STATUS OF THE DESERT TORTOISE AND ITS CRITICAL HABITAT

Desert Tortoise

Listing History

The Service listed the Mojave population of desert tortoise (all desert tortoises north and west of the Colorado River in Arizona, Utah, Nevada, and California) as threatened on April 2, 1990 [55 Federal Register (FR) 12178].

Recovery Plan

In the revised recovery plan for the desert tortoise, the Service (2011) identified the need for "conservation areas" to protect existing desert tortoise populations and habitat. Please refer to the description and map of these areas in the General Framework - Where Will Caltrans Apply Its Section 7(a)(1) Commitments? section of this biological opinion. Also, Box 2 and Figure 2 in the recovery plan (Service 2011) describe and depict these areas in a generalized manner, respectively.

The revised recovery plan lists three objectives and associated criteria to achieve delisting. The first objective is to maintain self-sustaining populations of desert tortoises within each recovery unit into the future. The criterion is that the rates of population change for desert tortoises are increasing over at least 25 years (i.e., a single generation), as measured by extensive, range-wide monitoring across conservation areas within each recovery unit and by direct monitoring and estimation of vital rates (recruitment, survival) from demographic study areas within each recovery unit.

The second objective addresses the distribution of desert tortoises. The goal is to maintain well-distributed populations of desert tortoises throughout each recovery unit; the criterion is that the distribution of desert tortoises throughout each conservation area increase over at least 25 years.

The final objective is to ensure that habitat within each recovery unit is protected and managed to support long-term viability of desert tortoise populations. The criterion is that the quantity of desert tortoise habitat within each conservation area be maintained with no net loss until population viability is ensured.

The revised recovery plan (Service 2011) also recommends connecting blocks of desert tortoise habitat, such as critical habitat units and other important areas, to maintain gene flow between populations. Linkages defined using least-cost path analysis (Averill-Murray *et al*. 2013) illustrate a minimum connection of habitat for desert tortoises between blocks of habitat and represent priority areas for conservation of population connectivity.

Threats

The threats described in the listing rule and both recovery plans (Service 1994, 2011) continue to affect the species. The most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle activity, wildfire, and habitat invasion by non-native invasive plant species.

We remain unable to precisely quantify how particular threats affect desert tortoise populations relative to other threats. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy *et al*. 2004).

For example, we have long known that the construction of a transmission line can result in the death of desert tortoises and loss of habitat. We have also known that common ravens (Corvus corax), known predators of desert tortoises, use transmission line pylons for nesting, roosting, and perching and that the access routes associated with transmission lines provide a vector for the introduction and spread of invasive weeds and facilitate increased human access into an area. Increased human access can accelerate illegal collection and release of desert tortoises and their deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive plants (Service 2011). Changes in the abundance of native plants, because of invasive weeds, can compromise the physiological health of desert tortoises, making them more vulnerable to drought, disease, and predation.

Five-Year Review

Section 4(c)(2) of the Endangered Species Act requires the Service to conduct a status review of each listed species once every 5 years. The purpose of a 5-year review is to evaluate whether the species' status has changed since listing (or since the most recent 5-year review); these reviews, at the time of their completion, provide the most up-to-date information on the range-wide status of the species. For this reason, we are incorporating the 5-year review of the status of the desert tortoise (Service 2010) by reference to provide most of the information needed for this section of the biological opinion. The following paragraphs provide a summary of the relevant information in the 5-year review.

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing (i.e., the five-factor analysis required by section 4(a)(1) of the Endangered Species Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

With regard to the status of the desert tortoise as a distinct population segment, the Service concluded in the 5-year review that the recovery units recognized in the original and revised recovery plans (Service 1994 and 2011, respectively) do not qualify as distinct population segments under the Service's distinct population segment policy (61 FR 4722; February 7, 1996). We reached this conclusion because individuals of the listed taxon occupy habitat that is relatively continuously distributed, exhibit genetic differentiation that is consistent with isolation-by-distance in a continuous-distribution model of gene flow, and likely vary in behavioral and physiological characteristics across the area they occupy as a result of the transitional nature of, or environmental gradations between, the described subdivisions of the Mojave and Colorado deserts.

The Service summarizes information in the 5-year review with regard to the desert tortoise's ecology and life history. Of key importance to assessing threats to the species and to developing and implementing a strategy for recovery is that desert tortoises are long lived, require up to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition. Predation seems to play an important role in clutch failure. Predation and environmental factors also affect the survival of hatchlings. The Service notes in the 5-year review that the combination of the desert tortoise's late breeding age and a low reproductive rate challenges our ability to recover the species.

The 5-year review also notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease, and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native annual plants) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal *et al*. 2002; Tracy *et al*. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number of animals that reaches adulthood. Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to affect the reproduction of desert tortoises and recruitment into the adult population in a negative manner.

"Adult" desert tortoise connotes reproductive maturity. Desert tortoises may become reproductive at various sizes. We have used the term "adult" in this biological opinion to indicate reproductive status. In range-wide monitoring and for pre-project surveys, the Service uses 180 millimeters as its cut-off length for counting desert tortoises, because the best available information indicates that surveyors do not see desert tortoises that are smaller than millimeters with the same frequency that they see the large animals (Service 2019c).

The vast majority of threats to the desert tortoise or its habitat are associated with human land uses. Using captive neonate and yearling desert tortoises, Drake *et al*. (2016) found that individuals "eating native forbs had better body condition and immune functions, grew more, and had higher survival rates (>95%) than (desert) tortoises consuming any other diet"; health and body condition declined in individuals fed only grasses (native or non-native). Current information indicates that invasive species likely affect a large portion of the desert tortoise's range. Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.

Drake *et al*. (2015) "compared movement patterns, home-range size, behavior, microhabitat use, reproduction, and survival for adult desert tortoises located in, and adjacent to, burned habitat" in Nevada. They noted that the fires killed many desert tortoises but found that, in the first 5 years post-fire, individuals moved deeper into burned habitat on a seasonal basis and foraged more frequently in burned areas (corresponding with greater production of annual plants and herbaceous perennials in these areas). Production of annual plants upon which desert tortoises feed was 10 times greater in burned versus unburned areas but was dominated by non-native species (e.g., red brome [Bromus rubens]) that frequently have lower digestibility than native vegetation. During years six and seven, the movements of desert tortoises into burned areas contracted with a decline in the live cover of a perennial forage plant that rapidly colonizes burned areas. Drake *et al*. (2015) did not find any differences in health or survivorship for desert tortoises occupying either habitat (burned or unburned) during this study or in reproduction during the seventh year after the fire.

Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and areas of critical environmental concern designated by the Bureau that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoise during the construction of the projects, such as translocation of affected individuals. In aggregate, these projects would result in an overall loss of approximately 66,837 acres of habitat of the desert tortoise. We also predicted that the project areas supported up to 15,390 desert tortoises; we concluded that most of these individuals were small desert tortoises, that most large desert tortoises would likely be translocated from project sites, and that most mortalities would be small desert tortoises (< 180 millimeters) that were not detected during clearance surveys. To date, 661 desert tortoises have been observed during construction of solar projects (see Appendix); most of these individuals were translocated from work areas, although some desert tortoises have been killed. The mitigation required by the Bureau and California Energy Commission (the agencies permitting some of these facilities) resulted in the acquisition of private land and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. These mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise; many of the measures have been derived directly from the recovery plans and the Service supports their implementation. We expect that, based on the best available scientific information, they will result in conservation benefits to the desert tortoise; however, it is difficult to assess how desert tortoise populations will respond because of the long generation time of the species.

In August 2016, the Service (2016) issued a biological opinion to the Bureau for a land use plan amendment under the Desert Renewable Energy Conservation Plan. The land use plan amendment addressed all aspects of the Bureau's management of the California Desert

Conservation Area; however, the Service and Bureau agreed that only those aspects related to the construction, operation, maintenance, and decommissioning of renewable energy facilities were likely to adversely affect the desert tortoise. The land use plan amendment resulted in the designation of approximately 388,000 acres of development focus areas where the Bureau would apply a streamlined review process to applications for projects that generate renewable energy; the Bureau estimated that approximately 11,290 acres of modeled desert tortoise habitat within the development focus areas would eventually be developed for renewable energy. The Bureau also adopted numerous conservation and management actions as part of the land use plan amendment to further reduce the adverse effects of renewable energy development on the desert tortoise.

The land use plan amendment also increased the amount of land that the Bureau manages for conservation in California (e.g., areas of critical environmental concern, California Desert National Conservation Lands, etc.) from 6,118,135 to 8,689,669 acres (Bureau 2015); not all of the areas subject to increased protection are within desert tortoise habitat. The Bureau will also manage lands outside of development focus areas according to numerous conservation and management actions; these conservation and management actions are more protective of desert tortoises than direction contained in the previous land use plan. The Service (2016) concluded that the land use plan amendment was not likely to jeopardize the continued existence of the desert tortoise and would benefit its recovery.

In addition to the biological opinions issued for solar development within the range of the desert tortoise, the Service (2012) also issued a biological opinion to the Department of the Army (Army) for the use of additional training lands at Fort Irwin. As part of this proposed action, the Army translocated approximately 650 adult desert tortoises from 18,197 acres of the southern area of Fort Irwin, which had been off-limits to training, to lands south of the base that are managed by the Bureau and the Army. The Army would also use an additional 48,629 acres that lie east of the former boundaries of Fort Irwin; much of this parcel is either too mountainous or too rocky and low in elevation to support numerous desert tortoises. As part of the proposed action, the Army also acquired approximately 100,000 acres of non-federal land within the Superior-Cronese Critical Habitat Unit for management for conservation of desert tortoises. It also purchased the base property of three cattle allotments; the Bureau subsequently re-allotted the forage on those allotments to wildlife. The Army also funded several other activities aimed at conserving desert tortoises in the Western Mojave Recovery Unit.

The Service also issued a biological opinion to the Department of the Navy (Navy) that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service 2017a). We concluded that the Navy’s proposed action, the use of approximately 167,982 acres of public and private land for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-highway Vehicle Recreation Area. As part of this proposed action, the Navy translocated 998 adult desert tortoises from the expansion area to 4 recipient sites to the north and east of the expansion area (Henen 2019). The Lucerne-Ord and Siberia sites are entirely within Bureau-managed lands, and the Rodman-Sunshine Peak North and Cleghorn sites overlap Bureau-managed lands and lands managed by the Navy. The Lucerne-Ord site lies within the

Ord-Rodman Area of Critical Environmental Concern. The Navy translocated desert tortoises from the Johnson Valley Off-highway Vehicle Recreation Area into populations that were below the Service's established minimum viable density, to attempt to augment these populations and make them more viable in the long-term.

The Service also issued a biological opinion to the Navy that considered the effects of the expansion of the Naval Air Weapons Station at China Lake (Service 2019b). We concluded that the Navy's proposed action, the use of approximately 2,777 acres of the 26,509-acre Cuddeback Range expansion area, was not likely to jeopardize the continued existence of the desert tortoise. The Cuddeback Range lies within the Superior-Cronese Critical Habitat Unit. However, all of the disturbance would occur in a previously disturbed area that the U.S. Air Force historically used as a target zone. The Navy will include the entire Cuddeback Range in its Integrated Natural Resource Management Plan and construct a perimeter fence around the range to prevent trespass by the public. These actions will provide conservation benefits for plants, fish, and wildlife within the area, including the desert tortoise. Because the Navy will not disturb most of the area, it did not translocate any desert tortoises as part of this action.

The incremental effect of the larger actions (i.e., solar development, the expansions of Fort Irwin and the Marine Corps Air Ground Combat Center) on the desert tortoise is unlikely to be positive, despite the numerous conservation measures that have been (or will be) implemented as part of the actions. The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and federal, state, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section. Land managers have been implementing measures to manage these threats and we expect, based on the best available scientific information, that such measures provide conservation benefits to the desert tortoise. We have been unable, to date, to determine whether desert tortoise populations have benefited from the measures. This is partly because of the low reproductive capacity of the desert tortoise. Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range.

As the Service notes in the 5-year review (Service 2010), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses."

Climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest more frequent and/or prolonged droughts with an increase of the annual mean temperature by 3.5 to 4.0 degrees Celsius. The greatest increases will likely occur in summer (June-July-August mean increase of as much as 5 degrees Celsius [Christensen *et al*. 2007]). Precipitation will likely decrease by 5 to 15 percent annually in the region; with winter precipitation decreasing by up to 20 percent and summer precipitation increasing by up to 5 percent. Because germination of the desert tortoise's food plants is highly dependent on coolseason rains, increasing temperatures and decreasing winter precipitation could reduce the forage base. Although drought occurs routinely in the Mojave Desert, extended periods of drought have the potential to affect desert tortoises and their habitats through physiological effects to individuals (i.e., stress) and limited forage availability. To place the consequences of long-term drought in perspective, Longshore *et al*. (2003) demonstrated that even short-term drought could result in elevated levels of mortality of desert tortoises. Therefore, long-term drought is likely to have even greater effects, particularly given that the current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development, highways, freeways, military training areas, etc.) will make recolonization of extirpated areas difficult, if not impossible.

Core Criteria for the Jeopardy Determination

When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). We have used the best available information to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

Reproduction

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal *et al*. 2002), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native annual plants) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal *et al*. 2002; Tracy *et al*. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number of animals that reaches adulthood; see previous information from Drake *et al*. (2016). Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to affect the reproduction of desert tortoises and recruitment into the adult population in a negative manner.

Various human activities have introduced numerous species of non-native invasive plants into the California desert. Routes that humans use to travel through the desert (paved and unpaved roads, railroads, motorcycle trails, etc.) serve as pathways for new species to enter habitat of the desert tortoise and for species that currently occur there to spread. Other disturbances of the desert substrate also provide invasive species with entry points into the desert. The abundance and distribution of invasive weeds may compromise, at least to some degree in localized areas across its range, the reproductive capacity of the desert tortoise; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species.

Numbers

In the 5-year review, the Service discusses various means by which researchers have attempted to determine the abundance of desert tortoises and the strengths and weaknesses of those methods. Due to differences in area covered and especially to the non-representative nature of earlier study sites, data gathered by the Service's current range-wide monitoring program cannot be reliably compared to information gathered through other means at this time.

Data from small-scale study plots (e.g., one square mile) established as early as 1976 and surveyed primarily through the mid-1990s indicate that localized population declines occurred at many sites across the desert tortoise's range, especially in the western Mojave Desert. Spatial analyses of more widespread surveys also found evidence of relatively high mortality in some parts of the range (Tracy *et al*. 2004). Although we cannot extrapolate population densities from the local study plots to provide an estimate of the number of desert tortoises on a range-wide basis, historical densities in some parts of the desert exceeded 38 per square kilometer; Tracy *et al*. 2004). The Service (2010) concluded that "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly."

The range-wide monitoring that the Service initiated in 2001 is the first comprehensive attempt to determine the densities of desert tortoises in conservation areas across their range. Allison and McLuckie (2018) used annual density estimates obtained from this monitoring effort to evaluate range-wide trends in the density of desert tortoises over time. (All references to the density of desert tortoises within each monitoring area are averages. Some local areas within each monitoring area support higher densities and some lower; desert tortoises do not occur in uniform densities across large areas.) This analysis indicates that densities in the Northeastern Mojave Recovery Unit have increased since 2004, with the increase apparently resulting from increased survival of adults and sub-adults moving into the adult size class. The analysis also indicates that the populations in the other four recovery units are declining; Table 1 depicts the estimated abundance of desert tortoises within the recovery units and the change in abundance. Surveys did not include the steepest slopes in these desert tortoise conservation areas; however, the model developed by Nussear *et al*. (2009) generally rates steep slopes as less likely to support desert tortoises.

Table 1. Change in desert tortoise abundance in recovery units (Allison and McLuckie 2018)*.

Recovery Units	Modeled Habitat (km^2)	2004 Abundance	2014 Abundance	Change in Abundance
Western Mojave	23,139	131,540	64,871	-66,668
Colorado Desert	18,024	103,675	66,097	-37,578
Northeastern Mojave	10,664	12,610	46,701	+34,091
Eastern Mojave	16,061	75,342	24,664	-50,679

Recovery Units	Modeled Habitat (km^2)	2004 Abundance	2014 Abundance	Change in Abundance
Upper Virgin River	613	13,226	10,010	-3,216
Total	68,501	336,393	212,343	-124,050

* Allison and McLuckie (2018) used modeled habitat within the entire range of the desert tortoise for this estimate. In other discussions in this biological opinion, we used information only the area of monitored habitat with desert tortoise conservation areas to estimate the number of desert tortoises in the recovery unit.

To further assess the status of the desert tortoise, the Desert Tortoise Recovery Office (Service 2015a) used multi-year trends from the best-fitting model describing log-transformed density of adult animals per square kilometer. In 2014, 3 of the 5 recovery units supported densities below 3.9 adult animals per square kilometer [Western Mojave (2.8), Eastern Mojave (1.5), and Colorado Desert (3.7); see Table 10 in Service 2015b], which is the minimum density recommended to avoid extinction in the 1994 recovery plan. The Northeastern Mojave Recovery Unit supported 4.4 adult desert tortoises per square kilometer and the Upper Virgin River Recovery Unit, which is by far the smallest recovery unit, supported 15.3 adults per square kilometer.

Allison and McLuckie (2018) considered the declines of adult desert tortoises in the Western Mojave and Easter Mojave recovery units and concluded that these "steep declines" in density are sustainable only if reproduction and the growth and survival of juveniles improved greatly. (Allison and McLuckie used 180 millimeters as the separation point between large and small desert tortoises.) However, they note "the proportion of juveniles has not increased anywhere since 2007, and in these two recovery units the proportion of juveniles in 2014 has declined to 91% and 77% of their representation in 2004, respectively." In short, as of 2014, small desert tortoises were not moving into the large cohort at a rate that was sufficient to reverse declines.

Distribution

The Service (2010) concluded in its 5-year review that the distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 in terms of the overall extent of its range. Prior to 1994, urban and agricultural development, military training, and off-road vehicle use extirpated desert tortoises from large areas within their distributional limits. For example, the cities of Barstow, Lancaster, Las Vegas, and St. George, agricultural areas south of Edwards Air Force Base, the National Training Center at Fort Irwin, and portions of off-road recreation areas managed by the Bureau are located within the range of the desert tortoise. Unauthorized off-highway vehicle use in areas such as east of California City has also affected the distribution of the desert tortoise.

Urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range since 1994. Desert tortoises have essentially been removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012). The development of large solar facilities has also reduced the amount of habitat available to desert tortoises. No solar facilities have been developed within areas of critical environmental concern that the Bureau has designated for the desert tortoise in California, although such projects have occurred in areas that the Service considers important linkages between conservation areas (e.g., Silver State South Project in Nevada).

In recognition of the absence of specific and recent information on the location of habitable areas within the Mojave Desert, especially at the outer edges, Nussear *et al*. (2009) developed a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River. The model incorporates environmental variables such as precipitation, geology, vegetation, and slope and uses occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2008 range-wide monitoring surveys. The model predicts the relative potential for desert tortoises to be present in any given location, given the combination of habitat variables at that location in relation to areas of known occupancy throughout the range. Calculations of the amount of desert tortoise habitat in the 5-year review (Service 2010) and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

Table 2 depicts acreages of habitat (as modeled by Nussear *et al*. 2009, using only areas with a probability of occupancy by desert tortoises greater than 0.5 as potential habitat) within the recovery units of the desert tortoise and of impervious surfaces as of 2006 (Fry *et al*. 2011); calculations are by Darst (2014). Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises. All units are in acres.

Table 2. Modeled habitat of the desert tortoise; all units are in acres.

Recovery Units	**Modeled Habitat**	**Impervious Surfaces (percentage)**	**Remaining Modeled Habitat**
Western Mojave	7,585,312	1,989,843 (26)	5,595,469
Colorado Desert	4,950,225	510,862 (10)	4,439,363
Northeastern Mojave	3,012,293	386,182 (13)	2,626,111
Eastern Mojave	4,763,123	825,274 (17)	3,937,849
Upper Virgin River	231,460	84,404 (36)	147,056
Total	20,542,413	3,796,565 (18)	16,745,848

Since 2010, we again conclude that the species' distribution has not changed substantially in terms of the overall extent of its range. However, solar facilities, military activities, and other developments have removed desert tortoises from several thousand acres within their range.

Status of Critical Habitat of the Desert Tortoise

The Service designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah in a final rule published February 8, 1994 (59 FR 5820). The Service designates critical habitat to identify the key biological and physical needs of the species and key areas for recovery and to focus conservation actions on those areas. Within the geographical area occupied by the species at the time of listing, critical habitat is composed of specific geographic areas that contain the biological and physical features essential to the species' conservation and that may require special management considerations or protection. These features, which include space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats, are called the physical and biological features of critical habitat. The specific physical and biological features of critical habitat of the desert tortoise are: sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow; sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators; and habitat protected from disturbance and human-caused mortality.

Critical habitat of the desert tortoise would not be able to fulfill its intended recovery function without each of the physical and biological features being functional. For example, critical habitat would not function properly if a sufficient amount of forage species were present but human-caused mortality was excessive. A second example is that critical habitat could not fulfill its intended function for recovery if an area with sufficient space to support viable populations and to provide for movement, dispersal, and gene flow did not support adequate forage species.

The final rule for designation of critical habitat did not explicitly ascribe specific conservation roles or functions to the various critical habitat units. Rather, it refers to the strategy of establishing recovery units and "desert wildlife management areas" recommended by the recovery plan for the desert tortoise, which had been published as a draft at the time of the designation of critical habitat, to capture the "biotic and abiotic variability found in desert tortoise habitat" (59 FR 5823). Specifically, we designated the critical habitat units to follow the direction provided by the draft recovery plan for the establishment of desert wildlife management areas. The critical habitat units in aggregate are intended to protect the variability that occurs across the large range of the desert tortoise; the loss of any specific unit may compromise the ability of critical habitat as a whole to serve its intended function for recovery.

Since the designation of critical habitat, Congress increased the size of Joshua Tree National Park and created the Mojave National Preserve. A portion of the expanded boundary of Joshua Tree National Park lies within critical habitat of the desert tortoise; portions of other critical habitat units lie within the boundaries of the Mojave National Preserve.

Congress also increased the size of the Johnson Valley Off-highway Vehicle Recreation Area through the passage of the Dingell Act in 2019. This act included 3,471 acres of the Ord-Rodman Critical Habitat Unit in the Johnson Valley Off-highway Vehicle Recreation Area, which represents approximately 1.37 percent of the 253,200-acre critical habitat unit.

Within each critical habitat unit, both natural and anthropogenic factors affect the function of the physical and biological features of critical habitat. As an example of a natural factor, in some specific areas within the boundaries of critical habitat, such as within and adjacent to dry lakes, some of the physical and biological features are naturally absent because the substrate is extremely silty; desert tortoises do not normally reside in such areas. Comparing the acreage of desert tortoise habitat as depicted by Nussear *et al.*'s (2009) model to the gross acreage of the critical habitat units demonstrates quantitatively that the entire area within the boundaries of critical habitat likely does not support the physical and biological features. In Table 3, the acreage for modeled habitat is for the area in which the probability that desert tortoises are present is greater than 0.5. (We used the 0.5 probability here, rather than the 0.6 value we used to define conservation areas, to depict the broader area that most desert tortoises likely occupy, instead of the slightly more restricted area we consider important for conservation.) The acreages of modeled habitat do not include loss of habitat due to human-caused impacts. The difference between gross acreage and modeled habitat is 653,214 acres; that is, approximately 10 percent of the gross acreage of the designated critical habitat is unlikely to support the features of habitat that are conducive to the presence of desert tortoises.

Table 3. Acreage of gross and modeled habitat within critical habitat units for the desert tortoise. We have not adjusted the acreage for the Ord-Rodman Critical Habitat Unit in response to the Dingell Act. All units are in acres.

Critical Habitat Unit	Gross Acreage	Modeled Habitat
Superior-Cronese	766,900	724,967
Fremont-Kramer	518,000	501,095
Ord-Rodman	253,200	184,155
Pinto Mountain	171,700	144,056
Piute-Eldorado	970,600	930,008
Ivanpah Valley	632,400	510,711
Chuckwalla	1,020,600	809,319
Chemehuevi	937,400	914,505
Gold Butte-Pakoon	488,300	418,189
Mormon Mesa	427,900	407,041
Beaver Dam Slope	204,600	202,499
Upper Virgin River	54,600	46,441
Total	6,446,200	5,792,986

Human activities can have obvious or more subtle effects on the physical and biological features of critical habitat. The grading of an area and subsequent construction of a building removes physical and biological features; this action has an obvious effect on critical habitat. The revised recovery plan identifies human activities such as urbanization and the proliferation of roads and highways as threats to the desert tortoise and its habitat; these threats are examples of activities that have a clear effect on the physical and biological features of critical habitat.

Condition of the Physical and Biological Features of Critical Habitat

The revised recovery plan (Service 2011) discusses the importance of understanding the combined and synergistic effects of human activities on habitat of the desert tortoise. For example, surface disturbance causes increased rates of erosion and generation of dust. Increased erosion alters additional habitat outside of the area directly affected by altering the nature of the substrate, removing shrubs, and possibly destroying burrows and other shelter sites. Increased dust affects photosynthesis in the plants that provide cover and forage to desert tortoises. Disturbed substrates and increased atmospheric nitrogen enhance the likelihood that invasive weeds will out-compete native species; the proliferation of weedy species increases the risk of large-scale fires, which further move habitat conditions away from those that are favorable to desert tortoises.

The following paragraphs generally describe how the threats described in the revised recovery plan affect the physical and biological features of critical habitat of the desert tortoise.

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

Urban and agricultural development, concentrated use by off-road vehicles, and other activities such as development of transmission lines and pipelines completely remove habitat. Although we are aware of local areas within the boundaries of critical habitat that have been heavily disturbed, we do not know of any areas that have been disturbed to the intensity and extent that compromise the function of this physical and biological feature. To date, the largest single loss of critical habitat is the use of 18,197 acres of additional training land in the southern portion of Fort Irwin. The congressional transfer of 3,471 acres of the Ord-Rodman Critical Habitat Unit to the Johnson Valley Off-highway Vehicle Recreation Area may reduce the space available to support viable populations within the Western Mojave Recovery Unit and to provide for movement, dispersal, and gene flow. The extent to which recreationists use the transferred area will determine the extent of the effect on this and the other physical and biological features.

The widening of existing freeways likely caused the second largest loss of critical habitat. Despite these losses of critical habitat, which occur in a linear manner, the critical habitat units continue to support sufficient space to support viable populations within each of the six recovery units.

In some cases, major roads likely disrupt the movement, dispersal, and gene flow of desert tortoises. State Route 58 and Highway 395 in the Fremont-Kramer Critical Habitat Unit, Fort Irwin Road in the Superior-Cronese Critical Habitat Unit, and Interstate 10 in the Chuckwalla Critical Habitat Unit are examples of large and heavily travelled roads that likely disrupt movement, dispersal, and gene flow. Roads that have been fenced and provided with underpasses may alleviate this fragmentation to some degree; however, such facilities have not been in place for sufficient time to determine whether they will eliminate fragmentation.

The threats of invasive plant species described in the revised recovery plan generally do not result in the removal of this physical and biological feature because they do not convert habitat into impervious surfaces, as would urban development.

Sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species

This physical and biological feature addresses the ability of critical habitat to provide adequate nutrition to desert tortoises. As described in the revised recovery plan and 5-year review, grazing, historical fire, invasive plants, altered hydrology, drought, wildfire potential, fugitive dust, and climate change/temperature extremes contribute to the stress of "nutritional compromise." Paved and unpaved roads through critical habitat of the desert tortoise provide avenues by which invasive native species disperse; these legal routes also provide the means by which unauthorized use occurs over large areas of critical habitat. Nitrogen deposition from atmospheric pollution likely occurs throughout all the critical habitat units and exacerbates the effects of the disturbance of substrates. Because paved and unpaved roads are so widespread through critical habitat, this threat has adversely affected the value of critical habitat for conservation of the desert tortoise throughout its range, to some degree.

Suitable substrates for burrowing, nesting, and overwintering

Surface disturbance, motor vehicles traveling off route, use of off-highway vehicle management areas, off-highway vehicle events, unpaved roads, grazing, historical fire, wildfire potential, altered hydrology, and climate change leading to shifts in habitat composition and location, storms, and flooding can alter substrates to the extent that they are no longer suitable for burrowing, nesting, and overwintering. Erosion caused by these activities can alter washes to the extent that desert tortoise burrows placed along the edge of a wash, which is a preferred location for burrows, could be destroyed. We expect that the area within critical habitat that is affected by off-road vehicle use to the extent that substrates are no longer suitable is relatively small in relation to the area that desert tortoises have available for burrowing, nesting, and overwintering; consequently, off-road vehicle use has not had a substantial effect on this physical and biological feature.

Most livestock allotments have been eliminated from within the boundaries of critical habitat. Of those that remain, livestock would compact substrates to the extent that they would become unsuitable for burrowing, nesting, and overwintering only in areas of concentrated use, such as around watering areas and corrals. Because livestock grazing occurs over a relatively small portion of critical habitat and the substrates in most areas within livestock allotments would not be substantially affected, suitable substrates for burrowing, nesting, and overwintering remain throughout most of the critical habitat units.

Burrows, caliche caves, and other shelter sites

Human-caused effects to burrows, caliche caves, and other shelter sites likely occur at a similar rate as effects to substrates for burrowing, nesting, and overwintering for the same general reasons. Consequently, sufficient burrows, caliche caves, and other shelter sites remain in the critical habitat units.

Sufficient vegetation for shelter from temperature extremes and predators

In general, sufficient vegetation for shelter from temperature extremes and predators remains throughout critical habitat. In areas where large fires have occurred in critical habitat, many of the shrubs that provide shelter from temperature extremes and predators have been destroyed; in such areas, cover sites may be a limiting factor. The proliferation of invasive plants poses a threat to shrub cover throughout critical habitat as the potential for larger and more frequent wildfires increases.

In 2005, wildfires in Nevada, Utah, and Arizona burned extensive areas of critical habitat (Service 2010). Although different agencies report slightly different acreages, Table 4 provides an indication of the scale of the fires. The Service is aware that fires in August 2020 also occurred in critical habitat of the desert tortoise; at the time of this biological opinion, we do not know the acreages of those fires.

Table 4. Summary of total burned area within desert tortoise critical habitat.

Critical Habitat Unit	Total Area Burned (acres)	Percent of the Critical Habitat Unit Burned
Beaver Dam Slope	53,528	26
Gold-Butte Pakoon	65,339	13
Mormon Mesa	12,952	3
Upper Virgin River	10,557	19

The revised recovery plan notes that the fires caused statistically significant losses of perennial plant cover, although patches of unburned shrubs remained. The percentages of burned habitat do not mean that the fire removed all habitat value for desert tortoises. Drake *et al*. (2015) noted that the production of annual plants was 10 times greater in burned areas compared to unburned areas; however, non-native plants, such as red brome (Bromus madritensis ssp. rubens), dominated the burned areas. Desert tortoises continued to use the dead branches of shrubs, such as creosote (Larrea tridentata) and burro bush (Ambrosia dumosa). Their use of burrows was similar in burned and unburned areas (Drake *et al*. 2015). We cannot quantify precisely the extent to which these fires disrupted the value of the critical habitat, given the patchiness with which the physical and biological features of critical habitat are distributed across the critical habitat units and the varying intensity of the wildfires. The work by Drake *et al*. (2015) demonstrates that the physical and biological features within burned areas retain at least some of their value for the conservation of desert tortoises but conclude "burned habitat may take years to recover sufficiently to fully support (desert) tortoise populations."

Habitat protected from disturbance and human-caused mortality

In general, the Federal agencies that manage lands within the boundaries of critical habitat have adopted land management plans that include implementation of some or all of the recommendations contained in the original recovery plan for the desert tortoise (see pages 70 to

72 of Service 2010). The Bureau's (Service 2016) land use plan amendment for the Desert Renewable Energy Conservation Plan increased the amount of land under protective status and adopted conservation and management actions that furthered the Bureau's goals for these areas. Areas of critical environmental concern and California Desert National Conservation Lands are the units by which the Bureau manages its lands; for the most part, these management units overlap critical habitat of the desert tortoise.

To at least some degree, the adoption of these plans has resulted in the implementation of management actions that are likely to reduce the disturbance and human-caused mortality of desert tortoises. For example, these plans resulted in the designation of open routes of travel and the closure (and, in some cases, physical closure) of unauthorized routes. Numerous livestock allotments have been relinquished by the permittees and cattle no longer graze these allotments. Because of actions on the part of various agencies, many miles of highways and other paved roads have been fenced to prevent desert tortoises from wandering into traffic and being killed. The Service and other agencies of the Desert Managers Group in California are implementing a plan to remove common ravens that prey on desert tortoises and to undertake other actions that would reduce subsidies (i.e., food, water, sites for nesting, roosting, and perching, etc.) that facilitate their abundance in the California Desert (Service 2008).

Despite the implementation of these actions, disturbance and human-caused mortality continue to occur in many areas of critical habitat to the extent that they adversely affect the value of critical habitat for the conservation of the desert tortoise, to some degree. For example, many highways and other paved roads in California remain unfenced. Hughson and Darby (2013) noted that as many as 10 desert tortoises are reported killed annually on paved roads within Mojave National Preserve. Because scavengers quickly remove carcasses from roads, we expect that vehicle use kills more desert tortoises are than are reported.

Unauthorized off-road vehicle use continues to disturb habitat and result in loss of vegetation within the boundaries of critical habitat; although we have not documented the death of desert tortoises as a direct result of this activity, it likely occurs. Additionally, the habitat disturbance caused by this unauthorized activity exacerbates the spread of invasive plants, which displace native plants that are important forage for the desert tortoise, thereby increasing the physiological stress faced by desert tortoises.

Finally, in California, the Bureau will not allow the development of renewable energy facilities on public lands within the boundaries of areas of critical environmental concern and California Desert National Conservation Lands. Counties have not specifically restricted the development of renewable energy facilities on private lands within the boundaries of areas of critical environmental concern. However, the checkerboard pattern of land ownership would likely necessitate that the Bureau consider issuance of a right-of-way for such a facility, which likely decreases the potential for such proposals in the future.

Summary of the Status of Critical Habitat of the Desert Tortoise

As noted in the 5-year review and revised recovery plan for the desert tortoise (Service 2010, 2011), critical habitat of the desert tortoise is subject to landscape-level impacts in addition to the site-specific effects of individual human activities. Land managers have undertaken actions to improve the status of critical habitat. For example, as part of its efforts to offset the effects of the use of additional training maneuver lands at Fort Irwin (Service 2004), the Department of the Army acquired the private interests in the Harper Lake and Cronese Lakes allotments, which are located within critical habitat in the Western Mojave Recovery Unit; as a result, cattle have been removed from these allotments. The retirement of allotments assists in the recovery of the species by eliminating disturbance to the physical and biological features of critical habitat by cattle and range improvements.

Although human activities have affected the remaining physical and biological features to some degree by, these impacts have not, to date, appreciably diminished the value of the critical habitat units for the conservation of the desert tortoise. We have reached this conclusion primarily because the effects are localized and thus do not affect the value of large areas of critical habitat for the conservation of the desert tortoise.

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APPENDIX

SOLAR PROJECTS FOR WHICH THE U.S. FISH AND WILDLIFE SERVICE HAS ISSUED BIOLOGICAL OPINIONS OR INCIDENTAL TAKE PERMITS

(FEBRUARY 2021)

Table A1 summarizes information regarding the solar projects for which the Fish and Wildlife Service has issued a biological opinion, pursuant to section 7(a)(2), or an incidental take permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act, with regard to the desert tortoise. We are aware of five solar projects for which we issued biological opinions that are no longer on the Federal agency's list of projects; we have removed these projects from this list.

Table A1. List of solar projects that have received biological opinions or incidental take permits.

Project	Recovery Unit	Acres of Desert Tortoise Habitat[1]	Desert Tortoises Estimated[2]	Desert Tortoises Observed[3]	Citations[4]
Ivanpah Solar Electric Generating System	Eastern Mojave	3,582	1,136	175	Service 2011a, Davis 2014
Stateline	Eastern Mojave	1,685	947	55	Service 2013a, Ironwood Consulting 2014
Silver State North	Eastern Mojave	685	14	7	Service 2010, Newfields 2011
Silver State South	Eastern Mojave	2,427	1,020	152	Service 2013a, Cota 2014
Nevada Solar One	Eastern Mojave	400	-[5]	-[5]	Burroughs 2012, 2014
Copper Mountain North	Eastern Mojave	1,400	-[5]	-[5]	Burroughs 2012
Copper Mountain	Eastern Mojave	380	-[5]	-[5]	Burroughs 2012, 2014
Townsite	Eastern Mojave	885	-[5]	-[5]	Service 2014b
Techren Boulder City	Eastern Mojave	2,200	-[5]	-[5]	Service 2012b
Valley Electric Association	Eastern Mojave	80	4	4	Service 2015a
Canyon Mesa	Eastern Mojave	123	2	-	Service 2019a
Yellow Pine	Eastern Mojave	4,285	1,032	-	Service 2020b
Mojave	Western Mojave	Primarily in abandoned agricultural fields	4	0	Service 2011b
Cinco	Western Mojave	500	53	2	Service 2015b, Daitch 2015
Soda Mountain	Western Mojave	1,726	78	-	Service 2015c

Project	Recovery Unit	Acres of Desert Tortoise Habitat[1]	Desert Tortoises Estimated[2]	Desert Tortoises Observed[3]	Citations[4]
High Desert	Western Mojave	547	24	4	Service 2019b, ECORP Consulting 2020
Res Americas Moapa Solar Energy Center (MSEC; totals adjusted based on overlapping ACSP acreage)	Northeastern Mojave	104	37	-	Service 2014a
Moapa K Road	Northeastern Mojave	2,141	208	177	Service 2012a, Cardno 2018
Playa	Northeastern Mojave	1,538	258	77	Service 2015d, Ironwood Consulting 2016
Invenergy Harry Allen	Northeastern Mojave	594	242	-	Service 2015d
NV Energy Dry Lake Solar Energy Center	Northeastern Mojave	751	45	-	Service 2015d
NV Energy Dry Lake Solar Energy Center at Harry Allen	Northeastern Mojave	55	15	-	Service 2015d
Aiya	Northeastern Mojave	672	91	-	Service 2015e
Mountainview	Northeastern Mojave	146	-[5]	-[5]	Wise 2018
Gemini	Northeastern Mojave	7,113	5,215	-	Service 2019c
Eagle Shadow Mountain	Northeastern Mojave	2,285	2,941	-	Service 2019d
Arrow Canyon Solar Project (ACSP; MSEC expansion)	Northeastern Mojave	2,124	1,863	-	Service 2020c
Genesis	Colorado	1,774	8	0	Service 2010b, Fraser 2014a
Blythe	Colorado	6,958	30	0	Service 2010c, Fraser 2014b
Desert Sunlight	Colorado	4,004	56	7	Service 2011c, Fraser 2014a
McCoy	Colorado	4,533	15	0	Service 2013c, Fraser 2014b
Desert Harvest	Colorado	1,300	5	-	Service 2013b
Rice	Colorado	1,368	18	1	Service 2011d, Fraser 2014a
Desert Quartzite	Colorado	2,831	4	-	Service 2019e
IP Athos	Colorado	3,440	5	-	Service 2019f

Project	Recovery Unit	Acres of Desert Tortoise Habitat[1]	Desert Tortoises Estimated[2]	Desert Tortoises Observed[3]	Citations[4]
Crimson	Colorado	2,201	20	-	Service 2020a
Total		66,837	15,390	661	

[1] The acreages may include substations and other ancillary facilities.

[2] The numbers in this column are not necessarily comparable because the methodologies for estimating the numbers of desert tortoises occasionally vary between projects. The largest numbers included the estimated number of small desert tortoises, which likely far exceeded the numbers of individuals present. In some cases, desert tortoises will remain inside the security fence for the solar project; we anticipated that some mortalities would occur during operation of the facility and included these numbers in the estimated total.

[3] This column reflects the numbers of desert tortoises observed within project areas. It includes translocated animals and those that were killed by project activities. Project activities may result in the deaths of more desert tortoises than are found. Dashes represent projects for which we have no information at this point; some projects had not broken ground at the time of this biological opinion.

[4] The first citation in this column is for both the acreage and the estimate of the number of desert tortoises. The second is for the number of desert tortoises observed during construction of the project; where only one citation is present, construction has not begun or data are unavailable at this time.

[5] These projects occurred under the Clark County Multi-species Habitat Conservation Plan; the provisions of the habitat conservation plan do not require the removal of desert tortoises. In some case, the Service issued biological opinions for access roads and generator tie-in line for these projects. We did not include the acreages and number of desert tortoises for those aspects of the overall action; we did not want to provide the impression that those effects were directly associated with the solar facility.

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[Service] U.S. Fish and Wildlife Service. 2014a. Biological opinion for the Res Americas Moapa Solar Energy Center, Moapa River Indian Reservation, Clark County, Nevada. Dated January 21. Memorandum to Superintendent, Southern Paiute Agency, Bureau of Indian Affairs, St. George, Utah. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

[Service] U.S. Fish and Wildlife Service. 2014b. Biological opinion for the Townsite Solar Transmission Project. Dated July 24. Memorandum to Environmental Manager, Western Area Power Administration, U.S. Department of Energy, Phoenix, Arizona; Supervisory Biologist - Habitat, Nevada Department of Wildlife, Las Vegas, Nevada. From State Supervisor, Nevada Fish and Wildlife Office. Reno, Nevada.

[Service] U.S. Fish and Wildlife Service. 2015a. Biological opinion for the Valley Electric Association's Community Solar Project Low-Effect Habitat Conservation Plan. Dated October 8. Memorandum to Assistant Regional Director, Ecological Services, Sacramento, California; Supervisory Biologist – Habitat, Nevada Department of Wildlife, Las Vegas, Nevada. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2015b. Biological opinion for the RE Barren Ridge 1 LLC's RE Cinco Generation Intertie Line and RE Cinco Solar Project, Kern County, California. Dated February 11. Memorandum to Field Manager, Ridgecrest Field Office, Bureau of Land Management, Ridgecrest, California, and Deputy Regional Director, Region 8, U.S. Fish and Wildlife Service, Sacramento, California. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2015c. Biological opinion for the Soda Mountain Solar Project, San Bernardino County, California. Dated January 13. Memorandum to District Manager, California Desert District, Bureau of Land Management, Moreno Valley, California. From Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2015d. Final - Project-level formal consultations for four solar energy projects in the Dry Lake Solar Energy Zone, Clark County, Nevada. Dated May 1. Memorandum to Assistant Field Manager of Natural Resources, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2015e. Final biological opinion for the Aiya Solar Energy Project. Dated December 18. Memorandum to Bureau of Indian Affairs, Phoenix, Arizona, and Bureau of Land Management, Las Vegas, Nevada. Las Vegas, Nevada. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2019a. Intra-Service biological opinion for issuance of a section 10(a)(1)(B) incidental take permit for the Canyon Mesa Solar Project Low-Effect Habitat Conservation Plan, Nye County, Nevada (TE53923D-0). Dated September 19. Memorandum to Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service Sacramento, California. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2019b. Intra-Service consultation on the issuance of a section 10(a)(1)(B) permit for the High Desert Solar Project, San Bernardino County, California. Dated October 23. Memorandum to Field Supervisor, Carlsbad Fish and Wildlife Office, U.S. Fish and Wildlife Service, Carlsbad, California. From Acting Assistant Field Supervisor, Palm Springs Fish and Wildlife Office. Palm Springs, California.

[Service] U.S. Fish and Wildlife Service. 2019c. Formal and informal consultation under section 7 of the Endangered Species Act for the Gemini Solar Project, Clark County, Nevada. Dated November 7. Memorandum to Assistant Field Manager of Natural Resources, Las Vegas Field Office, Bureau of Land Management, Las Vegas, Nevada. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2019d. Biological Opinion for the Eagle Shadow Mountain Solar Project, Moapa River Indian Reservation, Clark County, Nevada. Dated November 12. Memorandum to Western Regional Director, Bureau of Indian Affairs, Phoenix, Arizona. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2019e. Section 7 biological opinion on the Desert Quartzite Solar Project, Riverside County, California. Dated April 12. Memorandum to Field Manager, Palm Springs-South Coast Field Office, Bureau of Land Management, Palm Springs, California. From Acting Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2019f. Section 7 biological opinion on the IP Athos Renewable Energy Project, Riverside County, California. Dated August 28. Memorandum to Field Manager, Palm Springs-South Coast Field Office, Bureau of Land Management, Palm Springs, California. From Acting Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2020a. Section 7 biological opinion on the Crimson Solar Project, Riverside County, California. Dated February 19. Memorandum to Field Manager, Palm Springs-South Coast Field Office, Bureau of Land Management, Palm Springs, California. From Acting Field Supervisor, Carlsbad Fish and Wildlife Office. Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2020b. Formal consultation under section 7 of the Endangered Species Act for the Yellow Pine Solar Project, Nye County, Nevada. Dated July 14. Memorandum to Assistant Field Manager, Division of Natural Resources, Southern Nevada District Office, Bureau of Land Management, Las Vegas, Nevada. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

[Service] U.S. Fish and Wildlife Service. 2020c. Biological Opinion for the Arrow Canyon Solar Project, Moapa River Indian Reservation, Clark County, Nevada. Dated November 12, 2020. Memorandum to Western Regional Director, Bureau of Indian Affairs, Phoenix, Arizona. From Field Supervisor, Southern Nevada Fish and Wildlife Office. Las Vegas, Nevada.

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