doak et al. 1994). At the Desert Tortoise Natural Area (Kern County, California), the past ten years decline has reduced the tortoise population by 88%; a similar 84% decline has been reported for Johnson Valley (USFWS 1994). At Joshua Tree National Park (then a Monument) populations appear to have remained stable and locally robust (up to 200 tortoises/sq mi). For the Mojave Desert threatened population, the overall estimated rate of decline for the past fourteen years is 4.6% annually (USFWS 1994).

At Chuckwalla Bench in the eastern Colorado Desert, a population decline began in the early 1980s and continued through 1990 (Berry 1992), culminating in a 60-70% population loss. However, adjacent Colorado Desert Chemehevi and Ward Valley populations remain the largest and most robust in the entire range (USFWS 1994).

Sonoran Desert populations in Arizona do not appear to have undergone large declines.

Global Inventory Needs: Regular population monitoring is needed.
Global Protection: Few (1-3) occurrences appropriately protected and managed*
Global Protection Comments: Tortoise habitat in California has been protected within the Desert Tortoise Natural Area and at the West Mojave Ecological Reserve and Fremont Valley Ecological Reserve (California DF&G 1990). In 1991 in Clark County in southern Nevada, development of 9000 ha of tortoise habitat in the Las Vegas Valley

was authorized in exchange for the establishment of at least 162,000 ha of conserved tortoise habitat in outlying areas of Clark County. See USFWS (1993, 1994) for a description of areas proposed to be designated as critical habitat (12 areas encompassing 6.6 million acres in in California, Nevada, Utah, and Arizona).
Global Protection Needs: Protect large tracts of suitable habitat, well dispersed throughout the range.
Degree of Threat: B
Threats: Declines have been due to habitat loss and degradation (through livestock grazing, invasion of exotic annuals, especially red brome grass which fuels local fires [e.g., Esque et al. 2003]), energy and mineral development, ORV use, road traffic collisions with tortoises, trail construction, disease, vandalism (illegal shooting), and collecting. Livestock and feral burros may compete for food in some areas (Oldemeyer 1994, USFWS 1994). These factors may vary regionally in their severity. Lovich and Daniels (2000) studied habitat use in an area of wind energy development and concluded that this disturbance, with proper planning, may be compatible with tortoise conservation. Heavy grazing, especially by sheep, alters forage availability and protein content, and it also removes the desert soil crust, inducing soil compaction and increasing erosion. Tracy (1992) pointed out that a high fiber/low protein diet can retard the age of first reproduction by more than five years, which would have significant demographic consequences; this relationship bears significantly on the debate about the importance of competition between tortoises and cattle and sheep. Urbanization of the Antelope Valley has led to major extirpation from the southwestern corner of historical tortoise range, and this process is being repeated in the Victor Valley (San Bernardino County, California,) the valley of Las Vegas, and along the Virgin River (St. George, Utah) (USFWS 1994, Appendix D). Natural droughts from 1986-1992, and in 1994 have exacerbated anthropogenic impacts on the Mojave population. During the 1980s and 1990s, severe population losses in the western Mojave Desert resulted from MYCOPLASMA-caused (Jacobson et al. 1995) disease (upper respiratory tract disease [URTD], possibly introduced through release of captive tortoises) and possibly from raven predation (15-fold increase in raven population between 1968 and 1988) (California Dept. of Fish & Game 1990). Ravens, along with coyotes, feral dogs, and cats are "subsidized" predators that have semi-urban populations enlarged by feeding on the refuse and rodents associated with human garbage dumps and backyards. They may be significant predators on young (< 7 years old or 120 mm plastron length) tortoises. However, in the south-central Mojave Desert, Bjurlin and Bissonette (2004) found that neonatal desert tortoises are less susceptible to predation than was previously thought, perhaps because of their cryptic coloration and secretive habits. The common raven was not found to be a source of neonate mortality. Decline at Chuckwalla Bench in the eastern Colorado Desert was due to an unidentified shell disease, probably caused by toxicants or mineral deficiencies, in addition to shooting, vehicle kills, and the effects of drought (Berry 1992). Perhaps the most widespread, and recent cause of increased mortality has been URTD (Jacobson 1994). The causal agent is a mycoplasma, MYCOPLASMA AGASSIZII. Drought and concomitant poor nutrition may immunocompromise tortoises making them more vulnerable to infection. However, even healthy, well-fed tortoises may become infected (USFWS 1994). See USFWS (1994) for a review of factors affecting Mojave and Colorado desert populations. The

Sonoran Desert population apparently has not been negatively affected by habitat loss or respiratory disease to the same degree as have populations in the Mojave and Colorado deserts, though local losses have occurred. Releases of non-native desert tortoises into areas occupied by native populations pose a potential threat because of the possible introduction of disease, competition between released and native tortoises for limited resources, and possible outbreeding depression (Bury et al. 1994). Relatively tolerant of nondestructive intrusion. Interventions that cause voiding of tortoise bladder contents or that deny tortoises access to surface water or burrows could result in unfavorable water balance, especially in dry seasons.

MANAGEMENT SUMMARY:

Stewardship Overview: This tortoise is a predominantly herbivorous and semifossorial inhabitant of warm upland plateaus and mountain slopes in deserts west of the Continental Divide, and north of Baja California. Its slow population growth and vulnerability to habitat degradation, human subsidized predation, and epidemic disease make the establishment and management of large preserves the only probable means for restoring the threatened Mojave population of this species. Management that results in low mortality rates for large adult females is necessary for population recovery. Restocking, translocations, and habitat restoration should be regarded as experimental rather than proven mitigation techniques.
Restoration Potential: Veterinary treatment of illness, translocations, restocking, and artificial watering of habitats for forage enrichment all appear to be experimental, costly, often ineffective, and, in some cases, detrimental. Although this species is easily maintained and bred in captive and/or confined circumstances (Booth and Buskirk 1988, Spotila et al. 1994), and the appropriate husbandry is available to develop restocking programs without the risk or disruption of translocating wild tortoises, and large pools of captive tortoises are available for relocation into depleted natural habitats, pilot studies in California and Utah have not been encouraging (St. Amant and Hoover 1978, Minden and Metzger 1981). More importantly, some past translocation/restocking efforts may have introduced or propagated the URTD epidemic through formerly captive hosts. Also, introduced tortoises may compete with native tortoises for limited resources, and interbreeding between native and introduced tortoises may disrupt locally coadapted gene complexes (Bury et al. 1994). Natural population recovery is slow, with best case scenarios projecting 1% population growth per year or a doubling time of 70 years; at the more realistic rate of 0.5%, the doubling time increases to 140 years (USFWS 1994). Germano and Joyner (1988) reported that tortoises in the Piute Basin recovered from short-term high mortality.

Restoration of the degraded desert ecosystems supporting tortoise populations is both a slow and uncertain process. Without proven protocols for effective mitigation, no assurance may be made for re-establishing climax communities. Historical climatic regimes have been altered, water tables lowered irreversibly, and new exotic vegetation may preclude the restoration of native dominants.

No specific densities are required for delisting, but a stable population or one with a growth trend must be confirmed by repeated monitoring. A stable population would be confirmed by the following age class proportions: hatchlings about 22%, small juveniles 22%, larger juveniles 6%, subadults 8%, and adults 42%. Populations consisting entirely of adults or adults and hatchlings/neonatals may not be undergoing progressive replacement. Population viability, above a certain minimum, may be better evaluated by age class (and sex) distribution, than by absolute density.

Preserve Selection & Design Considerations: Major protection units (critical habitat blocks or Desert Wildlife Management Areas, DWMAs) should be capable of supporting metapopulations of 50,000 adults, according to some Minimum Viable Population (MVP) models (USFWS 1994). A population viability analysis by Brussard (1992) concluded that preserves or management areas should be large enough to support 20,000 adults. By genetic criteria alone a minimal adult population would require 5,000 adults (assuming an effective population size of 0.1 or 500) for continued viability (see Gilpin's model in USFWS 1994). Optimally these DWMAs should be individually 1,000 square miles in extent. Preserves should contain large uninterrupted and undisturbed blocks of high quality habitat (perennial grasses and native forbs) and should be interconnective, simply shaped polygons spread across representative habitats and regions.

See Britten et al. (1997) for information on the concordance between DWMAs and genetically distinct populations of tortoises in the northeastern Mojave Desert.

Berry (1986) recommended that areas to be restocked should be at least 14 km in diameter to permit dispersal.

Management Requirements: Active management may be required to maintain the viability of relatively small populations. Such management might entail frequent patrols and/or establishment of vehicular barriers to reduce destructive intrusion by humans, plus measures to address abnormally high levels of predation or excessive grazing by livestock.

An important management consideration is maintenance of the integrity of burrow systems, which are important in energy and water balance (Zimmerman et al. 1994); hence limitation of off-road vehicle use in tortoise habitat is warranted. Provision of burrows may facilitate adjustment of relocated individuals to the new area; captive tortoises readily use artificial burrows constructed of PVC pipe (Bulova 1992, 1994). However, release of captive tortoises into the wild is not a recommended conservation measure (Bury et al. 1994).

Studies by Ruby et al. (1994) indicate that fencing could be useful in reducing mortality by keeping tortoises off well-traveled highways. Tortoises readily enter undergound culverts, and these may be effective in allowing tortoises to move safely from one side of a fenced road to another (Ruby et al. 1994). Ruby et al. (1994) recommended 1-cm-mesh hardware cloth as an effective fence material but noted that other barriers also could be used.

In October 1989, BLM declared a special quarantine that closed 15,260 ha of the Mojave Desert southwest of Ridgecrest, California, to human use for one year (see Washington Post, 2 October 1989); this was in response to the epidemic respiratory infection, which may be spread in the wild population through the release of pet tortoises; the closure generated strong objections from developers, ranchers, and recreationists in California and Nevada (Matthews and Moseley 1990).

Conservation efforts that improve availability and abundance of annual plants can benefit juveniles (Nagy et al. 1997).

See Collins (1995) for a review of management and protection actions in Clark County, Nevada.

A population in the Black Mountain of Arizona, east of the Colorado River, is genetically and morphologically most similar to Mojavean populations west of the river and, despite contrary regulatory designation by USFWS, should be managed as such (McLuckie et al. 1999).
Monitoring Requirements: Adequate protection requires repeated and adequate monitoring for densities, age classes, forage, and health. In the past, several techniques involving strip transects (805-2400 m, Turner et al. 1982, Turner and Berry 1984), quadrate and grid systems (Bury and Luckenbach 1977), and permanent plots and mark and recapture estimations have been used to estimate tortoise density. In these surveys, sign (scat) and burrows as well as tortoises were often used to determine local densities. Such estimations may be distorted by weather, season, vegetation, decomposition, and tortoise behavior (especially the tendency to excavate and utilize more than one burrow) (Berry 1986, Fritts 1985). Furthermore, juvenile tortoises are especially refectory to observation (Adest et al. 1989, Morafka 1994) and particularly prone to excavate multiple burrows as well as utilize preformed and abandoned rodent burrows.

Currently, the USFWS is evaluating monitoring protocols that determine tortoise densities using distance weighted-sampling and the Zippen removal method (or maximum likelihood method described by Southwood 1978). In the procedure, a DWMA is divided into 1- sq-km plots using Universal Transverse Mecator coordinates. Plots encompassing disturbed areas or those over 4,000 ft elevation generally are excluded. A minimum of 10 sample plots is examined. At least three control plots 2-10 miles outside the DWMA boundary also are sampled. Then plots constituting 5% of the reserve area are surveyed by "removing"(marking) all tortoises 140 mm in mid- carapace length or greater. Adults also are sexed. This estimation method predicts that the rate at which new captures declines is directly related to the size of the total population and the total number previously removed/marked. Unlike more traditional mark-recapture methods, this approach requires tortoises to be handled only once. Tortoise densities for each sex are estimated along with their standard errors for each plot (USFWS 1994, Appendix A). A schedule implementing the above removal protocol would require sampling a random 5% of each Desert Wildlife Management Area (DWMA) every three years, during the months of February (Morafka recommends surveying no earlier than April 1) through May. At least 20 sample plots would be investigated in tandem with a minimum of three control plots outside the reserve. The control plot comparisons would continue through a minimum of five samples (12 years) in order to establish statistically valid trends in the effects of DWMA management (USFWS 1994). During a twelve-year period with a minimum of five sampling cycles, statistical comparisons of density trends within and outside the DWMA allow evaluation of the hypothesis that DWMA protection significantly increases tortoise densities over unprotected controls. Support of the hypothesis would confirm the efficacy of the reserve, while rejection, and/or the establishment of a negative correlation, might justify more stringent protection for the DWMA and the extension of its protection for a longer period of time.

Freilich et al. (2000) evaluated factors affecting population assessments and found that desert tortoises are likely to be undercounted in dry years.

A serological test has been developed to confirm the presence of blood antibodies to the URTD pathogen, but no effective cure for the disease is available (Schumacher et al. 1993). Proper health monitoring entails the establishment of baseline values (adjusted for age, sex, and season, see O'Connor et al. 1994) for healthy tortoises before blood panels are used for diagnostic monitoring purposes. Seropositive tortoises, even those with nasoepithelial lesions, are sometimes externally asymptomatic (Jacobson et al. 1995). Infections may be suppressed by Baytril treatments, but poorly vascularized regions, such as nasal epithelium often serve as reservoirs for re-infection. Symptoms include clear wet discharges from eyes and nose (the latter often generating nasal bubbles), loss of weight, and wheezing. Translucent, opaque, or colored discharges generally indicate the presence of other, largely bacterial, infections. Infection of mycoplasma may be achieved the transmission of moist discharges from an original host, nose to nose encounters involving aerosol exchanges, or cophrophagy. The origin of this infection is unknown though the concentration of infected individuals around urban areas raises the possibility of its introduction through the field release of former captives, or even by infections from other domesticated species. The capacity of tortoises to develop immunological and genetic resistance is unknown. See Jacobson et al. (1992) for information on blood sampling methods.

Peterson (1994) suggested the following criteria for monitoring and perhaps defining health: the body mass to the cube of carapace length ratio, and blood chemistry panel values for plasma osmolarity, CPK (creatinine phosphokinase), blood potassium, and BUN (blood urea nitrogen).

Germano (1988) reproted that scute annuli can be used to age individuals up to 20-25 years, but Tracy and Tracy (1995) found that this technique may not be accurate and urged caution in the use of scute-ring counts to estimate age.

See Blankenship et al. (1990) for information on a method for tracking tortoises using fluorescent powder.

Management Programs: TNC has been active in acquiring and retiring grazing privileges on BLM-administered lands that include high-quality tortoise habitat.

See End. Sp. Tech. Bull., Sept./Dec. 1991, for information on BLM's proposed licensing of livestock use on public land in tortoise habitat in southern Nevada; one prescription (for 726,390 ha) restricts grazing from March 1 to June 14, in order to reduce trampling and forage competition, whereas the other prescription (for 557,085 ha) includes no seasonal restriction on grazing (USFWS issued a no-jeopardy biological opinion).

In the early 1990s, Utah Division of Wildlife Resources was considering relocating some tortoises from east of the Beaver Dam Mountains to Beaver Dam Slope (west of mountains) (Glenn et al. 1990).

Management Research Programs: The following bibliographies and review articles summarize recent knowledge and technical trends in both desert tortoise biology and management: Auffenberg (1969), Auffenberg and Franz (1978), Auffenberg and Iverson (1979), Beaman et al (1989), Bury (1982), Bury and Germano (1994), Douglass (1975, 1977), Duck (1988), Grover and DeFalco (1995), Hohman et al (1980), Johnson et al (1990).

The following individuals are key contacts with regard to major endeavors now investigating tortoise biology and management needs; Life history and demographics: California: K. Berry, National Biological Service (NBS), Riverside, CA 92507, (909) 697-5361; Nevada: P. Brussard, Biology, Univeristy of Nevada, Reno; Arizona, Mexico: C. Schwalbe, NBS/NPS, University of Arizona, Tucson (602) 621-5508; Utah: C. R. Tracy, Biology, University of Nevada, Reno (702) 784-4565; Nutrition: J. Spotila, Drexel Univeristy, Dept of Bioscience, Philadelphia, PA 19104; Oftendal, Washington, D.C., National Zoo; H. Avery, as for Berry (NBS); Tracy, see above; Husbandry: H. Lawlor, Herpetology, Arizona-Sonora Desert Museum, Tucson (602) 883-3035; Predation: J. Boarman, see Berry, NBS, Riverside; Growth: D. Germano, Biology, California State University, Bakersfield, CA 93311 (805) 589-7846; Systematics: C. Crumly, Academic Press, 525 B St., San Diego, CA 92101 (619) 699-6754; Physiology: K. Nagy, Biology, UCLA, Los Angeles, CA 90024 (310) 825-8771; C. R. Tracy, see above; Reproduction: Nagy, see above; Endocrinology: V. Lance, CRES, San Diego Zoo (619) 557-3944; J. Spotila, see above; Paleontology: W. Auffenberg, Florida State Museum Natural History, Gainesville; D. Bramble, University Utah, Biology, Salt Lake City, Utah; Juveniles: D. J. Morafka, Biology, California State University, Dominguez Hills, Carson, CA 90747 (310) 475-3397; J. Spotila, see above; Health: E. Jacobson, University of Florida, Gainesville, School of Veterinary Medicine, (904) 392-4700 x5700; M. Christopher, School of Veterinary Medicine, University of California, Davis, CA; Habitat& Demographic Modeling: C. R. Tracy, see above; A. Krzysik, CERL, Champaign-Urbana, IL (800) USA-CERL X5479; J. Watts, TEC, Remote Sensing Laboratory, U.S. Army Topographic Engineering Center, Washington, D. C., (703) 355-2840 x2550, e-mail: watts@tec.army.mil; Conservation & Management: K. Berry, see above; P. Brussard, see above; Genetics: T. Lamb, Biology, Eastern Carolina University, Greenville, NC 27858, (919) 328-6718; R. Murphy, Royal Ontario Museum, Toronto, Canada M5S 2C6 (416) 586-5763.
Biological Research Needs: Future research needs to determine minimum viable population sizes in various habitat types, nutritional forage quantity and quality needs, the juvenile niche, nest microhabitat requirements, TSD as determined by field nest temperature cycles (not fixed incubation values), mating systems in nature, genetics, the taxonomy and distinctiveness of Nevada/Utah Sonoran and Sinaloan haplotypes, and the behavioral and physiological differences between these units. **Additional topics:** A library focusing on GOPHERUS has been established at the Archbold Biological Station, Lake Placid, FL 33852.

Population/Occurrence Delineation

Use Class: Not applicable
Minimum Criteria for an Occurrence: Occurrences are based on evidence of historical presence, or current and likely recurring presence, at a given location. Such evidence minimally includes collection or reliable observation and documentation of one or more individuals (including eggs) in or near appropriate habitat where the species is presumed to be established and breeding.
Separation Barriers: Busy highway or highway with obstructions such that turtles rarely if ever cross successfully; untraversable topography (e.g., cliff); major river, lake, pond, or deep marsh; urbanized area dominated by buildings and pavement; ladscapes with elevations higher than 6,000 feet.
Separation Distance for Unsuitable Habitat: 1 km

Separation Distance for Suitable Habitat: 5 km
Separation Justification: Annual home ranges generally are less than 50 ha; one estimate of lifetime home range size was 180 ha (see Migration/Mobility comments). However, individuals may move several kilometers over several weeks or years (Auffenberg and Iverson 1979; Berry 1986; Barrett 1990; Edwards et al. 2004, Herpetol. Rev. 35:381-382). Separation distance reflects occasional long-distance dispersal but is restricted such that occurrences do not become too large for practical conservation use.

Populations are typically uneven in density and often discontinuously distributed. This is particularly true of the upland "island" populations of the Sonoran Desert (Dodd 1982). Even in relatively undisturbed expanses of good lowland Mojave Desert habitat high density clusters are separated by low densities or even total absence. The minimal population unit, or deme, could be as small as 10-20 adults. Intervening habitat supporting less than 10 adult tortoises/sq mi could effectively isolate, at least behaviorally, such patches. Such patches, estimated by the collective home ranges, and allowing for partial overlap, might cover 500-1,000 hectares. Larger demographic units could be defined in terms of clusters of these demes isolated by topographic barriers, namely uplands higher than 4,000 to 5,200 feet (Yucca Mt., Nevada) in the Mojave Desert and paradoxically, valleys below 2,000 feet elevation in the Sonoran Desert. [This paragraph by D. Morafka.]
Inferred Minimum Extent of Habitat Use (when actual extent is unknown): 1 km
Date: 27Apr2005
Author: Hammerson, G.

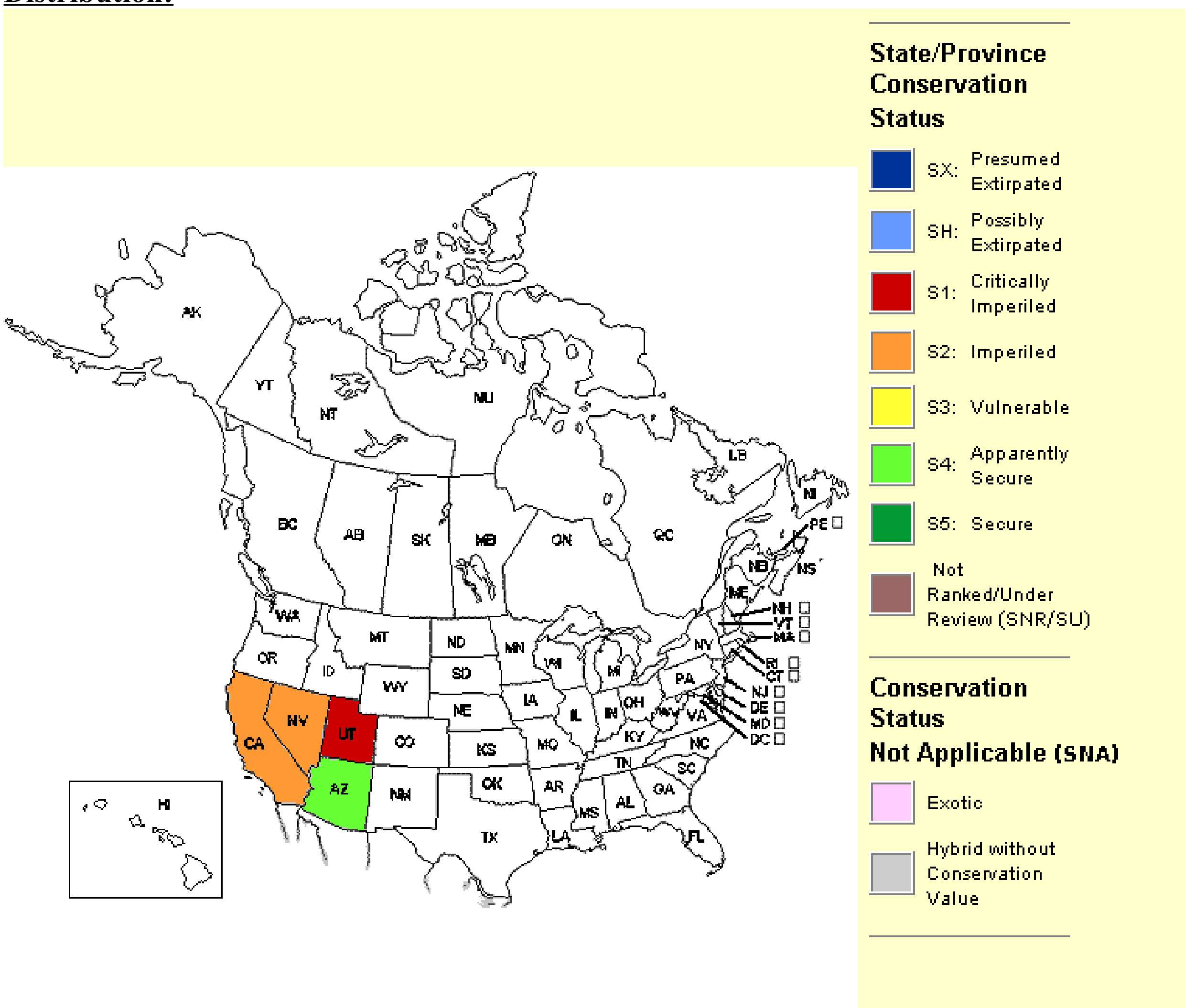
<u>Population/Occurrence Viability:</u>

Not Yet Assessed

<u>U.S. Invasive Species Impact Rank (I-Rank)</u>

Not Yet Assessed

Distribution:



Endemism: occurs (regularly, as a native taxon) in multiple nations

U.S. & Canada State/Province Distribution	
United States	AZ, CA, NV, UT

Range Map

No map available.

Global Range Comments: Ranges from Inyo County, California (north to Death Valley

National Park and about 10 miles south of Lone Pine), southern Nevada (Clark, Nye, and Lincoln counties, north to Yucca Mt. and Coyote Springs), and extreme southwestern Utah (Washington County: Beaver Dam slope and north St. George) south throughout most of the Mojave Desert to the eastern Colorado Desert of Los Angeles, Kern, San Bernardino, Imperial, Riverside counties, California, east through the Mojave Desert of Mohave County, Arizona, and south through the upper Sonoran Desert of Arizona (almost as far east as the New Mexico border on U.S. 80), including Cochise, Graham, Maricopa, Pima, Pinal, and Yuma counties and again south through Sonora (including Isla Tiburon in the Gulf of California) to the thornscrubs and oak woodlands of northern Sinaloa, Mexico. Recently reported from western Chihuahua (Smith et al, 2004, Herpetol. Rev. 35:284). Elevational range is mainly below 4000 feet; extends from below sea level (Death Valley and sea level in Sonora) to 5000-7000+ feet in a few areas. In the Mojave Desert, occurrences typically are between 1000 and 4000 ft elevation; elevational range is 1,000-2000 feet in the Colorado Desert, 2700-4000 ft in the Sonoran Desert, and in 1000-2600 ft in Sonora-Sinaloa, Mexico (Fritts and Scott 1984, Fritts and Jennings 1994), though locally down to sea level (Tiburon Island). Recorded at 7806 feet in the Sonoran Desert of Pima County, Arizona (Aslan et al. 2003). Tortoises are generally found in regions receiving an average annual rainfall in excess of four inches (100 mm) and below twelve inches (300 mm). Since portions of the western Sonoran (Colorado) Desert have annual precipitation of less than two inches (40 mm), this factor alone may explain the local exclusion of tortoises from hot, dry, low valleys (Fritts and Jennings 1994). Late Pleistocene records would extend its distribution west across the southern San Joaquin Valley and coastal Orange County, California, and east to southeastern New Mexico and adjacent Texas (Miller 1942, Miller 1970, Moodie and Van Devender 1979).

U.S. Distribution by County (based on available natural heritage records)

State	County Name (FIPS Code)
CA	Imperial (06025), Inyo (06027), Kern (06029), Los Angeles (06037), Riverside (06065), San Bernardino (06071)
NV	Clark (32003), Esmeralda (32009), Lincoln (32017), Nye (32023)
UT	Washington (49053)

U.S. Distribution by Watershed (based on available natural heritage records)

Watershed Region	Watershed Name (Watershed Code)
15	Lake Mead (15010005), Grand Wash (15010006), Upper Virgin (15010008), Fort Pierce Wash (15010009), Lower Virgin (15010010), White (15010011), Muddy (15010012), Meadow Valley Wash (15010013), Las Vegas Wash (15010015), Havasu-Mohave Lakes (15030101), Piute Wash (15030102), Imperial Reservoir (15030104)
16	Sand Spring-Tikaboo Valleys (16060014), Ivanpah-Pahrump Valleys (16060015)
18	Upper Amargosa (18090202), Death Valley-Lower Amargosa (18090203), Panamint Valley (18090204), Indian Wells-Searles Valleys (18090205), Antelope-Fremont Valleys (18090206), Coyote-Cuddeback Lakes (18090207), Mojave (18090208), Southern Mojave (18100100), Salton Sea (18100200)

Department of Fish & Game - California
http://www.dfg.ca.gov

DFG Services -Animals & Plant Info-Threatened and Endangered Species – Reptiles – tortoise, desert (Gopherus agassizii). NO DATA AVAILABLE.

DFG Services -Animals & Plant Info- Species Account Search – Reptile – Desert Tortoise – more info link – other links;

A picture of the Desert Tortoise
http://www.cdpr.ca.gov/doc/es/esqifs/dt_S1-t.gif and

Desert Tortoise. Species Profile. U.S.Fish and Wildlife Services,1998
http://ecos.fws.gov/species_profile/SpeciesProfile?spcode+E06D . This second link takes you to Chinook salmon (Oncorhynchus (=Salmo) tshawytscha). NO DATA AVAILABLE.

Desert Tortoise (Mojave Population) Recovery Plan. Fed. Register Notice, U.S. Fish and Wildlife Service, 1994.
http://ecos.fws.gov/docs/recovery_plans/1994/940628.pdf
28.94 MB. After downloading 28.94 MB of information, only blank screen appears.
NO AVAILABLE DATA.

LINK:
US Fish & Wildlife Services
Endangered Species Program
Number of Listed Species in each State of US Territory (map)
USFWS Threatened and Endangered Species System (TESS)
Species Profile: Desert torotise
http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode+C04L