



DESERT TORTOISE COUNCIL

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Via email only

19 August 2022

Superintendent
Tule Springs Fossil Beds National Monument
601 Nevada Way
Boulder City, NV 89005
tusk_information@nps.gov

RE: Request for Ideas from the Public for Tule Springs Fossil Beds General Management Plan,
Clark County, NV

Dear Superintendent,

The Desert Tortoise Council (Council) is a non-profit organization comprised of hundreds of professionals and laypersons who share a common concern for wild desert tortoises and a commitment to advancing the public's understanding of desert tortoise species. Established in 1975 to promote conservation of tortoises in the deserts of the southwestern United States and Mexico, the Council routinely provides information and other forms of assistance to individuals, organizations, and regulatory agencies on matters potentially affecting desert tortoises within their geographic ranges.

We appreciate this opportunity to provide comment on the development of this plan. Given the planning area includes habitats likely occupied by Mojave desert tortoise (*Gopherus agassizii*) (synonymous with Agassiz's desert tortoise), our comments pertain to enhancing protection of this species during activities funded, authorized, or carried out by the National Park Service (NPS), which we assume will be added to the Administrative Record for this plan. Please accept, carefully review, and include in the relevant file the Council's following comments and attachments for the proposed plan.

The Mojave desert tortoise is among the top 50 species on the list of the world's most endangered tortoises and freshwater turtles. The International Union for Conservation of Nature's (IUCN) Species Survival Commission, Tortoise and Freshwater Turtle Specialist Group, now considers the Mojave desert tortoise to be Critically Endangered (Berry et al. 2021), as it is a "species that

possess an extremely high risk of extinction as a result of rapid population declines of 80 to more than 90 percent over the previous 10 years (or three generations), population size fewer than 50 individuals, other factors.” It is one of three turtle and tortoise species in the United States to be critically endangered. This status, in part, prompted the Council to join Defenders of Wildlife and Desert Tortoise Preserve Committee (Desert Tortoise Council 2020) to petition the California Fish and Game Commission in March 2020 to elevate the listing of the Mojave desert tortoise from threatened to endangered in California.

Established in 2014 by Congress and created from lands previously managed by the Bureau of Land Management (BLM), the primary purpose of this 22,650-acre Tule Springs Fossil Beds National Monument NM is to conserve, protect, enhance, and interpret late Pleistocene fossils, their geologic context, and other scientific values in the upper Las Vegas Wash through education, research, community collaboration, and appropriate public use. The NM area follows upper Las Vegas Wash and has two units, a larger North Unit bisected by the access road to the Desert National Wildlife Refuge’s Visitor Center and the smaller South Unit bisected by Decatur Road. Both units abut the City of Las Vegas northern boundary. An existing powerline is along the southern boundary of the North Unit and a powerline extends along Las Vegas Wash in the Southern Unit.

The NPS has request input from the public on desired natural and cultural resource conditions, visitor experiences, and other important values during the development of the General Management Plan (Plan) for the (NM). General management plans set long-term goals for the NM and provide broad direction for resource preservation and visitor use. The Plan will incorporate best practices for managing visitor use to protect resources. The NPS will develop alternatives based on legal mandates; NPS policies; the NM’s purpose, significance and mission; and key issues facing the NM.

To assist the NPS with complying with its mandates under the Organic Act and section 7(a)(1) of the Federal Endangered Species Act, which includes contributing to the recovery of the listed species, we are providing data on the status of the Mojave desert tortoise for your use (Appendix A). The NM is located in the Northeastern Mojave Recovery Unit for the tortoise and near the Eastern Mojave Recovery Unit.

The Council is concerned that the NM is located adjacent to the Las Vegas metropolitan area. We anticipate a large number of authorized visitors to the NM with attendance increasing annually. In addition, we anticipate that unauthorized public use of activities that are not compatible with the NM’s purpose (e.g., social gatherings, tagging, drug sales and/or use, campfires, using fireworks, etc.). This location and anticipated visitor use provides many challenges to the NPS to manage for the protection of the natural and cultural resources within the NM. the challenges of managing the NM to comply with the legal mandates given the anticipated large numbers of people accessing the NM for authorized and unauthorized activities

The threats to the Mojave desert tortoise are almost all human-caused or human-enhanced. These include:

- direct mortality or loss from wild populations (e.g., human collecting, vandalism, mortality from vehicle strikes);

- destruction of habitat from various types of human developments (e.g., construction of roads, buildings, utilities, etc.);
- indirect mortality from unintentionally subsidizing tortoise predators that increase predator abundance and predation pressure on the tortoise (e.g., improperly stored food and trash, artificial water sources and leaking water pipes, elevated structures used for nesting and hunting);
- degradation of habitat (e.g., surface disturbance and vehicle access that introduces and spreads non-native invasive plants that outcompete native vegetation. Generally, non-native plants are lower in nutritional quality (nutrients and water) than native forbs, and some (e.g., *Bromus* species) cause physical injury to tortoises; reduction in woody plant cover and density, reduction in frequency and abundance of native forbs caused by increasing temperatures and reduced soil moisture from climate change (tortoises need cover from woody perennial plants for protection from temperature extremes and predators and native forbs for sufficient nutrients for growth, reproduction, and recruitment)
- competition with non-native large herbivores (e.g., livestock, feral horses and burros) for limited nutritious forage
- habitat fragmentation and lost population connectivity from locations and use of roads, locations of human development, and siting of solar energy development
- unintentional destruction of habitat from fires, most of which are started by humans/equipment.

Recommendations for Tule Springs Fossil Beds National Monument's General Management Plan

Configuration of areas designated a frontcountry and backcountry lands: While the NM was created for its paleontological resources, the Council believes protecting them would help protect tortoises and tortoise habitat. The Council recommends the NPS designate as large a contiguous area as possible that connects to Desert National Wildlife Refuge as backcountry lands with no public access roads. Front country lands (easy access for people) should be a small area and configured as a circle or rectangle, not linear to reduce the likelihood of spillover impacts from the frontcountry lands to backcountry lands.

Managed Human Access: Because the NM is adjacent to Las Vegas, we are concerned about human caused fires and human access, especially after dark, resulting in vandalism of NM resources, collection of tortoises, introduction and spread of invasive plants, and trash. Human access should be controlled to both units to limit unintentional and intentional direct and indirect impacts to paleontological resources, tortoises, tortoise habitat, and other natural and cultural resources. Fire is one of the Council's greatest concerns. Once native perennial vegetation has been destroyed, especially by fire, it may take decades to centuries for the original diversity of plants to reestablish (Abella et al. 2021).

Education and Outreach: The NM has an opportunity to develop and implement an education and outreach program at their visitor center for the tortoise and other natural and cultural resources and at various locations in the frontcountry lands. When effectively implemented, the dissemination of this information should substantially reduce human-caused impacts to the resources in the NM, including to the tortoise and its habitat.

Management of Existing Rights-of-Way: The future management of what we presume to be an existing powerline right-of-way is important as it has the potential to provide uncontrolled human access throughout the NM at any time. We recommend the NPS engage in discussions with the utility owner of the powerline to implement management actions that would be aligned with the NPS's mission and mandates while providing the utility with needed access for operations and maintenance. For example, there is likely an unpaved access road along the powerline for occasional monitoring and maintenance. We suggest the utility work with the NPS to physically close this road to public access. This would reduce the likelihood of vandalism/damage to the powerline structures by the public's use of the road that may inadvertently damage paleontological resources and other cultural and natural resources including desert tortoise and their habitat. If the powerline line towers are providing nesting sites for common ravens (*Corvus corax*), a known and subsidized predator of the tortoise, the NPS should work with the utility to modify the towers so preventing nesting.

Below are specific recommendations the Council would like to see implemented:

1. Limit miles of road and vehicle access by the public. Implement and enforce low speed limits. Discourage construction of paved roads.
2. Close the NM at night and install barriers to prevent vehicle access and the impacts of unauthorized night activities such as social gatherings with large number of vehicles, campfires, people using fireworks, recreational drug use that involves smoking that can start fires.
3. Do not sell food or allow food concessions – food and trash attract tortoise predators.
4. To ensure that predators of tortoises and other wildlife species are not unintentionally subsidized by trash and food, please ensure that trash containers (i.e., trash cans, dumpsters, etc.) are predator-proof (i.e., cannot be accessed by common ravens, coyotes, etc.)
5. Develop a multimedia education program for the tortoise and what they can do to help it, then implement it and monitor its effectiveness; modify it to make it more effective.
We suggest collaborating with BLM at Red Rock Canyon National Conservation Area and U.S. Fish and Wildlife Service at Desert National Wildlife Refuge.
6. Develop and implement invasive non-native plant species, habitat restoration, and fire prevention plans to protect paleontological resources, tortoises, and biological resources.
7. Maximize area of backcountry designation and provide connectivity for the tortoise population and habitat to Desert National Wildlife Refuge through the configuration of this area.
8. Design access so visitor must go through visitor center before experiencing most of the NM so they would learn about the resources the NM is protecting.
9. Develop and implement a tortoise management/monitoring plan. Determine baseline densities, locations, and demographics for the population at the NM. Every few years, revisit collecting these data to determine trend for the tortoise and whether changes in management should be made.

To assist the NPS in its vegetation restoration efforts in the NM, particularly for the Mojave desert tortoise, we are providing the following papers and a reference for your use:

Best Management Practices – Restoring Perennial Plants

https://deserttortoise.org/wp-content/uploads/BMP_fact_sheet_1_restore_perennials.pdf

Best Management Practices – Enhancing Forage for the Mojave Desert Tortoise
https://deserttortoise.org/wp-content/uploads/BMP_fact_sheet_2_forage.pdf

Best Management Practices – Salvaging Topsoil
https://deserttortoise.org/wp-content/uploads/BMP_fact_sheet_3_topsoil.pdf

Best Management Practices – Rehabilitating Lands After Severe Disturbance
https://deserttortoise.org/wp-content/uploads/BMP_fact_sheet_4_severe_disturbance.pdf

Best Management Practices – Reducing Impacts of Roads
https://deserttortoise.org/wp-content/uploads/BMP_fact_sheet_5_roads.pdf

Restoration plan for site within the Eastern Expansion Area of Desert Tortoise Research Natural Area

https://deserttortoise.org/wp-content/uploads/restoration_plan_guidance_21apr2017.pdf

Abella S.R. and K.H. Berry. 2016. Enhancing and restoring habitat for the desert tortoise (*Gopherus agassizii*). Journal of Fish and Wildlife Management 7(1):255–279.
<https://doi.org/10.3996/052015-JFWM-046>.

In addition, we suggest contacting Dr. Scott Abella at the University of Nevada, Las Vegas, and other authorities on the best methods to use to facilitate restoring the biotic diversity, functions, and values of previously-disturbed or lost vegetation associations in the NM.

We appreciate this opportunity to provide input during the development of this Plan and trust our comments will help protect tortoises during any resulting authorized activities. Herein, we reiterate that the Desert Tortoise Council wants to be identified as an Affected Interest for this and all other plans and projects funded, authorized, or carried out by the NPS that may affect species of desert tortoises, and that any subsequent environmental documentation for this Plan is provided to us at the contact information listed above. Additionally, we ask that you respond in an email that you have received this comment letter so we can be sure our concerns have been registered with the appropriate personnel and office for this project.

Respectfully,



Edward L. LaRue, Jr., M.S.
Desert Tortoise Council, Ecosystems Advisory Committee, Chairperson

Attachment: Appendix A: Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*)

Literature Cited

Abella, S.R., D.M. Gentilcore, and L.P. Chiquoine, 2021. Resilience and alternative stable states after desert wildfires. *Ecological Monographs*, 91(1), 2021, e01432. https://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=1851&context=sls_fac_articles

Berry, K.H., L.J. Allison, A.M. McLuckie, M. Vaughn, and R.W. Murphy. 2021. *Gopherus agassizii*. The IUCN Red List of Threatened Species 2021: e.T97246272A3150871. <https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T97246272A3150871.en>

Desert Tortoise Council. 2020. A Petition to the State of California Fish and Game Commission to change the status of *Gopherus agassizii* from Threatened to Endangered. Formal petition submitted on 11 March 2020.

Appendix A. Status and Trend of the Mojave Desert Tortoise (*Gopherus agassizii*)

To assist the Agencies with their analysis of the direct, indirect, and cumulative impacts of the Proposed Project on the Mojave desert tortoise, we provide the following information on its status and trend. In reviewing the data presented below, note that the location of the proposed project is within the Northeastern Mojave Recovery Unit and adjacent to the Eastern Mojave Recovery Unit, the unit that has experienced the greatest decline in tortoise density and abundance, -67%, since 2004.

The Desert Tortoise Council (Council) has serious concerns about direct, indirect, and cumulative sources of human mortality for the Mojave desert tortoise given the status and trend of the species range-wide, within each of the five recovery units, and within the Tortoise Conservation Areas (TCAs) that comprise each recovery unit.

Densities of Adult Mojave Desert Tortoises: A few years after listing the Mojave desert tortoise under the Federal Endangered Species Act (FESA), the U.S. Fish and Wildlife Service (USFWS) published a Recovery Plan for the Mojave desert tortoise (USFWS 1994a). It contained a detailed population viability analysis. In this analysis, the minimum viable density of a Mojave desert tortoise population is 10 adult tortoises per mile² (3.9 adult tortoises per km²). This assumed a male-female ratio of 1:1 (USFWS 1994a, page C25) and certain areas of habitat with most of these areas geographically linked by adjacent borders or corridors of suitable tortoise habitat. Populations of Mojave desert tortoises with densities below this density are in danger of extinction (USFWS 1994a, page 32). The revised recovery plan (USFWS 2011) designated five recovery units for the Mojave desert tortoise that are intended to conserve the genetic, behavioral, and morphological diversity necessary for the recovery of the entire listed species (Allison and McLuckie 2018).

Range-wide, densities of adult Mojave desert tortoises declined more than 32% between 2004 and 2014 (Table 1) (USFWS 2015). At the recovery unit level, between 2004 and 2014, densities of adult desert tortoises declined, on average, in every recovery unit except the Northeastern Mojave (Table 1). Adult densities in the Northeastern Mojave Recovery Unit increased 3.1% per year (SE = 4.3%), while the other four recovery units declined at different annual rates: Colorado Desert (-4.5%, SE = 2.8%), Upper Virgin River (-3.2%, SE = 2.0%), Eastern Mojave (-11.2%, SE = 5.0%), and Western Mojave (-7.1%, SE = 3.3%)(Allison and McLuckie 2018). However, the small area and low starting density of the tortoises in the Northeastern Mojave Recovery Unit (lowest density of all Recovery Units) resulted in a small overall increase in the number of adult tortoises by 2014 (Allison and McLuckie 2018). In contrast, the much larger areas of the Eastern Mojave, Western Mojave, and Colorado Desert recovery units, plus the higher estimated initial densities in these areas, explained much of the estimated total loss of adult tortoises since 2004 (Allison and McLuckie 2018).

At the population level, represented by tortoises in the TCAs, densities of 10 of 17 monitored populations of the Mojave desert tortoise declined from 26% to 64% and 11 have densities less than 3.9 adult tortoises per km² (USFWS 2015).

Population Data on Mojave Desert Tortoise: The Mojave desert tortoise was listed as threatened under the FESA in 1990. The listing was warranted because of ongoing population declines throughout the range of the tortoise from multiple human-caused activities. Since the listing, the status of the species has changed. Population numbers (abundance) and densities continue to decline substantially (please see Tables 1 and 2).

Table 1. Summary of 10-year trend data for 5 Recovery Units and 17 Critical Habitat Units (CHU)/Tortoise Conservation Areas (TCA) for the Mojave desert tortoise, *Gopherus agassizii* (=Agassiz’s desert tortoise). The table includes the area of each Recovery Unit and Critical Habitat Unit (CHU)/Tortoise Conservation Area (TCA), percent of total habitat for each Recovery Unit and Critical Habitat Unit/Tortoise Conservation Areas, density (number of breeding adults/km² and standard errors = SE), and the percent change in population density between 2004-2014. Populations below the viable level of 3.9 adults/km² (10 adults per mi²) (assumes a 1:1 sex ratio) and showing a decline from 2004 to 2014 are in red (Allison and McLuckie 2018, USFWS 2015).

Recovery Unit Designated Critical Habitat Unit/Tortoise Conservation Area	Surveyed area (km ²)	% of total habitat area in Recovery Unit & CHU/TCA	2014 density/km ² (SE)	% 10-year change (2004–2014)
Western Mojave, CA	6,294	24.51	2.8 (1.0)	-50.7 decline
Fremont-Kramer	2,347	9.14	2.6 (1.0)	-50.6 decline
Ord-Rodman	852	3.32	3.6 (1.4)	-56.5 decline
Superior-Cronese	3,094	12.05	2.4 (0.9)	-61.5 decline
Colorado Desert, CA	11,663	45.42	4.0 (1.4)	-36.25 decline
Chocolate Mtn AGR, CA	713	2.78	7.2 (2.8)	-29.77 decline
Chuckwalla, CA	2,818	10.97	3.3 (1.3)	-37.43 decline
Chemehuevi, CA	3,763	14.65	2.8 (1.1)	-64.70 decline
Fenner, CA	1,782	6.94	4.8 (1.9)	-52.86 decline
Joshua Tree, CA	1,152	4.49	3.7 (1.5)	+178.62 increase
Pinto Mtn, CA	508	1.98	2.4 (1.0)	-60.30 decline
Piute Valley, NV	927	3.61	5.3 (2.1)	+162.36 increase
Northeastern Mojave	4,160	16.2	4.5 (1.9)	+325.62 increase
Beaver Dam Slope, NV, UT, AZ	750	2.92	6.2 (2.4)	+370.33 increase
Coyote Spring, NV	960	3.74	4.0 (1.6)	+ 265.06 increase
Gold Butte, NV & AZ	1,607	6.26	2.7 (1.0)	+ 384.37 increase
Mormon Mesa, NV	844	3.29	6.4 (2.5)	+ 217.80 increase
Eastern Mojave, NV & CA	3,446	13.42	1.9 (0.7)	-67.26 decline
El Dorado Valley, NV	999	3.89	1.5 (0.6)	-61.14 decline
Ivanpah, CA	2,447	9.53	2.3 (0.9)	-56.05 decline
Upper Virgin River	115	0.45	15.3 (6.0)	-26.57 decline
Red Cliffs Desert	115	0.45	15.3 (6.0)	-26.57 decline
Total amount of land	25,678	100.00		-32.18 decline

Density of Juvenile Mojave Desert Tortoises: Survey results indicate that the proportion of juvenile desert tortoises has been decreasing in all five recovery units since 2007 (Allison and McLuckie 2018). The probability of encountering a juvenile tortoise was consistently lowest in the Western

Mojave Recovery Unit. Allison and McLuckie (2018) provided reasons for the decline in juvenile desert tortoises in all recovery units. These included decreased food availability for adult female tortoises resulting in reduced clutch size, decreased food availability resulting in increased mortality of juvenile tortoises, prey switching by coyotes from mammals to tortoises, and increased abundance of common ravens that typically prey on smaller desert tortoises.

Declining adult tortoise densities through 2014 have left the Eastern Mojave adult numbers at 33% (a 67% decline of their 2004 levels) and the Northeastern Mojave adult numbers increasing (325%)(Allison and McLuckie 2018, USFWS 2015). Such steep declines in the density of adults are only sustainable if there are suitably large improvements in reproduction and juvenile growth and survival. However, the proportion of juveniles has not increased anywhere in the range of the Mojave desert tortoise since 2007, and in the Eastern Mojave Recovery Unit the proportion of juveniles in 2014 declined from 14 to 11 percent (a 21% decline) of their representation since 2007 (Allison and McLuckie 2018).

The USFWS and Utah Division of Wildlife Resources have continued to collect density data on the Mojave desert tortoise since 2014. The results are provided in Table 2 along with the analysis USFWS (2015) conducted for tortoise density data from 2004 through 2014. These data show that adult tortoise densities in most Recovery Units continued to decline in density since the data collection methodology was initiated in 2004. In addition, in the Northeastern Mojave Recovery Unit that had shown an overall increase in tortoise density between 2004 and 2014, subsequent data indicate a decline in density since 2014 with most areas below the density for population viability (USFWS 2016, 2018, 2019, 2020, 2022a, 2022b).

Table 2. Summary of data for Agassiz’s desert tortoise, *Gopherus agassizii* (=Mojave desert tortoise) from 2004 to 2021 for the 5 Recovery Units and 17 Critical Habitat Units (CHUs)/Tortoise Conservation Areas (TCAs). The table includes the area of each Recovery Unit and CHU/TCA, percent of total habitat for each Recovery Unit and CHU/TCA, density (number of breeding adults/km² and standard errors = SE), and percent change in population density between 2004-2014 (USFWS 2015). Populations below the viable level of 3.9 breeding individuals/km² (10 breeding individuals per mi²) (assumes a 1:1 sex ratio) (USFWS 1994a, 2015) or showing a decline from 2004 to 2014 are in **red**.

Recovery Unit: Designated CHU/TCA &	% of total habitat area in Recovery Unit & CHU/TCA	2004 density/ km ²	2014 density/ km ² (SE)	% 10- year change (2004– 2014)	2015 density/ km ²	2016 density/ km ²	2017 density/ km ²	2018 density/ km ²	2019 density/ km ²	2020 density/ km ²	2021 density/ km ²
Western Mojave, CA	24.51		2.8 (1.0)	–50.7 decline							
Fremont- Kramer	9.14		2.6 (1.0)	–50.6 decline	4.5	No data	4.1	No data	2.7	1.7	No data
Ord-Rodman	3.32		3.6 (1.4)	–56.5 decline	No data	No data	3.9	2.5/3.4*	2.1/2.5*	No data	1.9/2.5*
Superior- Cronese	12.05		2.4 (0.9)	–61.5 decline	2.6	3.6	1.7	No data	1.9	No data	No data
Colorado Desert, CA	45.42		4.0 (1.4)	–36.25 decline							
Chocolate Mtn AGR, CA	2.78		7.2 (2.8)	–29.77 decline	10.3	8.5	9.4	7.6	7.0	7.1	3.9
Chuckwalla, CA	10.97		3.3 (1.3)	–37.43 decline	No data	No data	4.3	No data	1.8	4.6	2.6
Chemehuevi, CA	14.65		2.8 (1.1)	–64.70 decline	No data	1.7	No data	2.9	No data	4.0	No data
Fenner, CA	6.94		4.8 (1.9)	–52.86 decline	No data	5.5	No data	6.0	2.8	No data	5.3
Joshua Tree, CA	4.49		3.7 (1.5)	+178.62 increase	No data	2.6	3.6	No data	3.1	3.9	No data

Recovery Unit: Designated CHU/TCA	% of total habitat area in Recovery Unit & CHU/TCA	2004 density/ km ²	2014 density/km ² (SE)	% 10- year change (2004– 2014)	2015	2016	2017	2018	2019	2020	2021
Pinto Mtn, CA	1.98		2.4 (1.0)	–60.30 decline	No data	2.1	2.3	No data	1.7	2.9	No data
Piute Valley, NV	3.61		5.3 (2.1)	+162.36 increase	No data	4.0	5.9	No data	No data	No data	3.9
Northeastern Mojave AZ, NV, & UT	16.2		4.5 (1.9)	+325.62 increase							
Beaver Dam Slope, NV, UT, & AZ	2.92		6.2 (2.4)	+370.33 increase	No data	5.6	1.3	5.1	2.0	No data	No data
Coyote Spring, NV	3.74		4.0 (1.6)	+ 265.06 increase	No data	4.2	No data	No data	3.2	No data	No data
Gold Butte, NV & AZ	6.26		2.7 (1.0)	+ 384.37 increase	No data	No data	1.9	2.3	No data	No data	2.4
Mormon Mesa, NV	3.29		6.4 (2.5)	+ 217.80 increase	No data	2.1	No data	3.6	No data	5.2	5.2
Eastern Mojave, NV & CA	13.42		1.9 (0.7)	–67.26 decline							
El Dorado Valley, NV	3.89		1.5 (0.6)	–61.14 decline	No data	2.7	5.6	No data	2.3	No data	No data
Ivanpah Valley, CA	9.53		2.3 (0.9)	–56.05 decline	1.9	No data	No data	3.7	2.6	No data	1.8

Recovery Unit: Designated CHU/TCA	% of total habitat area in Recovery Unit & CHU/TCA	2004 density/ km ²	2014 density/km ² (SE)	% 10- year change (2004– 2014)	2015	2016	2017	2018	2019	2020	2021
Upper Virgin River, UT & AZ	0.45		15.3 (6.0)	-26.57 decline							
Red Cliffs Desert**	0.45	29.1 (21.4- 39.6)**	15.3 (6.0)	-26.57 decline	15.0	No data	19.1	No data	17.2	No data	
Range-wide Area of CHUs - TCAs/Range- wide Change in Population Status	100.00			-32.18 decline							

*This density includes the adult tortoises translocated from the expansion of the MCAGCC, that is resident adult tortoises and translocated adult tortoises.

**Methodology for collecting density data initiated in 1999.

Abundance of Mojave Desert Tortoises: Allison and McLuckie (2018) noted that because the area available to tortoises (i.e., tortoise habitat and linkage areas between habitats) is decreasing, trends in tortoise density no longer capture the magnitude of decreases in abundance. Hence, they reported on the change in abundance or numbers of the Mojave desert tortoise in each recovery unit (Table 2). They noted that these estimates in abundance are likely higher than actual numbers of tortoises, and the changes in abundance (i.e., decrease in numbers) are likely lower than actual numbers because of their habitat calculation method. They used area estimates that removed only impervious surfaces created by development as cities in the desert expanded. They did not consider degradation and loss of habitat from other sources, such as the recent expansion of military operations (753.4 km² so far on Fort Irwin and the Marine Corps Air Ground Combat Center), intense or large scale fires (e.g., 576.2 km² of critical habitat that burned in 2005), development of utility-scale solar facilities (as of 2015, 194 km² have been permitted) (USFWS 2016), or other sources of degradation or loss of habitat (e.g., recreation, mining, grazing, infrastructure, etc.). Thus, the declines in abundance of Mojave desert tortoise are likely greater than those reported in Table 3.

Habitat Availability: Data on population density or abundance does not indicate population viability. The area of protected habitat or reserves for the subject species is a crucial part of the viability analysis along with data on density, abundance, and other population parameters. In the Desert Tortoise (Mojave Population) Recovery Plan (USFWS 1994a), the analysis of population viability included population density and size of reserves (i.e., areas managed for the desert tortoise) and population numbers (abundance) and size of reserves. The USFWS Recovery Plan reported that as population densities for the Mojave desert tortoise decline, reserve sizes must increase, and as population numbers (abundance) for the Mojave desert tortoise decline, reserve sizes must increase (USFWS 1994a). In 1994, reserve design (USFWS 1994a) and designation of critical habitat (USFWS 1994b) were based on the population viability analysis from numbers (abundance) and densities of populations of the Mojave desert tortoise in the early 1990s. Inherent in this analysis is that the lands be managed with reserve level protection (USFWS 1994a, page 36) or ecosystem protection as described in section 2(b) of the FESA, and that sources of mortality be reduced so recruitment exceeds mortality (that is, $\lambda > 1$)(USFWS 1994a, page C46).

Table 3. Estimated change in abundance of adult Mojave desert tortoises in each recovery unit between 2004 and 2014 (Allison and McLuckie 2018). Decreases in abundance are in red.

Recovery Unit	Modeled Habitat (km ²)	2004 Abundance	2014 Abundance	Change in Abundance	Percent Change in Abundance
Western Mojave	23,139	131,540	64,871	-66,668	-51%
Colorado Desert	18,024	103,675	66,097	-37,578	-36%
Northeastern Mojave	10,664	12,610	46,701	34,091	270%
Eastern Mojave	16,061	75,342	24,664	-50,679	-67%
Upper Virgin River	613	13,226	10,010	-3,216	-24%
Total	68,501	336,393	212,343	-124,050	-37%

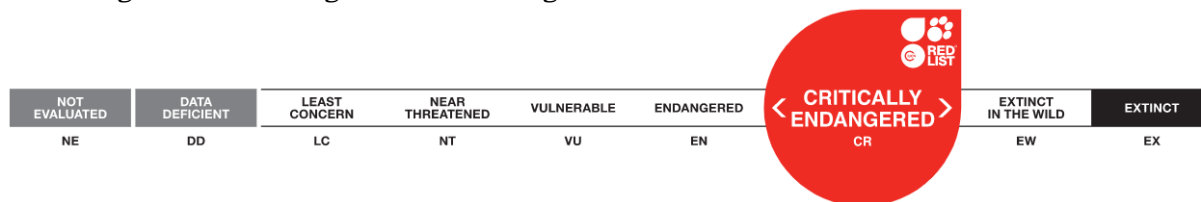
Habitat loss would also disrupt the prevailing population structure of this widely distributed species with geographically limited dispersal (isolation by resistance Dutcher et al. 2020). Allison and McLuckie (2018) anticipate an additional impact of this habitat loss/degradation is decreasing

resilience of local tortoise populations by reducing demographic connections to neighboring populations (Fahrig 2007). Military and commercial operations and infrastructure projects that reduce tortoise habitat in the desert are anticipated to continue (Allison and McLuckie 2018) as are other sources of habitat loss/degradation.

Allison and McLuckie (2018) reported that the life history of the Mojave desert tortoise puts it at greater risk from even slightly elevated adult mortality (Congdon et al. 1993; Doak et al. 1994), and recovery from population declines will require more than enhancing adult survivorship (Spencer et al. 2017). The negative population trends in most of the TCAs for the Mojave desert tortoise indicate that this species is on the path to extinction under current conditions (Allison and McLuckie 2018). They state that their results are a call to action to remove ongoing threats to tortoises from TCAs, and possibly to contemplate the role of human activities outside TCAs and their impact on tortoise populations inside them.

Densities, numbers, and habitat for the Mojave desert tortoise declined between 2004 and 2014 and densities continue to decline in most Recovery Units since 2014. As reported in the population viability analysis, to improve the status of the Mojave desert tortoise, reserves (area of protected habitat) must be established and managed. When densities of tortoises decline, the area of protected habitat must increase. When the abundance of tortoises declines, the area of protected habitat must increase. We note that the Desert Tortoise (Mojave Population) Recovery Plan was released in 1994 and its report on population viability and reserve design was reiterated in the 2011 Revised Recovery Plan as needing to be updated with current population data (USFWS 2011, p. 83). With lower population densities and abundance, a revised population viability analysis would show the need for greater areas of habitat to receive reserve level of management for the Mojave desert tortoise. In addition, we note that none of the recovery actions that are fundamental tenets of conservation biology has been implemented throughout most or all of the range of the Mojave desert tortoise.

IUCN Species Survival Commission: The Mojave desert tortoise is now on the list of the world’s most endangered tortoises and freshwater turtles. It is in the top 50 species. The International Union for Conservation of Nature’s (IUCN) Species Survival Commission, Tortoise and Freshwater Turtle Specialist Group, now considers Mojave desert tortoise to be Critically Endangered (Berry et al. 2021). As such, it is a “species that possess an extremely high risk of extinction as a result of rapid population declines of 80 to more than 90 percent over the previous 10 years (or three generations), a current population size of fewer than 50 individuals, or other factors.” It is one of three turtle and tortoise species in the United States to be critically endangered. This designation is more grave than endangered.



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