Status of the Desert Tortoise - Rangewide August 13, 2008

1. Listing History

On August 20, 1980, the Service published a final rule listing the Beaver Dam Slope population of the desert tortoise in Utah as threatened (45 FR 55654). In the 1980 listing of the Beaver Dam Slope population, the Service concurrently designated 26 square miles of BLM-administered land in Utah as critical habitat. The reason for listing was population declines because of habitat deterioration and past over-collection. Major threats to the tortoise identified in the rule included habitat destruction through development, overgrazing, and geothermal development; collection for pets, malicious killing, road kills, and competition with grazing or feral animals.

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 FR 42270). On April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened (55 FR 12178). Reasons for the determination included significant population declines, loss of habitat from construction projects such as roads, housing and energy developments, and conversion of native habitat to agriculture. Livestock grazing and off-highway vehicle (OHV) activity have degraded additional habitat. Also cited as threatening the deselt tortoise's continuing existence were illegal collection by humans for pets or consumption, upper respiratory tract disease (URTD), predation on juvenile desert tortoises by common ravens *(Corvus corax)*, coyotes *(Canis latrans)*, and kit foxes *(Vulpes macrotis)*, fire, and collisions with vehicles on paved and unpaved roads.

On February 8, 1994, the Service designated approximately 6.45 million acres of critical habitat for the Mojave population of the desert tOltoise in portions of California (4.75 million acres), Nevada (1.22 million acres), Arizona (339 thousand acres), and Utah (129 thousand acres) (59 FR 5820-5846, also see corrections in 59 FR 9032-9036), which became effective on March 10, 1994.

2. Species Account

The desert tortoise is a large, herbivorous reptile found in portions of California, Arizona, Nevada, and Utah. It also occurs in Sonora and Sinaloa, Mexico. The Mojave population of the deselt tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Sonoran Desert in California.

Desert tortoises reach 8 to 15 inches in carapace length and 4 to 6 inches in shell height. Hatchlings emcrge from the eggs at about 2 inches in length. Adults have a domed carapace and relatively flat, unhinged plastron. Their shells are high-domed, and greenish-tan to dark brown in color with tan scute centers. Deselt tortoises weigh 8 to 15 pounds when fully grown. The forelimbs have heavy, claw-like scales and are flattened for digging. I-lind limbs are more stumpy and elephantine.

Optimal habitat for the desert tortoise has been characterized as creosote bush scrub in which precipitation ranges from 2 to 8 inches, where a diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982, Turner 1982, Turner and Brown 1982). Soils must be friable enough for digging burrows, but firm enough so that burrows do not collapse. Desert tortoises occur from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982).

Desert tortoises are most commonly found within the desert scrub vegetation type, primarily in creosote bush scrub. In addition, they occur in succulent scrub, cheesebush scrub, blackbrush scrub, hopsage scrub, shadscale scrub, microphyll woodland, Mojave saltbush-allscale scrub and scrub-steppe vegetation types of the desert and semidesert grassland complex (Service 1994). Within these vegetation types, desert tortoises potentially can survive and reproduce where their basic habitat requirements are met. These requirements include a sufficient amount and quality of forage species; shelter sites for protection from predators and environmental extremes; suitable substrates for burrowing, nesting, and overwintering; various plants for shelter; and adequate area for movement, dispersal, and gene flow. Throughout most of the Mojave Region, tortoises occur most commonly on gently sloping terrain with soils ranging from sandy-gravel and with scattered shrubs, and where there is abundant inter-shrub space for growth of herbaceous plants. Throughout their range, however, tortoises can be found in steeper, rockier areas (Gardner and Brodie 2000).

The size of desert tortoise home ranges varies with respect to location and year. Tortoise activities are concentrated in overlapping core areas, known as home ranges. In the West Mojave Desert, Harless *et al.* (2007) estimated mean home ranges for male deselt tortoises to be 111 acres and 40 acres for females, Over its lifetime, each desert tortoise may require more than 1.5 square miles of habitat and make forays of more than 7 miles at a time (Berry 1986). In drought years, the ability of tortoises to drink while surface water is available following rains may be crucial for tortoise survival. During droughts, tortoises forage over larger areas, increasing the likelihood of encounters with sources of injury or mortality including humans and other predators.

Desert tortoises are most active during the spring and early summer when annual plants are most common. Additional activity occurs during warmer fall months and occasionally after summer rainstorms. Desert tOitoises spend most of the remainder of the year in burrows, escaping the extreme conditions of the desert. However, under certain conditions desert tortoises may be aboveground any month of the year. In Nevada and Arizona, tortoises are considered to be most active from approximately March I through October 31.

Tortoise activity patterns are primarily controlled by ambient temperature and precipitation (Nagy and Medica 1986, Zimmerman *et al.* 1994). Desert tortoises are active for approximately 6 weeks to 5 months of the year, depending on annual variations of temperature and rainfall. Deserts are characterized by prolonged periods of barely measurable rainfall. In much of the Mojave Desert, droughts of 8 months or more occur regularly. At such times, the desert is viliually devoid of food for tortoises except for cacti and dried grasses (Oftedal 2002). In the East Mojave and Colorado Deserts, annual precipitation occurs in both summer and winter, providing food and water to tOlioises throughout much of the summer and fall. Most precipitation occurs in winter in the West Mojave Desert, resulting in an abundance of annual spring vegetation, which dries up by late Mayor June. Tortoises in the West Mojave are primarily active in May and June, with a secondary activity period from September through October.

Tortoises may also be active during periods of mild or rainy weather in summer and winter. During inactive periods, tortoises rest in subterranean burrows or caliche caves, and spend approximately 98 percent of the time in these shelter sites (Nagy and Medica 1986). During active periods, they usually spend nights and the hotter part of the day in their burrow; they may also rest under shrubs or in shallow burrows (pallets). TOlioises may use an average of 7 to 12 burrows at any given time (Bulova 1994, TRW Environmental Safety Systems Inc. 1997).

Walde *el al.* (2003) observed that desert tortoises retreated into burrows when air temperature reached 91.0° F ± 3.55° F and ground temperatures reached F ± 6.05° F; 95 percent of observations of desert tortoises above ground occurred at air temperatures less than 91° F. The body temperature at which desert tortoises become incapacitated ranges from F to 113.2° F (Naegle 1976, Zimmerman *el al. 1994).*

Although desert tortoises eat alien plants, they generally prefer native forbs when available (Jennings 1993, Avery 1998). Consumption of alien plants may place them at a nitrogen and water deficit (Henen 1997). Droughts frequently occur in the desert, resulting in extended periods of low water availability. Periods of extended drought place tOlioises at even greater water and nitrogen deficit than during moderate or high rainfall years (Peterson 1996, Henen 1997). During a drought, more nitrogen than normal is required to excrete nitrogenous wastes, thus more rapidly depleting nitrogen stored in body tissues. Plants also play important roles in stabilizing soil and providing cover for protection from predators and heat.

Further information on the range, biology, and ecology of the deseli tortoise is available in Bury (1982), Bury and Germano (1994), Ernst *el al.* (1994), Jennings (1997), Service (2008), Tracy *el al.* 2004, Van Devender (2002), and collected papers in Chelonian Conservation and Biology (2002, Vol. 4, No.2), Herpetological Monographs (1994, No. 8), and the Desert Tortoise Council Proceedings.

3. Recovery Plan

On June 28, 1994, the Service approved the final Desert Tortoise (Mojave Population) Recovery Plan (Recovery Plan) (Service 1994). The Recovery Plan divides the range of the desert tortoise into 6 recovery units and recommends establishment of 14 desert wildlife management areas (DWMAs) throughout the recovery units. Within each DWMA, the Recovery Plan recommends implementation of reserve-level protection of desert tortoise populations and habitat, while maintaining and protecting other sensitive species and ecosystem functions. The design ofDWMAs should follow accepted concepts of reserve design. As part of the actions needed to accomplish recovery, the Recovery Plan recommends that land management within all DWMAs should restrict human activities that negatively impact desert tortoises (Service 1994). The DWMAs/areas of critical environmental concern (ACECs) have been designated by BLM through development or modification of their land-use plans in Arizona, Nevada, Utah, and parts of California.

The U.S. General Accounting Office (GAO) Report, *Endangered Species: Research Strategy and Long-Term Monitoring Neededfor the Mojave Desert Tortoise Recovery Program* (GAO 2002), directed the Service to periodically reassess the Recovery Plan to determine whether scientific information developed since its publication could alter implementation actions or allay some of the uncertainties about its recommendations. In response to the GAO report, the Service initiated a review of the existing Recovery Plan in 2003. In March 2003, the Service impaneled the Desert Tortoise Recovery Plan Assessment Committee (Committee) to assess the Recovery Plan. The Committee was selected to represent several important characteristics with emphasis on commitment to solid science. The charge to the Committee was to review the entire Recovery Plan in relation to contemporary knowledge to determine which parts of the recovery plan will need updating. The recommendations of the Committee were presented to the Service and Desert TOIioise Management Oversight Group on March 24,2004 (Tracy *et al.* 2004). The recommendations will be used as a guide by a recovery team of scientists and stakeholders to modify the Recovery Plan.

On November 3, 2004, the Service announced the formation of the Desert Tortoise Recovery Office (DTRO) and plans to revise the 1994 recovery plan and to coordinate with regional recovery implementation work groups to develop 5-year recovery action plans under the umbrella plan. A draft revision of the Recovery Plan was released to the public on August 4, 2008.

4. Recovery Units

The **Northeastern Mojave Recovery Unit** occurs primarily **in** Nevada, but **it** also extends into California along the Ivanpah Valley and into extreme southwestern Utah **and** northwestern Arizona. Vegetation within this unit is by creosote bush scrub, big galleta-scrub steppe, desert needlegrass scrub-steppe, and blackbrush scrub (in higher elevations). Topography is varied, with flats, valleys, alluvial fans, washes, and rocky slopes. Much of the nOlihern portion of the Northeastern Mojave Recovery Unit is characterized as basin and range, with elevations from 2,500 to 12,000 feet. Desert tortoises typically eat summer and winter annuals, cacti, and perennial grasses. Desert tortoises in this recovery unit, the northern portion of which represents the northernmost distribution of the species, are typically found **in** low densities (about 10 to 20 adults per square mile).

The Northeastern Mojave Recovery Unit includes the Mormon Mesa, Coyote Spring, Piute-Eldorado DWMAs; and a portion of the Beaver Dam Slope and Gold Butte-Pakoon

DWMAs. These areas generally overlap the Mormon Mesa, Piute-Eldorado, Beaver Dam Slope, and Gold Butte-Pakoon critical habitat units.

The Eastern Mojave Recovery Unit is situated primarily in California, but also extends into Nevada in the Amargosa, Pahrump, and Piute valleys. In the Eastern Mojave Recovery Unit, desert tortoises are often active in late summer and early autumn in addition to spring because this region receives both winter and summer rains and supports two distinct annual floras on which they can feed. Desert tortoises in the Eastern Mojave Recovery Unit occupy a variety of vegetation types and feed on summer and winter annuals, cacti, perennial grasses, and herbaceous perennials. They den singly in caliche caves, bajadas, and washes. This recovery unit is isolated from the Western Mojave Recovery Unit by the Baker Sink, a low-elevation, extremely hot and arid strip that extends from Death Valley to Bristol Dry Lake. The Baker Sink area is generally not considered suitable for desert tortoises. Desert tortoise densities in the Eastern Mojave Recovery Unit can vary dramatically, ranging from 5 to as much as 350 adults per square mile (Servicc 1994).

The Ivanpah, Piute-Eldorado, and Fenner DWMAs are included in the Eastern Mojave Recovery Unit which generally overlap the Ivanpah and Piute-Eldorado critical habitat units in California.

The Northern Colorado Recovery Unit is located completely in California. The 874,843-acre Chemehuevi DWMA is the sole conservation area for the desert tortoise in this recovery unit. Deselt tortoises in this recovery unit are found in the valleys, on bajadas and desert pavements, and to a lesser extent in the broad, well-developed washes. They feed on both summer and winter annuals and den singly in burrows under shrubs, in intershrub spaces, and rarely in washes. The climate is somewhat warmer than in other recovery units, with only 2 to 12 freezing days per year. The tOltoises have the California mitochondrial DNA (mtDNA) haplotype and phenotype. Allozyme frequencies differ significantly between this recovery unit and the Western Mojave, indicating some degree of reproductive isolation between the two.

The Eastern Colorado Recovery Unit is also located completely in California. The Chuckwalla DWMA and critical habitat unit; and a portion ofthe Joshua Tree DWMA and Pinto Basin critical habitat unit occur in this recovery unit. This recovery unit occupies well-developed washes, deselt pavements, piedmonts, and rocky slopes characterized by relatively species-rich succulent scrub, creosote bush scrub, and Blue Palo Verde-Ironwood-Smoke Tree communities. Winter burrows are generally shorter in length, and activity periods are longer than elsewhere due to mild winters and substantial summer precipitation. The tortoises feed on summer and winter annuals and some cacti; they den singly. They also have the California mtDNA haplotype and shell type.

Approximately 187,046 acres of critical habitat unit lie within the Chocolate Mountains Aerial Gunnery Range. The Marine Corps primarily uses the Chocolate Mountains Aerial Gunnery Range to SUppOlt target sites for aircraft and, to a lesser degree, ground-based mtillery; maintenance of the targets is the other primary activity in this area.

Target areas cover approximately 2,095 acres and forward arming and refueling points occupy 161 acres. Approximately 202.8 miles of roads cross this portion of the critical habitat unit.

The **Western Mojave Recovery Unit** occurs completely in California and is exceptionally heterogeneous and large. It is composed of the Western Mojave, Southern Mojave, and Central Mojave regions, each of which has distinct climatic and vegetational characteristics. The most pronounced difference between the Western Mojave and other recovery units is in timing of rainfall and the resulting vegetation. Most rainfall occurs in fall and winter and produces winter annuals, which are the primary food source of tortoises. Above ground activity occurs primarily in spring, associated with winter annual production. Thus, tortoises are adapted to a regime of winter rains and rare summer storms. Here, desert tortoises occur primarily in valleys, on alluvial fans, bajadas, and rolling hills in saltbrush, creosote bush, and scrub steppe communities. Tortoises dig deep burrows (usually located under shrubs on bajadas) for winter hibernation and summer aestivation. These desert tortoises generally den singly. They have a California mtDNA haplotype and a California shell type.

Four DWMAs occur wholly or partially within the Western Mojave Recovery Unit: Fremont-Kramer, Ord-Rodman, Superior-Cronese, and Joshua Tree. These areas approximate the Fremont-Kramer, Ord-Rodman, Superior-Cronese, and Pinto Basin critical habitat units.

The **Upper Virgin River Recovery Unit** encompasses all desert tOltoise habitat in Washington County, Utah, except the Beaver Dam Slope, Utah population. Only the Upper Virgin River DWMA and critical habitat unit occur in this recovery unit. The desert tOltoise population in the area of St. George, Utah is at the extreme northeastern edge of the species' range and experiences long, cold winters (about 100 freezing days) and mild summers, during which the tortoises are continually active. Here the animals live in a complex topography consisting of canyons, mesas, sand dunes, and sandstone outcrops where the vegetation is a transitional mixture of sagebrush scrub, creosote bush scrub, blackbush scrub, and a psammophytic community. Desert tortoises use sandstone and lava caves instead of burrows, travel to sand dunes for egg-laying, and use still other habitats for foraging. Two or more desert tortoises often use the same burrow. Shell morphology and mtDNA have not been studied in this recovery unit, but allozyme variation is similar to that found in the Northeastern Mojave Recovery Unit.

5. Distribution

Patterns of tortoise distribution are available from preliminary spatial analyses in Tracy *et al.* (2004). Their analyses revealed areas with higher probabilities of encountering both live and dead tortoises. In the western Mojave, areas with concentrations of dead tortoises without corresponding concentrations oflive tortoises were generally the same areas where declines have been observed in the past, namely the northern portion of the Fremont-Kramer critical habitat unit and the northwestern of the Superior-Cronese critical habitat unit. Limited data revealed large areas where dead tortoises, but no live tortoises, were observed in the Piute-Eldorado Valley and northern Coyote Springs Valley, Nevada, and the western and southern portions of the Ivanpah Valley, California, critical habitat unit. Most other recently sampled areas (mostly within critical habitat) reveal continued tortoise presence, although local population declines arc known within some of these areas, such as the Beaver Dam Slope, Arizona.

The prescriptions for recovery in the Recovery Plan assumed that preserving large blocks of habitat and managing threats in that habitat would be principally all that would be necessary to recover the species. Existing data have revealed population crashes that have occurred asynchronously across the range. There are reports that some populations, which have crashed previously, have subsequently increased in population density. Additionally, many known dense populations of desert tortoises have crashed. This suggests that density-dependent mortality occurs in desert tOltoise populations, and that population dynamics may be asynchronous.

The genetic distinctness of tortoise populations and their pathogens should be assessed to guide all manipulative management actions *(e.g.,* head starting, translocation, habitat restoration, and corridor management).

Threats

The Service identified key threats when the Mojave population of the desert tortoise was emergency listed as endangered and subsequently listed as a threatened species, which remain valid today. The Recovery Plan discusses threats and developed recovery objectives to minimize their effects on the desett tortoise and allow the tortoise to recover. Since becoming listed under the Act, more information is available on threats to the desert tortoise with some threats such as wildfires and alien plants affecting large areas occupied by tortoises.

Alien plants continue to contribute towards overall degradation or habitat quality for the desert tortoise. Land managers and field scientists identified 116 species of alien plants in the Mojave and Colorado Desetts (Brooks and Esque 2002). The proliferation of non-native plant species has also contributed to an increase in fire frequency in tortoise habitat by providing sufficient fuel to carry fires, especially in the intershrub spaces that are mostly devoid of native vegetation (Service 1994; Brooks 1998; Brown and Minnich 1986). Changes in plant communities caused by alien plants and recurrent fire may negatively affect the desert tortoise by altering habitat structure and species composition of their food plants (Brooks and Esque 2002).

Changing ecological conditions as a result of natural events or human-caused activities may stress individual tortoises and result in a more severe clinical expression of URTD (Brown *et al.* 2002). For example, the proliferation of non-native plants within the range of the tortoise has had far-reaching impacts on tOltoise populations. Tortoises have been documented to prefer native vegetation over non-natives (Tracy *et al.* 2004). Non-native annual plants in desert tortoise critical habitat in the western Mojave Desert were identified to compose over 60 percent of the annual biomass (Brooks 1998). The reduction in quantity and quality offOl'age may stress tortoises and make them more susceptible to drought- and disease-related mortality (Brown *et al.* 1994). Malnutrition has been associated with several disease outbreaks in other tUliles (Borysenko and Lewis 1979).

Numerous wildfires occurred in desert tortoise habitat across the range of the desert tortoise in 2005 due to abundant fuel from the proliferation of non-native plant species after a very wet winter. These wildfires heavily impacted two of the six desert tortoise recovery units, burning almost 19 percent of desert tortoise habitat in the Upper Virgin River and 10 percent in the NOliheastern Mojave (Table 1). In the Upper Virgin River Recovery Unit, 19 percent of the Upper Virgin River critical habitat unit (CHU) burned. In the Northeastern Mojave Recovery Unit, three CHUs were impacted: about 23 percent of the Beaver Dam Slope CHU burned, 13 percent of the Gold Butte-Pakoon CHU, and 4 percent of the Mormon Mesa CHU. Although it is known that tortoises were burned and killed by the wildfires, tOlioise mortality estimates are not available.

Table 1. Acres of desert tortoise habitat burned in each recovery unit during 2005.

Recovery Unit	Habitat Burned (acres)	% Habitat Burned	CH* Burned (acres)	%CH Burned
Upper Virgin River**	10,446	<19	10,446	19
Northeastern Mojave***	500,000	10	124,782	11
Eastern Mojave	6,000	< 1	1,219	<1
Western Mojave	0	0	0	0
Northern Colorado	0	0	0	0
Eastern Colorado	0	0	0	0
Total	**516,446**	**-**	**136,447**	**-**

* CH – ellt;eal hab,tat
** Estimates only for Upper Virgin River; needs GIS analysis.
*** Potential habitat was mapped and calculated as Mojave Desert less than 4,200 feet in elevation minus playas, open water, and developed and agricultural lands.

Disease and raven predation have been considered important threats to the desert tortoise since its emergency listing in 1989. What is currently known with celiainty about disease in the desert tortoise relates entirely to individual tortoises and not populations; viliually nothing is known about the demographic consequences of disease (Tracy *et al. 2004).* Disease was identified in the 1994 Recovery Plan as an important threat to the desert tortoise. Disease is a natural phenomenon in wild populations of animals and can contribute to population declines by increasing mortality and reducing reproduction. However, URTD appears to be a complex, multi-factorial disease interacting with other stressors to affect deseli tortoises (Brown *et al.* 2002; Tracy *et al.* 2004). The disease probably occurs mostly in relatively dense desert tortoise populations, as mycoplasmal infections are dependent upon higher densities of the host (Tracy *et al. 2004).*

From 1969 to 2004 the numbers of common ravens in the west Mojave Desert increased approximately 700 percent (Boarman and Kristan 2006). Population increases have also been noted at other locations pmiicularly in the California Desert. This many-fold increase above historic levels and a shift from a migratory species to a resident species is due in a large part to recent human subsidies of food, water, and nest sites (Knight *et al.* 1993, Boarman 1993, Boarman and Berry 1995). While not all ravens may include tortoises as significant components of their diets, these birds are highly opportunistic in their feeding patterns and concentrate on easily available seasonal food sources, such as juvenile tortoises.

Boarman (2002a) identified the following major categories of threats: Agriculture, collection by humans, construction activities, disease, drought, energy and mineral development, fire, garbage and litter, handling and deliberate manipulation of tortoises, invasive [alien] plants, landfills, livestock grazing, military operations, noise and vibration, off-road [OHV] activities, predation, non-off-road vehicle recreation, roads, highways and railroads, utility corridors, vandalism, and wild horses and burros. For additional information on threats to the desert tortoise refer to Boarman (2002a), Tracy *et al.* (2004), and Service (2008).

6. Reproduction

Desert tortoises possess a combination of life history and reproductive characteristics that affect the ability of populations to survive external threats. Tortoises grow slowly, require IS to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential (Turner *et al.* 1984; Bury 1987; Tracy *et al. 2004).*

Choice of mate is mediated by aggressive male-male interactions and possibly by female choice (Niblick *et al.* 1994). Tortoises in the West Mojave Desert may exhibit breeding dispersal movements, typical of other vertebrates, ranging from I to 10 miles in a single season (Sazaki *et al.* 1995). The advantage of pre-breeding dispersal may be to find a more favorable environment in which to reproduce. However, risks include increased mortality from predation, exposure, starvation, or anthropogenic factors *(e.g.,* motor vehicle mortality).

The average clutch size is 4.5 eggs (range I to 8), with clutches deposited per year (Turner *et al.* 1986). Clutch size and number probably depend on female size, water, and annual productivity of forage plants in the current and previous year (Turner *et* al. 1984, 1986; Henen 1997). The ability to alter reproductive output in response to resource availability may allow individuals more options to ensure higher lifetime reproductive success. The interaction of longevity, late maturation, and relatively low annual reproductive output causes tortoise populations to recover slowly from natural or anthropogenic decreases in density. To ensure population stability or increase, these factors also require relatively high juvenile survivorship (75 to 98 percent per year), particularly when adult mortality is elevated (Congdon *et* al. 1993). Most eggs are laid in spring (April through June) and occasionally in fall (September to October). Eggs are laid in sandy or friable soil, often at the entrance to burrows. Hatching occurs 90 to 120 days later, mostly in late summer and fall (mid-August to October). Eggs and young are untended by the parents.

Tortoise sex determination is environmentally controlled during incubation (Spotila *et al.* 1994). Hatchlings develop into females when the incubation (*i.e.*, soil) temperature is greater than 88.7° F) and males when the temperature is below that (Spotila *et al. 1994).* Mortality is higher when incubation temperatures are greater than 95.5° F or less than 78.8° F. The sensitivity of embryonic tortoises to incubation temperature may make populations vulnerable to unusual changes in soil temperature *(e.g.,* from changes in vegetation cover).

At Yucca Mountain, Nye County Nevada (Northeastern Mojave Recovery Unit), Mueller *et al.* (1998) estimated that the mean age of first reproduction was 19 to 20 years; clutch size (I to 10 eggs) and annual fecundity (0 to 16 eggs) were related to female size but annual clutch frequency (0 to 2) was not. Further, Mueller suggested that body condition during July to October may determine the number of eggs a tortoise can produce the following spring. McLuckie and Fridell (2002) determined that the Beaver Dam Slope desert tortoise population, within the Northeastern Mojave Recovery Unit, had a lower clutch frequency (1.33 ± 0.14) per reproductive female and fewer reproductive females (14 out of21) when compared with other Mojave desert tortoise populations. In the 1990's, Beaver Dam Slope experienced dramatic population declines due primarily to disease and habitat degradation and alteration (Service 1994). The number of eggs that a female desert tortoise can produce in a season is dependent on a variety offactors including environment, habitat, availability of forage and drinking water, and physiological condition (Henen 1997; McLuckie and Fridell 2002).

7. **Numbers**

Rangewide tortoise population monitoring began in 200I and is conducted annually. The status and trends of desert tortoise populations are difficult to determine based only upon assessment of tortoise density due largely to their overall low abundance, subterranean sheltering behavior, and cryptic nature of the species. Thus, monitoring and recovery should include a comprehensive assessment of the status and trends of threats and habitats as well as population distribution and abundance. Studies during early research on desell tortoises focused on basic biology and demography and were largely centered in areas with high densities of tortoises. These high-density areas were used to establish permanent (long-term) study plots that have been studied at various intervals from 1979 through the present, while some low-density plots were discontinued (Berry 1984; K. Berry, U.S. Geological Survey, pel's. comm. 2003, as reported in Tracy *et al. 2004).* However, historic estimates of desert tortoise density or abundance do not exist at the range-wide or regional level for use as a baseline. While a substantial body of data has been collected from long-term study plots and other survey efforts over the years, plot placement is generally regarded as a factor limiting demographic and trend conclusions only to those specific areas. Tracy *et al.* (2004) concluded that estimating accurate long-term trends of desert tortoise populations, habitat, and/or threats across the range was not feasible based on the combined suite of existing data and analyses. Instead, these data provide general insight into the range-wide status of the species and show appreciable declines at the local level in many areas (Luke *et al.* 1991; Berry 2003; Tracy *et al.* 2004).

In an attempt to refine the long-term monitoring program for the deselt tortoise, annual range-wide population monitoring using line distanee transeets began in 200I (1999 in the Upper Virgin River Reeovery Unit; MeLuekie *et al.* 2002) and is the first eomprehensive effort undertaken to date to estimate densities aeross the range of the speeies (Serviee 2006). Rangewide sampling was initiated during a severe drought that intensified in 2002 and 2003, partieularly in the western Mojave Desert in California. At the time the Recovery Plan was written, there was less consideration of the potentially impOltant role of drought in the desert ecosystem, pmtieularly regarding desert tortoises. In the meantime, studies have doeumented vulnerability of juvenile (Wilson *et al.* 200I) and adult tOltoises (Peterson 1994, Peterson 1996, Henen 1997, Longshore *et al.* 2003) to drought.

The monitoring program is designed to deteet long-term population trends, so density estimates from any brief time period *(e.g.,* 2001 to 2005) would be expected to detect only catastrophic declines or remarkable population increases. Therefore, following the first 5 years of the long-term monitoring project, the goal was not to document trends within this time period, but to gather information on baseline densities and annual and regional (between recovery unit) variability (Service 2006). Density estimates of adult tortoises varied among recovery units and years. Only if this variability is associated with consistent changes between years will monitoring less than 25 years describe important trends. For instance, considerable decreases in density were reported in 2003 in the Eastern Colorado and Western Mojave recovery units, with no correspondingly large rebound in subsequent estimates (Appendix A). Until the underlying variability that may affect our interpretation of these first years of data can be identified, inferences as to the meaning of these data should not be made. Over the first 5 years of monitoring, tortoises were least abundant in the Northeast Mojave Recovery Unit (I to 3 tortoises per kilometer^2 [2 to 8 tOltoises per mile^2]; Service 2006), and the highest reported densities occurred in the Upper Virgin River Recovery Unit (17 to 30 tortoises per kilometer^2 [44 to 78 tortoises per mile^2]; McLuckie *et al.* 2002,2006).

There are many natural causes ofmOltality, but their extents are difficult to evaluate and vary from loeation to location. Native predators known to prey on tortoise eggs, hatchlings, juveniles, and adults include: coyote, kit fox, badger *(Taxidea taxus),* skunks *(Spilogale putorius),* common ravens, golden eagles *(Aquila ehrysaetos),* and Gila monsters *(Heloderma suspeetum).* Additional natural sources of mortality to eggs, juvenile, and adults may include desiccation, starvation, being crushed (including in burrows), internal parasites, disease, and being turned over onto their backs during fights or courtship (Luckenbach 1982, Turner *et al.* 1987). Free-roaming dogs cause mOltality, injury, and harassment of desert tortoises (Evans 2001). Population models indieate that for a stable population to maintain its stability, on average, no more than 25 pereent of the juveniles and 2 pereent of the adults ean die eaeh year (Congdon *et al.* 1993, Service 1994). However, adult mortality at one site in the West Mojave was 90 pereent over a 13-year period (Berry 1997). Morafka *et al.* (1997) reported 32 pereent mortality over 5 years among free-ranging and semi-eaptive hatehling and juvenile tortoises (up to 5 years old) in the West Mojave. When the 26 that were known to have been preyed on by ravens were removed from the analysis, mOl1ality dropped to 24 percent. Turner *el al.* (1987) repo11ed an average annualm0l1ality rate of 19 to 22 percent among juveniles over a 9-year period in the East Mojave.

Declines in tortoise abundance appear to correspond with increased incidence of disease in some tortoise populations. The Goffs permanent study plot in Ivanpah Valley, California, suffered 92 to 96 percent decreases in tortoise density between 1994 and 2000 (Berry 2003). The high prevalence of disease in Goffs tortoises likely contributed to this decline (Christopher *et al.* 2003). Upper respiratory tract disease has not yet been detected at permanent study plots in the Colorado Desert of California, but is prevalent at study plots across the rest of the species' range (Berry 2003) and has been shown to be a contributing factor in population declines in the western Mojave Desert (Brown *et al.* 2002; Christopher *el al.* 2003). High mortality rates at permanent study plots in the northeastern and eastern Mojave appear to be associated with incidence of shell diseases in tortoises (Jacobson *et al.* 1994). Low levels of shell diseases were detected in many populations when the plots wcre first established, but were found to increase during the 1980s and 1990s (Jacobson *el al.* 1994; Christopher *el al.* 2003). A herpesvirus has recently been discovered in desert tortoises, but little is known about its effects on tortoise populations at this time (Berry *el al.* 2002; Origgi *et al. 2002).*

The general trend for desert tortoises within the California Desert is one of decline. Tracy *et al.* (2004) concluded that the apparent downward trend in desert tOl10ise populations in the western portion of the range that was identified at the time oflisting is valid and ongoing. Results from other portions of the range were inconclusive, but recent surveys of some populations found too few tortoises to produce population estimates *(e.g.,* 2000 survey of the Beaver Dam Slope, Arizona), suggesting that declines may have occurred more broadly. Transects in the Western Mojave Recovery Unit that did not detect any sign over large areas of previously occupied habitat and the numerous carcasses found on permanent study plots provide evidence of a decline. During line distance sampling conducted in 8 DWMAs in California in 2003, 930 carcasses and 438 live desert tortoises were detected; more carcasses than live animals were detected in every study area (Woodman 2004). In 2004, workers conducting line distance sampling in California detected 1,796 carcasses and 534 live desert tortoises; more carcasses were detected than live animals in every study area (Woodman 2005). Below, we elaborate on patterns within each recovery unit.

Northeastern Mojave Recovery Unit. A kernel analysis was conducted in 2003-2004 for the desert t0l10ise (Tracy *el al.* 2004) as part of the reassessment of the 1994 Recovery Plan. The kernel analyses revealed several areas in which the kernel estimations for live tortoises and carcasses did not overlap. The pattern of non-overlapping kernels that is of greatest concern is those in which there were large areas where the kernels encompassed carcasses but not live animals. These regions represent areas within DWMAs where there were likely recent die-offs or declines in tortoise populations. The kernel analysis indicated large areas in the Piute-Eldorado Valley where there were carcasses but no live tortoises. For this entire area in 2001, there were 103 miles of transects walked, and a total of 6 live and IS dead t0l10ises found, resulting in a live encounter rate of 0.06 tortoises per mile of transect for this area. This encounter rate was among the lowest that year for any of the areas sampled in the range of the Mojave desert tortoise (Tracy *et al. 2004).*

Results of desert tortoise surveys at three survey plots in Arizona indicate that all three sites have experienced significant die-offs. Six live tortoises were located in a 2001 survey of the Beaver Dam Slope Exclosure Plot (Walker and Woodman 2002). Three had definitive signs of URTD, and two of those also had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 31 live tortoises in 1996, 20 live tortoises in 1989, and 19 live tortoises in 1980. The 2001 survey report indicated that it is likely that there is no longer a reproductively viable population of tortoises on this study plot. Thirty-seven live tortoises were located in a 2002 survey of the Littlefield Plot (Young *et al.* 2002). None had definitive signs of URTD. Twenty-three tortoises had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 80 live tortoises in 1998 and 46 live tortoises in 1993. The survey report indicated that the site might be in the middle of a die-off due to the high number of carcasses found since the site was last surveyed in 1998. Nine live tortoises were located during the mark phase of a 2003 survey of the Virgin Slope Plot (Goodlett and Woodman 2003). The surveyors determined that the confidence intervals of the population estimate would be excessively wide and not lead to an accurate population estimate, so the recapture phase was not conducted. One tortoise had definitive signs of URTD. Seven tortoises had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 41 live tortoises in 1997 and 15 live tortoises in 1992. The survey report indicated that the site may be at the end of a die-off that began around 1996-1997.

Eastern Mojave Recovery **Unit.** The permanent study plot in the Ivanpah Valley is the only such plot in this DWMA; consequently, we cite information from that plot herein, although it is located within the Mojave National Preserve. Data on desert tortoises on a permanent study plot in this area were collected in 1980, 1986, 1990, and 1994; the densities of desert tortoises of all sizes per square mile were 386, 393, 249, and 164, respectively (Berry 1996).

The Shadow Valley DWMA lies north of the Mojave National Preserve and west of the Clark Mountains. It occupies approximately 101,355 acres. Data on desert tortoises on a permanent study plot in this area were collected in 1988 and 1992; the densities of desert tortoises of all sizes per square mile were 50 and 58, respectively (Berry 1996).

The Piute-Fenner DWMA lies to the east of the southeast portion of the Mojave National Preserve. It occupies approximately 173,850 acres. The permanent study plot at Goffs is the only such plot in this DWMA; consequently, we cite information from that plot herein, although it is located within the Mojave National Preserve. Data on desert tortoises on the permanent study plot were collected in 1980, 1990, and 1994; Berry (1996) estimated the densities of desert tortoises of all sizes at approximately 440, 362, and 447 individuals per square mile, respectively. As Berry (1996) noted, these data seem to indicate that this area supported "one of the more stable, high density populations" of desert tortoises within the United States. Berry (1996) also noted that high proportion of the animals (had) shell lesions." In 2000, only 30 live desert tortoises were found; Berry (2000) estimated the density of desert tortoises at approximately 88 animals per square mile. The shell and skeletal remains of approximately 393 desert tortoises were collected; most of these animals died between 1994 and 2000. Most of the desert tortoises exhibited signs of shell lesions; three salvaged deselt tOltoises showed abnormalities in the liver and other organs and signs of shell lesions. None of the three salvaged deselt tortoises tested positive for upper respiratory tract disease.

Ivanpah and Piute-Eldorado valleys contained study plots that were analyzed in the Eastern Mojave Recovery Unit analysis. While there was no overall statistical trend in adult density over time, the 2000 survey at Goffs and the 2002 survey at Shadow Valley indicate low densities of adult tortoises relative to earlier years. Unfortunately, there are no data in the latter years for all five study plots within this recovery unit, and therefore, while there is no statistical trend in adult densities, we cannot conclude that tOltoises have not experienced recent declines in this area. The probability of finding a carcass on a distance sampling transect was considerably higher for Ivanpah, Chemehuevi, Fenner, and Piute-Eldorado, which make up the Eastern Mojave Recovery Unit.

Northern Colorado Recovery Unit. Two permanent study plots are located within the Chemehuevi DWMA. At the Chemehuevi Valley and Wash plot, 257 and 235 desert tortoises were registered in 1988 and 1992, respectively (Berry 1999). During the 1999 spring survey, only 38 live desert tortoises were found. The shell and skeletal remains of at least 327 deselt tortoises were collected; most, if not all, of these animals died between 1992 and 1999. The frequency of shell lesions and nutritional deficiencies appeared to be increasing and may be related to the mortalities.

The Upper Ward Valley permanent study plot was surveyed in 1980, 1987, 1991, and 1995; Berry (1996) estimated the densities of desert tortoises of all sizes at approximately 437,199,273, and 447 individuals per square mile, respectively.

Eastern Colorado Recovery Unit. This recovery unit is also located completely **in** California, occupy well-developed washes, desert pavements, piedmonts, and rocky slopes characterized by relatively species-rich succulent scrub, creosote bush scrub, and Blue Palo Verde-Ironwood-Smoke Tree communities. Winter burrows are generally shorter in length, and activity periods are longer than elsewhere due to mild winters and substantial summer precipitation. The tortoises feed on summer and winter annuals and some cacti; they den singly. They also have the California mtDNA haplotype and shell type.

Two permanent study plots are located within this DWMA. At the Chuckwalla Bench plot, Berry (1996) calculated approximate densities of578, 396,167,160, and 182 desert tortoises per square mile in 1979, 1982, 1988, 1990, and 1992, respectively. At the Chuckwalla Valley plot, Berry (1996) calculated approximate densities of 163, 181, and 73 desert tortoises per square mile in 1980, 1987, and 1991, respectively. Tracy *et al.* (2004) concluded that these data show a statistically significant decline in the number of adult desert tortoises over time; they further postulate that the decline on the Chuckwalla

Bench plot seemed to be responsible for the overall significant decline within the recovery unit.

The kernel analysis of the Eastern Colorado Recovery Unit shows that the distributions of the living tortoises and carcasses overlap for most of the region. The Chuckwalla Bench study plot occurs outside the study area, which creates a problem in evaluating what may be occurring in that area of the recovery unit. However, the few transects walked in that portion ofthe DWMA yielded no observations oflive or dead tortoises. This illustrates our concern for drawing conclusions from areas represented by too few study plots and leaves us with guarded concern for this region. The percentage of transects with live animals was relatively high for most DWMAs within the Eastern Colorado Recovery Unit. In addition, the ratio of carcasses to live animals was low within this recovery unit relative to others.

Western Mojave Recovery Unit. This recovery unit includes the proposed Pinto Mountains, Ord-Rodman, Superior-Cronese, and Fremont-Kramer DWMAs. Heaton *et al.* (2004) estimated that 20,420 to 41,224 adult desert tortoises reside in the Western Mojave Recovery Unit; this range was based on extrapolation of data collected during line distance sampling.

The proposed 117,120-acre Pinto Mountains DWMA is located in the southeastern portion of the Western Mojave Recovery Unit. No permanent study plots are located in this proposed DWMA. Little information exists on the densities of desert tortoises in this area. Tracy *et al.* (2004) noted that the distribution of carcasses and live descrt tortoises appeared to be what one would expect in a "normal" population of desert tOltoises; that is, carcasses occurred in the same areas as live animals and were not found in extensive areas in the absence of live desert tOltoises.

The proposed Ord-Rodman DWMA is located to the southeast of the city of Barstow. As proposed, it would cover approximately 248,320 acres. The recovery plan notes that the estimated density of desert tortoises in this area is 5 to 150 animals per square mile (Service 1994). Three permanent study plots are located within and near this proposed DWMA.

The proposed Superior-Cronese DWMA is located north of the Ord-Rodman DWMA; two interstate freeways and rural, urban, and agricultural development separate them. This proposed DWMA covers 616,320 acres. No permanent study plots have been established in this area; the density of desert tortoises has been estimated through numerous triangular transects and line distance sampling effOlts. This DWMA SUppOltS densities of approximately 20 to 250 desert tortoises per square mile (Service 1994).

The proposed Fremont-Kramer DWMA is located west of the Superior-Cronese DWMA; the two DWMAs are contiguous. This proposed DWMA covers approximately 494,720 acres. The recovery plan notes that the estimated density of desert tortoises in this area was 5 to 100 animals per square mile (Service 1994).

Berry (1996) notes that the overall trend in this proposed DWMA is "a steep, downward decline" and identifies predation by common ravens and domestic dogs, off-road vehicle activity, illegal collecting, upper respiratory tract disease, and environmental contaminants as contributing factors.

During the summers of 1998 and 1999, the BLM funded surveys of over 1,200 transects over a large area of the western Mojave Desert. These transects failed to detect sign of desert tortoises in areas where they were previously considered to be common. Although these data have not been fully analyzed and compared with previously existing information, they strongly suggest that the number of desert tortoises has declined substantially over large areas of the western Mojave Desert. The Desert Tortoise Recovery Plan Assessment Committee also noted that the Western Mojave Recovery Unit has experienced declines in the number of deselt tortoises (Tracy *et al. 2004)*.

The Western Mojave has experienced marked population declines as indicated in the Recovery Plan and continues today. Spatial analyses of the Western Mojave show areas with increased probabilities of encountering dead rather than live animals, areas where kernel estimates for carcasses exist in the absence of live animals, and extensive regions where there are clusters of carcasses where there are no clusters of live animals. Collectively, these analyses point generally toward the same areas within the Western Mojave, namely the northern portion of the Fremont-Kramer DWMA and the northwestern part of the Superior-Cronese DWMA. Together, these independent analyses, based on different combinations of data, all suggest the same conclusion for the Western Mojave. Data are not currently available with sufficient detail for most of the range of the desert tortoise with the exception of the Western Mojave (Tracy *et al. 2004)*.

Upper Virgin River Recovery Unit. The recovery plan states that desert tortoises occur in densities of up to 250 adult animals per square mile within small areas of this recovery unit; overall, the area supports a mosaic of areas supporting high and low densities of desert tortoises (Service 1994). The Utah Division of Wildlife Resources (UDWR) has intensively monitored desert tortoises, using a distance sampling teclmique, since 1998. Monitoring in 2003 indicated that the density of desert tOltoises was approximately 44 per square mile throughout the reserve. This density represents a 41 percent decline since monitoring began in 1998 (McLuckie *et al.* 2006). The report notes that the majority of deselt tortoises that died within one year (n=64) were found in areas with relatively high densities; the remains showed no evidence of predation.

1n the summer of 2005, approximately 10,446 acres of deselt tortoise habitat burned in the Red Cliffs Desert Reserve. UDWR estimated that as amany as 37.5 percent of adult desert tortoises may have died as a direct result of the fires (McLuckie *et al. 2006)*.

8. Desert Tortoise Critical Habitat- Rangewide Status

Desert tOltoise critical habitat was designated by the Service to identify the key biological and physical needs of the desert tortoise and key areas for recovery, and focuses conservation actions on those areas. Desert tortoise critical habitat is composed of specific geographic areas that contain the primary constituent elements of critical habitat, consisting of the biological and physical attributes essential to the species' conservation within those areas, such as space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats. The specific primary constituent elements of desert tortoise critical habitat are:

I. sufficient space to support viable populations within each of the six recovery units, and to provide for movement, dispersal, and gene flow;

2. quality and quantity offorage species and the proper soil conditions to provide for the growth of these species;

3. suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites;

4. sufficient vegetation for shelter from temperature extremes and predators; and

5. habitat protected from disturbance and human-caused mortality.

CHUs were based on recommendations for DWMAs outlined in the *Draft Recovery Plan for the Desert Tortoise (Mojave Population)* (Service 1993). These DWMAs are also identified as desert tortoise ACECs by BLM. Because the critical habitat boundaries were drawn to optimize reserve design, the critical habitat unit may contain both "suitable" and "unsuitable" habitat. Suitable habitat can be generally defined as areas that provide the primary constituent elements.

Although recovery of the tortoise will focus on DWMAs/ACECs, section II.A.6. of the Recovery Plan and section 2(b) of the Act provide for protection and conservation of ecosystems on which federally-listed threatened and endangered species depend, which includes both recovery and non-recovery areas. The Mojave Desert ecosystem, of which the desert tortoise and its habitat are an integral part, consists of a dynamic complex of plant, animal, fungal, and microorganism communities and their associated nonliving environment interacting as an ecological unit (Noss and Cooperrider 1994). Actions that adversely affect components of the Mojave Desert ecosystem may directly or indirectly affect the desert tortoise. The Recovery Plan further states that desert tOltoises and habitat outside recovery areas may be impOltant in recovery of the tortoise. Healthy, isolated tortoise populations outside recovery areas may have a better chance of surviving catastrophic effects such as disease, than large, contiguous populations (Service 1994).

The Recovery Plan recommended DWMAs and subsequently the Service designated CHUs based on these proposed DWMAs (Service 1993). When designated, desert tortoise critical habitat contained all the primary constituent elements of desert tortoise critical habitat. The following seven principles of conservation biology serve as the standards by which the Service determines whether or not the CHUs are functioning properly:

(I) Reserves should be well-distributed across the species' range. The entire range of the Mojave desert tortoise occurs within one of the six recovery units identified in the

Recovery Plan and at least one DWMA and CHU occurs within each recovery unit. The reserves remain well-distributed across the range of the desert tortoise.

(2) Reserves should contain large blocks 0/habitat with large populations a/target species. The desert tortoise requires large, contiguous areas of habitat to meet its life requisites. Each DWMA and its associated CHUs that were designated to conserve contiguous blocks of habitat that exceed 500,000 acres, with the exception of the Upper Virgin River Recovery Unit (Table 2). The Upper Virgin River Recovery Unit does not meet the minimum size requirement identified in the Recovery Plan, however the Service anticipates that reserve-level management will adequately conserve the desert tortoise within this recovery unit Designation of CHUs were based largely on transect data and included areas with the largest populations of desert tortoises.

(3) Blocks a/habitat should be close together. This principle was met when CHUs were designated and remains valid.

(4) Reserves should contain contiguous rather than/ragmented habitat. This principle was met when CHUs were designated and generally continue to be met. Desert tortoise-proof fencing has been constructed along major roads and highways that traverse critical habitat including Interstate 15 in Nevada and California (Ivanpah Valley *DWMAICHU),* U.S. Highway 95 (US 95) in Nevada (Piute-Eldorado *DWMAICHU),* and Highway 58 in California (Fremont-Kramer *DWMAICHU).* Major roads and highways alone constitute a barrier to tortoise movements without fencing; however, the fencing minimized take of tortoises and culverts or underpasses allow for limited tortoise movement across the road or highway.

(5) Habitat patches should contain minimal edge-to-area ratios. This principle was met when CHUs were designated and generally continue to be valid. Notable exceptions include the northern Gold Butte-Pakoon CHU, and the southern termini of the Mormon Mesa, Ivanpah Valley, and Chuckwalla CHUs which have large edge-to-area rations and further compromised by highways that traverse these relatively narrow areas within the CHUs. Pending development of private lands in Coyote Springs Valley would substantially increase the edge-to-area ratio in the southwestern section of the Mormon MesaCHU.

(6) Blocks should be interconnected by corridors or linkages connecting protected, preferred habitat/or the target species. Most CHUs are contiguous with another CHU with the exception ofOrd-Rodman, Ivanpah Valley, Gold Butte Pakoon, and Upper Virgin River CHUs. Interstate 15 and the Virgin River separate the Gold Butte-Pakoon CHU from other CI-IUs in the Northeastern Mojave Recovery Unit. Similarly, Interstate 40 separates the Piute-Eldorado and Chemehuevi CHUs, and Ord Rodman and Superior-Cronese CHUs. Pending development in Coyote Springs Valley may fragment the Mormon Mesa DWMA by restricting tortoise movements between the Kane Springs ACEC to the north and Coyote Springs ACEC to the south which is dependant upon the extent of development.

(7) Blocks of habitat should be roadless or otherwise inaccessible to humans. Achieving this principle is the most problematic. A 2001 inventory of roads in the Western Mojave suggests that road density increased from the mid-1980's. Further evaluation should be conducted as some of the recently mapped roads were actually historical roads especially with the advent of effective mapping capabilities (Tracy *et al 2004)*. Roads proliferate desert tortoise habitat rangewide and may be increasing in density (Tracy *et al. 2004).*

The recommendations for desert tortoise critical habitat in the Recovery Plan include elimination of specified activities that are incompatible with desert tortoise conservation including habitat destruction that diminishes the capacity of the land to support desert tortoises, and grazing by livestock, and feral burros and horses. Since approval of the Recovery Plan, livestock grazing in desert tOlioise critical habitat has been substantially reduced. BLM and NPS manage for zero burros in Nevada and the California DeseJi Managers Group developed a burro management plan in 2004.

Table 2. Desert Tortoise CHUs, DWMAs, and Recovery Units- Size and Location

CHU	**SIZE** (ac.)	**STATE**	**DWMA**	**RECOVERY UNIT**
Chemehuevi	937,400	CA	Chemehuevi	Northern Colorado
Chuckwalla	1,020,600	CA	Chuckwalla	Eastern Colorado
Fremont-Kramer	518,000	CA	Fremont-Kramer	Western Mojave
1vanpah Valley	632,400	CA	Ivanpah Valley	Eastern Mojave
Pinto Mtns.	171,700	CA	Joshua Tree	Western Mojave/ Eastern Colorado
Ord-Rodman	253,200	CA	Ord-Rodman	Western Mojave
Piute-Eldorado- CA Piute-Eldorado- NV	453,800 516,800	CA NV	Fenner Piute-Eldorado	Eastern Mojave Northeastern & Eastern Mojave
Superior-Cronese	766,900	CA	Superior-Cronese Lakes	Western Mojave
Beaver Dam:	87,400 74,500 42,700	NV UT AZ	BeaverDam Beaver Dam Beaver Dam	Northeastern Mojave (all)
Gold Butte-Pakoon	192,300 296,000	NV AZ	Gold Butte-Pakoon Gold Butte-Pakoon	Northeastern Mojave (all)
Mormon Mesa	427,900	NV	Mormon Mesa Coyote Spring	Northeastern Mojave
Upper Virgin River	54,600	UT	Upper Virgin River	Upper Virgin River

The status of the desert tortoise and its critical habitat has been impacted by decades of human activities. In their 199I report, the GAO found that livestock grazing practices of the late 1880s and early 1990s badly damaged desert lands in the southwest. Domestic livestock grazing on BLM's hot desert allotments continue to pose the greatest risk of long-term environmental damage to a highly fragile resource. The GAO offered several options for consideration by Congress including the discontinuation of livestock grazing in hot desert areas. They concluded that BLM did not have the resources to properly manage the intensity of livestock grazing in hot deserts. Without sufficient monitoring data, BLM will not have the necessary data to change active preference levels and overgrazing may occur (GAO 1991).

Further information on deseli tortoise critical habitat can be found in the following documents:

- Desert Tortoise Recovery Plan Assessment Report (Tracy *el al.* 2004)- all CHUs

- Final Environmental Impact Report and Statement for the West Mojave Plan (BLM 2005)- Fremont-Kramer CHU, Superior-Cronese CHU, Ord-Rodman CHU, and Pinto Mountains CHU

- Mojave National Preserve General Management Plan (National Park Service 2002)- Ivanpah Valley CHU and Piute-Eldorado CHU

- Northern and Eastern Colorado Coordinated Management Plan (BLM 2002a)- Chemehuevi CHU, Pinto Mountains CHU, and Chuckwalla CHU

- Northern and Eastern Mojave Deseli Management Plan (BLM 2002b)- Ivanpah Valley CHU, Piute-Eldorado CHU, and Chemehuevi CHU

- Clark County Multiple Species HCP (RECON 2000)- Beaver Dam Slope CHU, Mormon Mesa CHU, Gold Butte-Pakoon CI-IU, and Piute-Eldorado CHU

- Washington County HCP (Washington County Commission 1995)- Upper Virgin River CHU

- Biological Assessment the Proposed Addition of Maneuver Training Land at Fort Irwin, CA (U.S. Army National Training Center 2003)- Superior-Cronese CHU

- Desert Tortoise (Mojave Population) Recovery Plan and Proposed Desert Wildlife Management Areas for Recovery of the Mojave Population of the Desert Tortoise (companion document to the Deseli Tortoise Recovery Plan) (Service 1994)- all CHUs

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Appendix A. Summary of density estimates for each of the 1994-designated recovery units. "Adult tortoises" is the number of adults and subadults (midline carapace length See Service (2006) for additional details.

Recovery Unit	Year	No. of Transects	Length (km)	Adult Tortoises	Encounter Rate	Std Error	Density (km)	Std Error	Coefficient of Variation (%)	95% Confidence Interval Low	95% Confidence Interval High
Eastern Mojave	2001	224	371.6	17	0.046	0.012	3.00	0.784	26.2	1.81	4.98
	2002	284	1120.4	56	0.050	0.008	4.11	0.797	17.0	2.94	5.72
	2003	59	215.1	11	0.051	0.016	2.76	0.874	31.7	1.49	5.12
	2004	140	1511.2	113	0.075	0.010	5.57	0.750	13.4	4.28	7.26
	2005	165	1839.5	108	0.059	0.006	5.54	0.656	11.8	4.39	6.99
Eastern Colorado	2001	205	328.0	54	0.165	0.025	10.80	1.712	15.9	7.91	14.73
	2002	104	416.7	42	0.101	0.019	8.28	1.670	20.2	5.58	12.30
	2003	108	431.7	32	0.074	0.014	4.00	0.774	19.3	2.74	5.85
	2004	132	1414.0	102	0.072	0.009	5.38	0.684	12.7	4.18	6.91
	2005	91	1094.3	74	0.068	0.011	6.38	1.062	16.6	4.60	8.86
Northern Colorado	2001				0.121				17.5	5.65	11.19
	2002		-		-						
	2003	112	445.2	54	0.121	0.020	6.55	1.122	17.1	4.67	9.17
	2004	76	835.9	79	0.095	0.014	7.04	1.099	15.6	5.17	9.59
	2005	94	1128.8	94	0.083	0.010	7.86	1.005	12.8	6.11	10.12
oja	2001	865	11384.0	160	0.116	0.010	7.58	0.710	9.4	6.31	9.11
	2002	547	2176.8	188	0.086	0.008	7.10	0.756	10.6	5.77	8.73
	2003	522	2083.2	218	0.105	0.008	5.65	0.499	8.8	4.75	6.72
	2004	166	1867.9	133	0.071	0.008	5.31	0.663	12.5	4.15	
	2005	229	2746.6	173	0.063	0.006	5.95	0.612	10.3	4.86	7.28

Appendix A. Continned

Recovery Unit	Year	Transects	Length (km)	Adult Tortoises	Encounter Rate	Std Error	(km^2)	Std Error	: of Variation (%)	95% Low	High
Upper Virgin River[1]	1999	158	306.5	150	0.49	0.07	27	3.92	14.5	21	37
	2000	153	302.0	162	0.54	0.07	30	4.36	14.5	23	40
	2001	159	313.8	168	0.535	0.069	30.11	4.16	13.8	22.95	39.51
	2002	-	-	-	-	-	-	-	-	-	-
	2003	157	309.1	96	0.311	0.038	16.88	2.17	12.8	13.11	21.72
	2004	-	-	-	-	-	-	-	-	-	-
	2005	155	304.5	136	0.45	0.05	21.77	3.17	14.6	16.36	28.95

Data from McLuckie *et al.* (2002, 2006)