California Energy Commission
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California Energy Commission
Dockets Office, MS-4
Docket No. 09-RENEW EO-01
1516 Ninth Street
Sacramento, CA 95814-5512

Re: Docket No. 09-RENEW EO-01; Desert Renewable Energy Conservation Plan

To Whom It May Concern:

I grew up in the California desert and spent much of my childhood exploring sandy washes, creosote bush scrub habitat and Joshua tree woodlands. I now frequently visit the desert for unconfined recreation, and enjoy wide-open, largely undisturbed natural landscapes that provide solitude. I appreciate the biodiversity of every corner of the desert and the intrinsic value of each species that inhabits these wildlands. For these reasons, I support the DRECP's goals of protecting wildlife and wildlands to ensure resilience in the face of climate change and other anthropogenic threats.

I strongly support energy conservation, energy efficiency and renewable energy deployment to cut our use of fossil fuels. The harm we have done through our use of fossil fuels is part of a broader pattern of often unnecessary and certainly unsustainable destruction of the land and wildlife. The manner in which we deploy renewable energy should reflect a new ethos that respects our land and biodiversity. Just as we have a loading order that prioritizes sources of energy with the lowest greenhouse gas emission, the steps we take to cut our fossil fuels should also prioritize technologies and policies that have the least impact on wildlife and wildlands. The California desert constitutes one of the last places in the lower 48 United States where you can travel and explore hundreds of square miles of contiguous wildlands with little or no modern human disturbance, and witness a wealth of plant and animal life. The DRECP should ensure that these nationally significant qualities are not lost.

The draft DRECP's preferred alternative reflects an imbalance between competing purpose and needs, favoring industrial development over conservation. The draft DRECP should be revised to correct this imbalance by 1.) properly accounting for the potential of energy efficiency and distributed generation to offset the need for utility-scale energy projects in the California desert, 2.) reducing the acreage of Development Focus Areas (DFA) to avoid intact desert wildlands, 3.) limiting deployment of the most destructive technologies until their impacts are better understood, and 4.) designating more lands as Areas of Critical Environmental Concern or as part of the National Landscape Conservation System (NLCS). These

revisions would be consistent with the DRECP's Independent Science Advisory Report to adhere to "no-regrets" strategies in our deployment of renewable energy.[1]

Incorporating Alternative Approaches and Reducing DFA Acreage

The DRECP discards the distributed generation alternative citing a purpose and need statement that has arbitrarily ignored California law and energy policy emphasizing energy efficiency and distributed generation. I urge the DRECP cooperating agencies and the California Public Utility Commission (CPUC) to revise the DRECP's underlying assumptions to place more emphasis on distributed generation and energy conservation and efficiency (demand-side management). Placing the priority called for by California law and policy on energy efficiency and distributed generation would allow DRECP agencies to drastically reduce the number of DFA acres proposed in the preferred alternative. As Basin & Range Watch lays out in its January 30, 2015 comment letter, "California law establishes energy efficiency as the highest priority resource in meeting California's energy needs," and the California Energy Efficiency Strategic Plan (CEESP) is part of California regulatory policy.

As an example of just a portion of the CEESP goals, the implementation plan sets a target to reduce energy purchases by 70% from 2008 levels in 25% of existing homes, and a 30% reduction for 75% of existing homes.[2] Additionally, according to the UCLA Luskin Center, "Los Angeles County has over 19,000 megawatts of rooftop solar PV potential, while the City of Los Angeles has over 5,500 megawatts."[3] Separate analysis by an energy expert estimates that parking lots in California could host 39,000 megawatts of solar power technology. [4]

The DRECP discards the distributed generation alternative citing, in part, that distributed solar generation is incapable of meeting energy demands under cloudy conditions or at night, placing an inflated value on utility-scale technologies (wind, geothermal, utility-scale solar with storage) for load shifting and storage to address the shortfalls of distributed solar generation. This is an inaccurate assumption, and if it is used in the DRECP's calculation, the calculations should be corrected to account for the expansion of distributed solar generation paired with battery storage capacity. Rooftop solar installation and leasing companies are preparing to expand deployment of solar systems paired with battery storage. Costs of distributed storage systems can be expected to drop; over 15,000 German households have rooftop solar paired with battery storage, and storage costs have dropped in that country 25% in less than a year, according to the German Solar Industry Association.[5]

Additionally, local grid enhancements and electric vehicle batteries will also offer opportunities for distributed storage functionality and demand-side management that should be incorporated in the DRECP's calculations and assumptions regarding the integration of distributed generation into the grid. The University of California,

Irvine hosts a large smart grid project that demonstrates the viability of distributed storage (battery and thermal) at the neighborhood level to effectively integrate distributed solar generation and demand-side response.[6][7] In January, utility company PG&E announced a pilot program with BMW to test the ability of electric vehicle batteries for demand-side management.[8]

The DRECP does not provide full transparency into how it arrived at the need for 20,000 megawatts of mostly utility-scale renewable energy projects in the California desert. However, it appears the DRECP underestimates the potential for energy efficiency and distributed generation and ignores separate California law and policies that emphasize these resources in the loading order. These alternatives should be incorporated into the DRECP DFA acreage calculations, and reduce that acreage substantially.

Bird and Insect Mortality at Solar Projects

With thousands of acres of once-intact desert lands now covered with heliostats, aluminum troughs, and photovoltaic panels, we have only begun to recognize the potential scale of ecological destruction of which these forms of energy generation are capable. The Conservation Management Actions appear to insufficiently account for and guard against some impacts, and should be revised to guide renewable energy development with more recognition of the different threats posed by specific technologies. This can be viewed as a "no-regrets" strategy for deploying specific technology types.

Although the DRECP preferred alternative attempts to concentrate the majority of DFAs on already-disturbed lands in the western Mojave Desert and Imperial Valley – minimizing impact on habitat for many terrestrial species – projects built on already-disturbed lands can still pose a significant risk of irreparable and immitigable damage to birds and insects. At this time, elevated temperatures above solar power tower projects and the "lake effect" of all solar technology can lure a wide range of flying wildlife from afar and increase their risk of mortality or injury.

The CMAs require installation of the "best available bird and bat detection and deterrent technologies available at the time of construction." However, the DRECP should be revised to recognize that there are no known effective deterrence measures to reduce mortality and injury resulting from lake effect at all solar projects, and heat stress at solar power tower projects. **Until such time that mitigation and deterrent measures can be identified based on data from existing solar projects, the DRECP should include a CMA that limits project development within the resident and dispersal range of covered species most likely to be impacted by heat stress and lake effect.** The geographic limitations might be expanded or reduced as new data becomes available.

As currently written, the DRECP would continue to streamline projects bearing characteristics or technology types (lake effect and solar power towers) that are already known to pose a significant risk to covered species, particularly in the

Imperial Valley and eastern Riverside County. The DRECP does not sufficiently acknowledge the evidence available, spell out assumptions, or disclose methodologies (if any) regarding how the DRECP CMAs address these risks. **Expanding solar power tower deployment and the "lake effect" threat in these areas without recognizing the best available science constitutes a failure to take a "hard look" at the potential cumulative impacts of the DRECP, as required by the National Environmental Policy Act.**

Solar Power Towers
The DRECP CMAs should be revised to specifically state which DFAs should not accommodate solar power tower technology, include a provision that the Adaptive Management Team will periodically review data to reassess impacts of solar power tower projects and identify appropriate revisions to the CMAs, and explicitly require two years of surveys for impacts on all flying wildlife.

Two separate solar power tower projects have demonstrated significant impacts on migratory and resident birds, and insects.[9] Insects may be attracted to the solar flux at solar power tower projects, in turn drawing in an entire food chain of bird species that feed on insects and predators of those birds. In less than a day of testing, biologists estimated that SolarReserve's Crescent Dunes solar power tower project in the Nevada desert killed at least 130 birds.[10] Biologist Shawn Smallwood estimated that bird mortality at the proposed Palen Solar power tower project may be between 3,573 and 18,000 birds per year, based on an examination of mortality records at the Ivanpah Solar project currently operational in the eastern Mojave Desert.[11]

Nearly all bird and flying insect species resident in the desert – or those that migrate through – are at risk of injury and mortality at solar power tower projects. Those at risk include covered species, as well as those not included on the covered species list because of assumptions that their primary habitat will fall within protected land designations.

The DRECP should identify DFAs where solar power tower technology will be prohibited. These limitations should also be based on the assessed risk to all covered species, including the Southwestern willow flycatcher, Least Bell's Vireo, and Western Yellow-billed Cuckoo. The DRECP Conservation Management Actions on page II.3-406 state that "power tower technology may not be allowed in migratory flyways frequented by waterfowl," but I have not found where this is further explained, or which areas are considered migratory flyways frequented by waterfowl.

The CMAs should be revised to explicitly call for two years of pre-construction surveys of all flying wildlife activity to ensure a robust baseline assessment of potential impacts. The draft CMAs require two years of risk assessment surveys per USFWS Eagle Conservation Plan Guidance (see AM-DFA-ICS-29), but it is not

clear if this will include surveys for all bird and insect activity in the area, and not just golden eagles.

The DRECP should be revised to recognize that elevated temperatures across a heliostat field can contribute to injury or mortality, and not just the zone of concentrated solar flux. The draft specifically states that deterrent measures should discourage birds from flying into the project's concentrated solar flux (page II.3-43). However, this language ignores preliminary findings indicating that the heat stress incurred by birds flying over other parts of the heliostat field – not just through the solar flux – may also lead to injury and mortality.[12] California Energy Commission Staff assessed that large heliostat fields may create a larger portion of aerial habitat with elevated temperatures, meaning that even moderately elevated temperatures pose a risk of injury or mortality to a bird if it spends enough time in that air space. The DRECP should be revised to recognize that elevated temperatures across a heliostat field can contribute to injury or mortality, and not just solar flux.

Lake Effect

Even photovoltaic and solar trough projects on already-disturbed lands can pose a threat to birds through a phenomenon known as "lake effect," whereby birds confuse the shining appearance of a field of solar panels to be a body of water, likely travelling far distances to reach the solar projects. Diversion from course, collision with panels, and difficulty resuming flight without water can result in mortality. As noted above, there are no known effective deterrent measures to prevent this phenomenon.

The Yuma clapper rail – a DRECP covered species - is at particular risk of the lake effect phenomenon. According to BLM and U.S. Fish and Wildlife Service documents received from a Freedom of Information Act request, sufficient evidence exists to assess that the proliferation of solar power projects in the southwestern deserts could eventually jeopardize this endangered species. Although the DRECP biological goals and objectives identify protection of riparian habitat as critical to the protection of the Yuma clapper rail, the DRECP does not account for the potential impacts resulting from dispersal and mortality of this species at solar projects as a result of lake effect.

As of August 2014, at least two Yuma clapper rails have been killed at utility-scale solar projects in eastern Riverside County and the Imperial Valley.[13] When combined with the fact that riparian bird species constitute a significant portion of the overall mortality at utility-scale solar projects in eastern Riverside County (Genesis and Desert Sunlight projects), it seems logical **that "take" of the Yuma clapper rail is "reasonably certain" to occur at solar power projects in eastern Riverside County and Imperial Valley**.[14] These areas are within dispersal range of the Yuma clapper rail.

As of 2012, the Yuma clapper rail population was estimated at 435, and some biologists estimated that each solar project within the dispersal range of the species could take at least one Yuma clapper rail, per year. Given that each solar project built within the dispersal range may have a 25-30 year lifespan, a significant expansion of utility-scale solar projects could have a devastating impact on this species.

The U.S. Fish and Wildlife Service General Conservation Plan (Appendix M of the draft DRECP) should be revised to account for potential "take" that will result from Yuma clapper rail mortality at project sites outside the species' core habitat. As currently written, the plan appears to only assess energy development that could directly impact riparian habitat. This undoubtedly results in an under-estimation of the likely threat to the Yuma clapper rail. **An upper level of permissible annual "take" should be identified (as is the case for the golden eagle in the draft DRECP), and take beyond that level should trigger a revision of the DRECP DFAs and CMAs to prevent further take.**

The DRECP CMAs should also mandate off-site habitat compensation for any approved solar project in Imperial and Riverside County, where take of the Yuma clapper rail is most likely.

Revisions to Land Use and Conservation Designations

Please consider the following revisions to land use and conservation designations on public and private lands. I strongly support designating public lands in the desert as part of the National Landscape Conservation System. The California desert is a remarkable landscape hosting an amazing diversity of plant and animal life, geological formations, and representative of our historical and cultural narrative. As stated earlier, the relative intact and undisturbed nature of vast swaths of the desert also lends to its national significance. NLCS designations should protect these landscapes to ensure the integrity of all of these values, including that which is becoming increasingly rare in the United States – wide-open expanses consisting of multiple mountain ranges and valleys largely devoid of modern human development, allowing visitors and residents unparalleled opportunities to experience nature and find solitude.

The BLM's preferred alternative does not appear to designate NLCS lands to the extent called for by Section 2002 of the Omnibus Public Land Management Act of 2009, which requires the BLM to designate as NLCS "public land within the California Desert Conservation Area administered by the Bureau of Land Management for conservation purposes." Although the DRECP explains the criteria by which lands were chosen for NLCS designation (page II.3-315 and II.3-316), the exact rationale for the current boundaries of proposed NLCS designations remains unclear since some lands that meet many of the criteria established remain undesignated.

Cady Mountains and Pisgah: Lands currently non-designated in the vicinity of Pisgah Crater and the creosote scrub and micro-dune habitat south of the Cady Mountains (in the vicinity of 34.792095; -116.424038; see Attachment A for map) should be designated as NLCS and ACEC. These lands meet several criteria for designation as NLCS identified in the DRECP (DRECP, page II.3-315 and 316), as the area includes high quality habitat for multiple native species, high ecological diversity, is the focus of scientific study, representative of a significant natural phenomenon, relatively undisturbed and intact habitat, and provides habitat linkage across NLCS lands.

The Department of Interior's Final Solar Programmatic EIS ultimately identified these lands – including lands listed as non-designated under the DRECP - as a solar exclusion area, in part because the area provided suitable habitat for as many as 54 special status species.[15] The lands north of Interstate 40 and south of the Cady Mountains were also previously reviewed for the proposed – and since-cancelled – Calico Solar power project. Surveys found that the lands north of Interstate 40 and south of the Cady Mountains provided habitat for several DRECP covered species, including the desert tortoise, desert bighorn sheep, Mojave fringe-toed lizard, and golden eagle (foraging). In addition, a species currently not covered under the DRECP but of conservation concern – the white-margined beardtongue – occurs in multiple locations on lands currently identified as non-designated north of Interstate 40.

South of Interstate 40, the Pisgah lava flow provides an area to continue nascent research into adaptive color polymorphism and unusually high genetic diversity in reptiles, according to a peer-reviewed study published in 2012.[16] Furthermore, DRECP Biological Objective L1.4 states that the BLM should "[c]onserve unique landscape features, important landforms, and rare or unique vegetation types identified within the Plan Area, including… [a]reas with unique geological activity (e.g., Pisgah and Amboy craters, Black Tank Wash volcanic area, Old Woman statue)." The Pisgah lava flow is also of significance for rockhounding because of its unique geological qualities. Much of the Pisgah lava flow is closed to the public because it is within the boundary of the Marine Corps Air-Ground Combat Center at Twentynine Palms, increasing the importance of managing remaining portions of the Pisgah area for its recreational and scientific importance.

Both sides of Interstate 40 are included as high priority desert tortoise linkage habitat in the draft biological goals and objectives, further underscoring the need to designate these lands as ACEC and NLCS.[17] Under the current version of the preferred alternative, the desert habitat south of the Cady Mountains and east and north of the Pisgah lava flow are depicted as having high habitat value for the tortoise, according to the biological goals and objectives.[18]

Furthermore, BLM should protect the micro-dune habitat and sandy washes north of Interstate-40 and south of the railroad, which are known to host the Mojave fringe-toed lizard. The Mojave fringe-toed lizard is a covered species under the

draft DRECP. During the review for the now-cancelled Calico Solar project, the BLM and CEC estimated that approximately 164 acres of sandy wash and micro-dune habitat existed in the footprint of the proposed project. According to the draft biological goals and objectives for the DRECP, the BLM should "[r]estore, maintain, or enhance Covered Species habitat and ecological health of the dune and sand-based natural community, including transitional areas encompassing the full array of sand-related and transitional community types in the Plan Area."[19]

Thus, these BLM-managed lands south of the Cady Mountains that are non-designated in the draft DRECP should be designated as ACEC and NLCS because they are significant for ecological, geological and recreation reasons outlined above.

Silurian Valley: I support the BLM California Director's decision to reject Iberdrola's variance application in the Silurian Valley, and the rationale outlined in that decision.[20] For the same reasons, the BLM should revise the draft DRECP to remove the proposed Special Analysis Area in the Silurian Valley. The Special Analysis Area in the Silurian Valley would jeopardize numerous nationally significant ecological and historic resources, so it should be removed from the draft DRECP and replaced with NLCS designations. These values are described in a memorandum from the BLM California Deputy Director for State Resources to the State Director dated November 20, 2014 regarding BLM's decision to reject a solar project within the proposed Special Analysis Area (BLM application number CACA 053865).

These include a least cost, "priority 1" desert tortoise connectivity corridor identified by the Fish and Wildlife Service (also identified in the Record of Decision for the Solar Programmatic Environmental Impact Statement[21]), the Old Spanish National Historic Trail, high scenic qualities, and a mineral rich rockhounding area.[22] The BLM should protect the relatively undisturbed qualities of the Silurian Valley for the sake of the Old Spanish Historic Trail, which was designated in 2002 as a National Historic Trail, of which a "high potential segment" of the trail passes through the Silurian Valley, according to the BLM variance determination.[23] According to the BLM Manual, the BLM should manage high potential historic sites "to interpret the historic significance of the trail during its period of major use and to identify and protect (NTSA Section 3(a)(3)) the visible historic remnants and scenic quality and to provide relative freedom from intrusion." [24] The National Trails System Act of 1968 (NSTA) charges BLM with protecting the values of this high potential historic segment. Allowing industrial-scale development within the proposed Special Analysis Area would contradict the NSTA and BLM's own implementing policy.

The Special Analysis Area could also jeopardize resources within the Silurian Valley that are recognized as requiring protection under the draft DRECP biological objectives. For example, wind and solar energy development would pose a threat to migratory birds, which utilize wetland habitat at the Salt Creek Hills ACEC, Saratoga Springs, and occasional wetlands in the Silver Lake after significant precipitation

events. Aeolian sand transport also occurs through the Silurian and adjacent Valjean Valley, according to draft DRECP biological objective L2.8 and published research on Aeolian sand transport.[25]

Mountain Pass: The Future Assessment Area in the vicinity of Mountain Pass (in the vicinity of 35.450943, -115.506612) should be reduced or removed entirely, and appropriate management actions prescribed to ensure that renewable energy development does not impact the visual and ecological resources of the neighboring Mojave National Preserve.

As currently designated, the Future Assessment Area would encourage industrial scale energy development – likely wind energy – that would impact a substantial portion of the Mojave National Preserve viewshed that is currently managed to provide visitors wide-open and natural landscapes. The proposed Future Assessment Area includes ridgelines of the Ivanpah Mountains reaching over 5,600 feet in elevation, and the bajada immediately adjacent to primitive backcountry camping areas in the Preserve. Because of the Future Assessment Area's placement along the ridgelines, future energy development could be visible across well over 100 square miles of the Preserve, including a substantial segment of the Preserve's most popular touring route along Morning Star Mine Road. Other backcountry camping areas along the New York Mountains and inter-mountain Joshua tree woodland habitat would also be impacted by highly visible industrial energy development.

In addition, the draft DRECP has identified multiple golden eagle nests adjacent to the Future Assessment Area, with one and four-mile territory buffer overlapping with the Future Assessment Area. [26] Wind energy in this area probably would pose a mortality threat to golden eagles.

Section 202 of the Federal Land Policy Management Act (FLPMA) requires coordination of land use planning with other Federal agencies, and BLM Manual section 1601 also requires the BLM to coordinate land use planning and management activities with other jurisdictional entities to ensure that such plans are consistent with the plans of neighboring entities. According to the California Desert Protection Act of 1994 established the Mojave National Preserve to " preserve unrivaled scenic, geologic, and wildlife values associated with these unique natural landscapes" and "perpetuate in their natural state significant and diverse ecosystems of the California desert." Energy development within much of the proposed Future Assessment Area near Mountain Pass and the Ivanpah Mountains would pose a significant and immitigable resource conflict.

Alvord to El Paso Mountains Landscape: The BLM should extend NLCS designation to lands stretching from the Alvord Mountains south of Fort Irwin to the El Paso Mountains south of Ridgecrest (see Attachment A for map). This landscape meets many of the criteria identified in the draft DRECP for NLCS designations.

The lands provide high quality habitat for multiple native species, including habitat designated as critical for the federally listed desert tortoise (Superior-Cronese and Fremont-Kramer critical habitat units) and Lane Mountain milkvetch (Coolgardie and Paradise Units). Many of the lands in the northwestern portion of this landscape unit also provide core and linkage habitat for the Mohave ground squirrel.[27]

The lands also constitute a nationally significant cultural landscape providing the setting for historic mining activity from the Calico Mountains to the Rand and El Paso Mountains.[28] The Calico Ghost Town at the southern edge of the Calico Mountains was designated a California State Historical Landmark. Abandoned mines dot the landscape from Alvord Mountain to the El Paso Mountains.

The landscape is largely intact with only a minimal road network, and is comprised mostly of large blocks of BLM lands, with lands managed by other agencies for conservation purposes interspersed. Most significantly, the Department of Defense manages lands acquired for desert tortoise mitigation purposes following the expansion of Fort Irwin. A significant parcel of land within this landscape – the former Cuddeback Air Force Range – was returned to BLM jurisdiction, and should also be managed for conservation purposes for reasons spelled out below.

Former Cuddeback Air Force Range: The former Cuddeback Air Force Range (in the vicinity of 35.304539, -117.400836) is incorrectly designated as a "Conservation Planning Area" in the draft DRECP maps provided through the DRECP Gateway. The draft DRECP should be revised to designate these lands as ACEC and NLCS. According to Department of Interior testimony before Congress on April 29, 2014, the Department of Defense has relinquished control of the former Cuddeback Air Force Range to the Bureau of Land Management.[29] The Conservation Planning Area designation is reserved for non-Federal lands and private lands (see II.3-18 of the draft DRECP).

Located along the western boundary of the Grass Valley Wilderness area and southeast of the Golden Valley Wilderness area, the Cuddeback Dry Lake area should be designated as NLCS because It is part of a contiguous block of predominately BLM-administered lands that stretches from the western boundary of Fort Irwin to the El Paso Mountains, via the Summit Range and Lava Mountains. These lands provide habitat for DRECP covered species, including the desert tortoise and Mohave ground squirrel.

The former Cuddeback Air Force Range overlaps with the Pilot Knob identified core area for the Mohave ground squirrel, and provides habitat connectivity between other identified core areas, according to research by Philip Leitner on the status of the Mohave ground squirrel.[30] The former Air Force Range and surrounding lands should be managed to maintain large blocks of intact habitat. According to the draft DRECP Biological Objective MGSQ1.1, the BLM should "[c]onserve and avoid disturbance of suitable habitat in specific geographic regions that are required for

Mohave ground squirrel population viability, identified as key population centers. Key population centers are presented in Figure C-39, described by Leitner (2008, 2013)."

Ridgecrest Area: Additional BLM lands south of Ridgecrest, and north of Brown Road and the Spangler OHV (in the vicinity of 35.564814, -117.747683; see Attachment A for map) area should be designated as an Area of Critical Environmental Concern and managed to protect Mohave ground squirrel habitat and connectivity. These lands are part of a habitat crossroads connecting several core populations of the Mohave ground squirrel, according to research cited in the DRECP's biological goals and objectives. Although the draft DRECP designates some BLM lands in this vicinity as an ACEC to protect Mohave ground squirrel habitat, the ACEC is likely to be insufficient to protect habitat connectivity because of the impact of private land uses and management of the nearby Spangler OHV area for intensive ground disturbing activity.

BLM lands north of Brown Road and west of U.S. Highway 395 were studied for Mohave ground squirrel to evaluate the proposed Ridgecrest Solar Power Project that has since been withdrawn. The study found that these BLM lands provided high quality Mohave ground squirrel habitat because of the existence of a wide desert wash (El Paso Wash) adjacent to high diversity creosote bush scrub habitat. The BLM and California Energy Commission staff's draft EIS (March 2010) for the Ridgecrest Solar power project found that loss of the lands north of Brown Road "would significantly reduce the connectivity for the MGS [Mohave ground squirrel] populations. There is no known way to fully mitigate for the loss of all or a portion of the proposed RSPP project site regarding connectivity."[31]

Although the portion of El Paso Wash that exists north of Brown Road does not fall within the boundary of the Western Mojave Plan Mohave ground squirrel conservation area, this is likely because Brown Road was chosen as an arbitrarily convenient boundary rather than a reflection of the quality of habitat north of Brown Road. Furthermore, the ACEC designation south of Brown Road is vulnerable to development of private property parcels within the ACEC boundary. Miles of new dirt roads, presumably for OHV use, have already been carved into a one square mile private property parcel immediately south of Brown Road and west of U.S. Highway 395 (within the proposed ACEC boundary). Extending the ACEC further north of Brown Road - will protect more of the high quality Mohave ground squirrel habitat for connectivity through El Paso Wash in an effort to ensure connectivity despite disturbance to habitat on private land parcels and adjacent OHV areas. Extending the ACEC coverage should at a minimum include the area within the following corners: 35.549456, -117.712179; 35.593247, -117.750288; 35.593574, -117.810911; 35.593574, -117.810911.

Cadiz Valley: The proposed Future Assessment Area and DRECP variance lands proposed for the Cadiz Valley are incompatible with BLM and local plans to manage these lands to protect qualities of national historical significance and international

tourism focus. If the DRECP retains the Future Assessment Area and variance lands in the final draft, the DRECP should include management actions that require any future renewable energy development not distract from the natural setting and relatively undisturbed viewshed. Specific management actions for a final FAA might exclude wind turbines and solar power towers because of these technologies' conflict with the cultural and visual qualities that BLM and the County of San Bernardino seek to protect along the Historic Route 66 corridor.
The draft DRECP should also revise Visual Resource Management (VRM) classes in the Cadiz Valley to reflect separate planning efforts, as required by the FLPMA.

Section 202 of the FLPMA and BLM Manual Section 1601 require coordination of land use planning with other jurisdictional entities to ensure that the land use plan is consistent with neighboring land use policies and management. Separate planning involving the BLM has identified the need for BLM to manage the Cadiz Valley – including portions identified in the draft DRECP as a Future Assessment Areas and variance lands – to protect the relatively undisturbed cultural and natural context along Historic Route 66.

The BLM and California Historic Route 66 Association have drafted the Route 66 Corridor Management Plan.[32] The draft plan recommends preserving the relatively undisturbed historical and natural context that exists along the Historic Route 66 between Ludlow and US Highway 95. The Cadiz Valley constitutes a central portion of this stretch, and industrial-scale energy development would disrupt the visitor experience and undermine the cultural significance of the corridor. Page 73 of Chapter 4 in the draft Route 66 Corridor Management Plan recommends designating lands in the Cadiz Valley (part of the section between Goffs and Ludlow) as VRM Class II. According to the draft Historic Route 66 Corridor Management Plan, "[o]ne of the most significant aspects of this section of Historic Route 66 is that the corridor-wide context-lands that can be seen from Historic Route 66 and form its distinctive setting – have changed little since the time when Historic Route 66 was commissioned in 1926 and indeed, back into prehistory." This section of the road has been nominated to the National Register of Historic Places, and several additional properties along the road (and within view of the Cadiz Valley) are also deemed eligible.

A solar power tower or field of large wind turbines would significantly distract from the natural and historical context that the BLM and other partners seek to protect along this stretch of Route 66. According to analysis of the former BrightSource Palen Solar Electric Generating System (ownership of this proposed project now rests with Abengoa), a solar power tower can be visible from over 100 miles away.[33] Yet, the Future Assessment Area and variance lands would be less than three miles from Historic Route 66. To manage the Cadiz Valley to protect this nationally significant cultural and historical resource, the BLM should revise any VRM Class III designations in the Cadiz Valley to Class II to ensure that any future development respects the context of this stretch of Historic Route 66. The BLM should also include management actions for visual resources that specifically discourage wind

turbines, solar power towers, and similarly tall structures along the Historic Route 66 Corridor.

Soda Mountains and Valley: Pending withdrawal of the proposed Soda Mountain Solar project, the DRECP should classify lands in Soda Mountain valley south of Interstate-15 as an ACEC (in the vicinity of 35.160740, -116.177872; see Attachment A for map). The inter-mountain habitat across both north and south of Interstate 15 presents an important opportunity to restore habitat connectivity for the desert bighorn sheep that has since been severed by the highway. Bighorn sheep experts and biologists have commented that "research finds that the Soda Mountains connection is a particularly important restorable corridor in the southeastern desert region of California, where a wildlife overpass would re-establish migration affecting numerous bighorn sheep populations on either side of I-15."[34] According to a biological research, Interstate 15 has contributed to a decline in genetic diversity in desert bighorn sheep.[35] A separate study (Attachment B) concluded based on network analysis "that the North-South Soda Mountain connection is the most important restorable corridor for long-term demographic potential (i.e., population recolonization by ewes) across the entire southeastern Mojave Desert of California, as it would provide the best and only opportunity for movement between bighorn populations in the Mojave National Preserve and the large complex of populations to the north of Interstate 15, and would facilitate gene flow as well resulting in long-term (multi-step) connections with bighorn sheep populations in Death Valley National Park."[36]

The draft DRECP biological goals and objectives identify the inter-mountain habitat between the Soda Mountains and across Interstate 15 as a high priority opportunity to "promote unimpeded movement of desert bighorn sheep across highway infrastructure."[37] This movement and genetic exchange will be critical to maintain species' resilience in the face of climate change. Improper management of the valley could result in the loss of a least-cost and critical opportunity to restore a migratory corridor for the bighorn sheep across Interstate 15. Desert bighorn sheep inhabit the portion of the Soda Mountains south of the highway, and can connect with other sheep populations to the north with proper study and investment in a wildlife overpass. Until proper study and consideration of restoring habitat connectivity in valley is complete, the BLM and REAT agencies should not foreclose on this opportunity.

Manzanar National Historic Site: BLM lands adjacent to the Manzanar National Historic Site should be designated under the National Landscape Conservation System because they contain a nationally significant cultural landscape that provides context and setting for the wrongful internment of Japanese Americans during World War II. Preserving the open desert scrub between the Manzanar site and Sierra range will retain the sense of isolation and solitude experienced by internees sent to Manzanar. Although some of the adjacent lands are identified as legally or legislatively protected in DRECP maps, other lands immediately adjacent to the site remain non-designated.

Lucerne Valley Wildlife Linkage: The DRECP designates a narrow swath of the Lucerne Valley – linking the Juniper Flats region to the Granite Mountains - as an Area of Critical Environmental Concern. However, much of these lands are in private hands, increasing the uncertainty that a viable linkage can be maintained through conservation easements or land acquisition. The Reserve Design should be revised to widen the extent of the conservation priority area for this linkage to account for this uncertainty and increase the chances that enough intact desert habitat is protected or restored to maintain a linkage. As currently proposed, one of the narrowest points of the linkage is slightly less than 1.5 miles across. This means that a couple of uncooperative property owners could allow for development that significantly undermines the viability of this linkage.

DFAs on either side of the currently proposed ACEC and Conservation Priority Area should be removed and replaced by these conservation designations. Objective L1.2 of the draft DRECP Biological Goals and Objectives requires that landscape linkage corridors be three miles wide "where feasible," and 1.2 miles when greater widths are not feasible. However, a wider linkage corridor is certainly feasible through the Lucerne Valley. The DRECP has designated some of the rural residential development in this area as "impervious and urban." Although the residential developments are not ideal habitat, much of the parcels with residential development still allow for some wildlife connectivity, and maintain some natural desert substrate.

The DRECP should take a closer look at the land use and conservation designations to ensure all opportunities for maintaining this wildlife linkage are exploited. At a minimum, the DRECP should consider revising the linkage to make Willow Wells Road the eastern boundary, and Milpas Drive the western boundary of the linkage. The majority of land within these boundaries is relatively intact, and enough desert habitat can be maintained among the rural residential development to allow for a viable wildlife linkage.

Juniper Flats: I support community petitions to extend NLCS designation to the Juniper Flats area southeast of Apple Valley (in the vicinity of 34.382990, -117.125335). Although a portion of the Juniper Flats is designated as NLCS under the draft DRECP, the BLM does manage additional lands east and west of this proposed designation that could be included. The lands contain a high level of ecological diversity, a high level of landscape intactness, and – because of their higher elevation – may provide important refuge and habitat resilience for wildlife facing the effects of climate change. Portions of the Juniper Flats also serve as part of the wildlife linkage between the San Bernardino Mountains and the Granite Mountains to the north. The area also constitutes a large block of land managed by the BLM.

Flat-tailed Horned Lizard Habitat: DFAs proposed for BLM lands near the Borrego Badlands (in the vicinity of 33.203373, -115.982028) should be removed

from the draft DRECP. The California Fish and Game Commission on February 12, 2015 agreed to consider listing the species as endangered under California state law. Utility-scale renewable energy development would be incompatible with the protection of Flat-tailed horned lizard habitat, as outlined in the draft biological goals and objectives, and these DFAs specifically fall within an identified Flat-tailed horned lizard reserve, and areas of very high habitat intactness.[38] [39]

Additionally, BLM lands immediately west of the North Algodones Dunes Wilderness Area (in the vicinity of 32.989384, -115.232211) should be designated as an Area of Critical Environmental Concern. These lands host flat-tailed horned lizard habitat this is judged to have moderately high to high intactness. The current draft DRECP appears to have conflicting land use designations for the area, with overlapping DFA and NLCS designations. The DFA designations should be removed, and the lands should be granted NLCS or ACEC designation.

Thank you for your time and consideration.

Sincerely,

Shaun Gonzales

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[1] *Recommendations of Independent Science Advisors for the California Desert Renewable Energy Conservation Plan*, October 2010.
[2] *California Energy Efficiency Strategic Plan*, January 2011 Update, page 20.
[3] DeShazo, J.R.; Matulka, Ryan; Wong, Norman; *Los Angeles Rooftop Solar Atlas*, UCLA Luskin Center for Innovation, 2011.
[4] See attachment to Basin & Range Watch comment letter, January 30, 2015.
[5] Shahan, Zachary, "German Solar Power Storage System Prices Drop 25%," *CleanTechnica*, January 7, 2015. <http://cleantechnica.com/2015/01/07/german-solar-power-storage-system-prices-drop-25/>
[6] Irvine Smart Grid Demonstration, UC Irvine, <http://www.apep.uci.edu/3/research/partnership_ISGD.aspx>
[7]"UCI Migrogrid: Thermal Storage," Department of Energy Storage Database, <http://www.energystorageexchange.org/projects>
[8] "Pilot Will Reward Vehicle Owners for Using Batteries to Help Manage Electric Grid," Pacific Gas & Electric, January 5, 2015. < http://www.pge.com/en/about/newsroom/newsdetails/index.page?title=20150105_pge_and_bmw_partner_to_extract_grid_benefits_from_electric_vehicles>

[9] Clarke, Chris, "April Was Bad Month for Birds at Ivanpah Solar," KCET ReWire, May 26, 2014. <http://www.kcet.org/news/redefine/rewire/solar/concentrating-solar/april-was-bad-month-for-birds-at-ivanpah-solar.html>
[10] Clarke, Chris, "Scores of Birds Killed During Test of Solar Project in Nevada," KCET ReWire, February 18, 2015. <http://www.kcet.org/news/redefine/rewire/solar/concentrating-solar/scores-of-birds-killed-during-test-of-solar-project-in-nevada.html>
[11] Smallwood, Shawn; Testimony before the California Energy Commission, cited in "OPENING BRIEF OF INTERVENOR CENTER FOR BIOLOGICAL DIVERSITY AFTER REOPENED HEARINGS," August 15, 2014. <http://docketpublic.energy.ca.gov/PublicDocuments/09-AFC-07C/TN202935_20140815T145913_Center_Opening_Brief_for_Reopened_Hearings.pdf>
[12] California Energy Commission Staff, "ENERGY COMMISSION STAFF REBUTTAL TESTIMONY PALEN SOLAR ELECTRIC GENERATING SYSTEM DOCKET NO. (09-AFC-7C)," July 18, 2014. <http://docketpublic.energy.ca.gov/PublicDocuments/09-AFC-07C/TN202773_20140718T165158_Staff%27s_Rebuttal_Testimony.pdf>
[13] Danelski, David, "Solar reviews overlooked endangered bird, group says," *The Press-Enterprise*, August 21, 2014. <http://www.pe.com/articles/solar-748681-wildlife-agencies.html>
[14] Clarke, Chris, "Water Birds Turning Up Dead at Solar Projects in the Desert," *KCET ReWire*, July 17, 2013. <http://www.kcet.org/news/redefine/rewire/solar/water-birds-turning-up-dead-at-solar-projects-in-desert.html>
[15] Supplement to the Draft Solar Programmatic Environmental Impact Statement, Appendix B, pages B11-B14. <http://www.solareis.anl.gov/documents/supp/index.cfm>
[16] "Adaptive Color Polymorphism and Unusually High Local Genetic Diversity in the Side-Blotched Lizard, Uta stansburiana," Steven Micheletti, Eliseo Parra, Eric J. Routman, October 25, 2012, <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0047694>
[17] Draft DRECP, Appendix C, Figure C-36 and page C-22.
[18] Draft DRECP, Appendix C, Figure C-36 and page C-22.
[19] Draft DRECP, Appendix C, Objective DUN1.2, page C-17.
[20] Bureau of Land Management, "BLM Rejects Solar Development in Silurian Valley," November 20, 2014, <http://www.blm.gov/ca/st/en/info/newsroom/2014/november/siluranvalley.html>
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[22] Memorandum from Deputy State Director for Resources to the State Director for California, BLM, "Silurian Valley Solar Project Variance Determination," November 20, 2014.
[23] Bureau of Land Management, "BLM Rejects Solar Development in Silurian Valley," November 20, 2014,

<http://www.blm.gov/ca/st/en/info/newsroom/2014/november/siluranvalley.html>

[24] Bureau of Land Management Manual 6280, "Management of National Scenic and Historic Trails and Trails Under Study or Recommended as Suitable for Congressional Designation (Public)," page 1-21.

[25] J.C. Dohrenwend , "Aeolian geomorphology of the Devil's Playground, Kelso Dunes, and Silurian Valley, California." *Surficial Geology of the Eastern Mojave Desert, California*, 162-173, Geological Society of America, Boulder, Colorado.

[26] Draft DRECP, Appendix R2.7, Figure R2.7-1

[27] "Current Status of the Mohave Ground Squirrel," Philip Leitner, Transactions of the Western Section of the Wildlife Society, 44:11-29, 2008

[28] Clapp, Nicholas, *Gold and Silver in the Mojave – Images of a Last Frontier*, October 25, 2012.

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[32] "Route 66 Corridor Management Plan," Bureau of Land Management and the California Historic Route 66 Association, <http://www.blm.gov/ca/st/en/fo/needles/route_66/route66cmp.html>

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[35] Epps, Clinton, Wehausen, John, "Highways block gene flow and cause a rapid decline in genetic diversity of desert bighorn sheep," *Ecology Letters*, 2005.

[36] Epps, Clinton; Wehausen, John; Monello, Ryan, and Creech, Tyler, "Potential impacts of proposed solar energy development near the South Soda Mountains on desert bighorn sheep connectivity," *Report to the California Department of Fish and Wildlife, National Park Service, and Bureau of Land Management*, 25 February 2013

[37] Draft DRECP, Appendix C, page C-38.

[38] Draft DRECP, Appendix C, figure C-37 and page C-23.

[39] DRECP Gateway dataset, "Flat-tailed horned lizard – Habitat Intactness, DRECP."

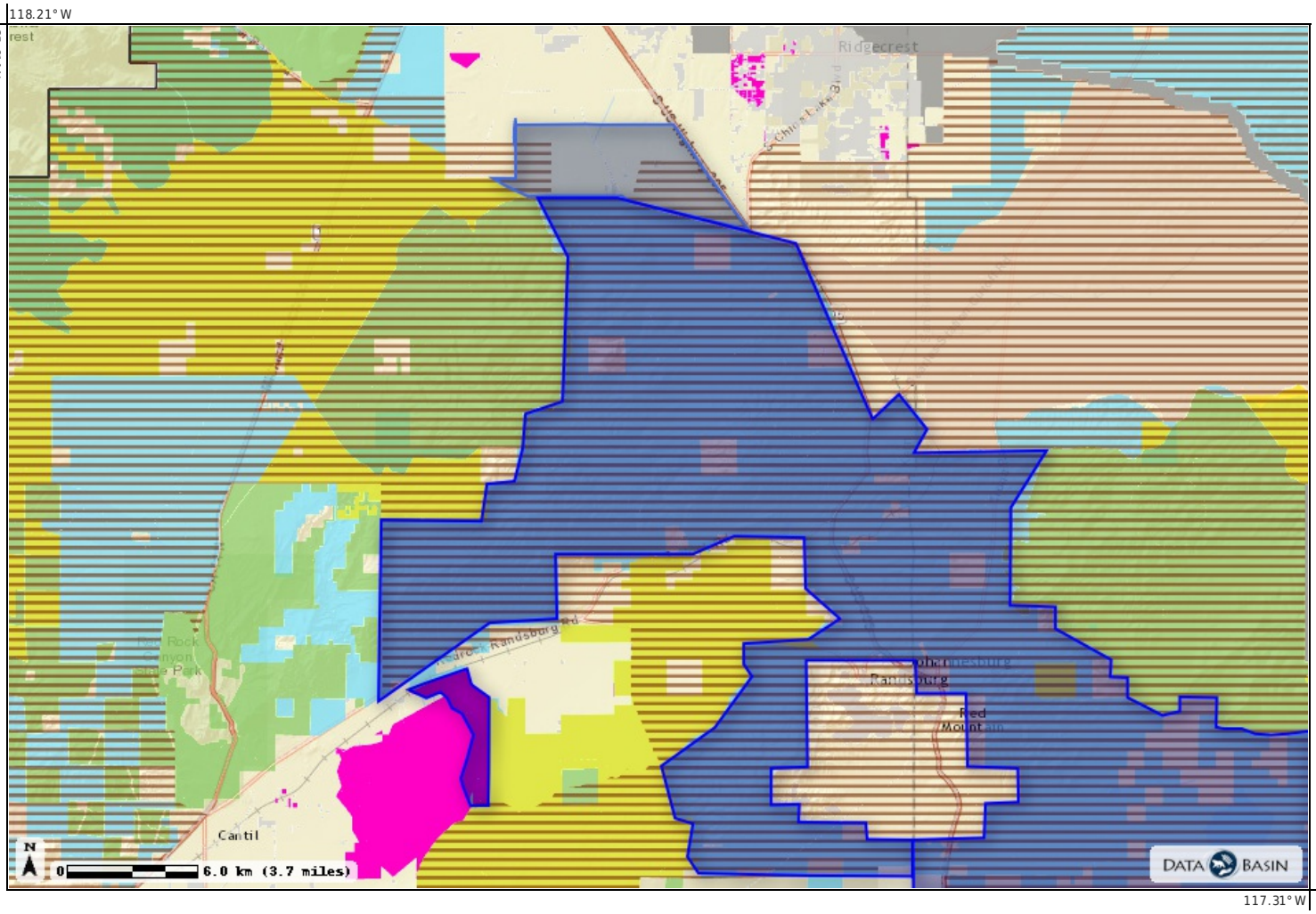
Review for *FIGURE II.3-4, Interagency Preferred Alternative - BLM LUPA*

Map URL: http://drecp.databasin.org/maps/7a338b84d1724cfb92ca391284deee26
Date: February 22, 2015
Reviewer: Shaun Gonzales

Map

118.21° W

35.61° N



35.30° N

117.31° W

For an

interactive map with legend go to: http://drecp.databasin.org/maps/7a338b84d1724cfb92ca391284deee26

Legend

Proposed Special Recreation Management Areas (SRMA), Preferred Alt.

Existing Special Recreation Management Areas (SRMA), DRECP

DRECP Boundary

Development Focus Areas on BLM Land, Preferred Alt.

Study Area Lands on BLM Land, Preferred Alt.

Displaying: **Type**

- Special Analysis Areas
- Future Assessment Areas
- DRECP Variance Lands

Reserve Design Envelope (Existing Cons.), DRECP

Displaying: **Existing Conservation**

- Legislatively and Legally Protected Areas
- Military Expansion Mitigation Lands

Reserve Design Envelope (NLCS) on BLM Land, Preferred Alt.

- National Landscape Conservation System

Reserve Design Envelope (ACECs & Wildlife Allocation) on BLM Land, Preferred Alt.

Displaying: **BLM Existing & Proposed Land Use Plan Amendment Designations**

- Areas of Critical Envirionmental Concern
- Wildlife Allocation

Other Lands, DRECP

Displaying: **Type**

- Impervious and Urban
- Military
- Tribal Lands
- OHV Areas

Comment: These BLM lands should be included as part of the Juniper Flats NLCS designation.

Comment: The Lucerne Valley wildlife linkage connecting the Juniper Flats area with the Granite Mountains should be widened to include additional lands as part of the Conservation Priority Area.

Comment: The South Soda Mountains and corresponding valley should be designated as an Area of Critical Environmental Concern to protect a critical opportunity to restore bighorn sheep habitat connectivity.

Comment: The DFAs west of the Salton Sea and east of the Borrego Badlands should be removed as they fall within habitat reserve for the flat-tailed horned lizard.

Comment: Cuddeback Air Force Range was relinquished by the U.S. Air Force in 2012 back to the BLM. The BLM should designate these as ACEC and NLCS lands.

Comment: The Alvord to El Paso Mountains landscape should be designated as NLCS for its scientific and cultural values. The Randsburg area is a historic mining district where gold mining began in the late...

Comment: NLCS designation should be extended to the lands around Iron Mountain to protect the wilderness characteristics of the area and include this as part of the uniquely intact ecosystem that stretches...

Comment: BLM LUPA map indicates conflicting designations - DFA overlapping with ACEC. The DFA designation should be removed.

Comment: BLM LUPA map indicates conflicting designations - DFA overlapping proposed ACEC. The DFA designation should be removed.

Comment: BLM LUPA map contains conflicting designations in this area near the Algodones Dunes. BLM lands immediately next to the wilderness area and containing intact desert wildlands should be...

Comment: The map depicts conflicting LUPA designations. DFA lands overlap with proposed ACEC. As desert habitat adjacent to the Desert Tortoise Natural Area, this should be designated as an ACEC.

Comment: The BLM lands in the vicinity of the Manzanar National Historic Site should be designated NLCS for their unique cultural value. The viewshed of the Manzanar site is part of the important historic...

Comment: The Future Assessment area in the Cadiz Valley could encourage energy development that is inconsistent with the visual resource management objectives currently being evaluated in the Route 66...

Comment: This Future Assessment Area should be reduced to avoid the potential that future energy development will be visible to visitors to the Mojave National Preserve. People visit the Preserve for...

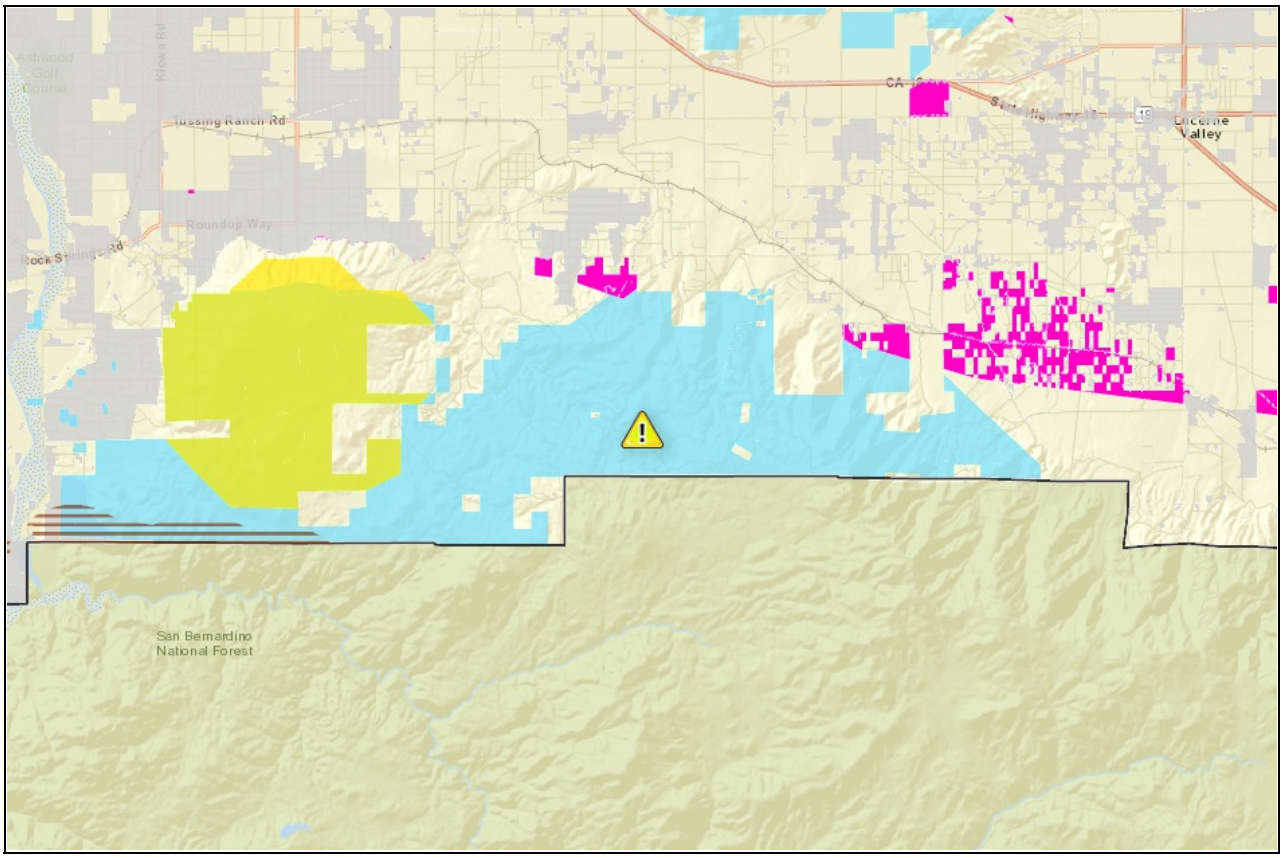
Comment: The Special Analysis Area in the Silurian Valley should be rejected in its entirety, and the underlying lands should be designated as NLCS lands. Industrial-scale energy development or other types...

Comment: The Pisgah area south of the Cady Mountains should be designated as an ACEC and NLCS. To the north of Interstate 15, these lands were studied extensively for the now abandoned Calico Solar power...

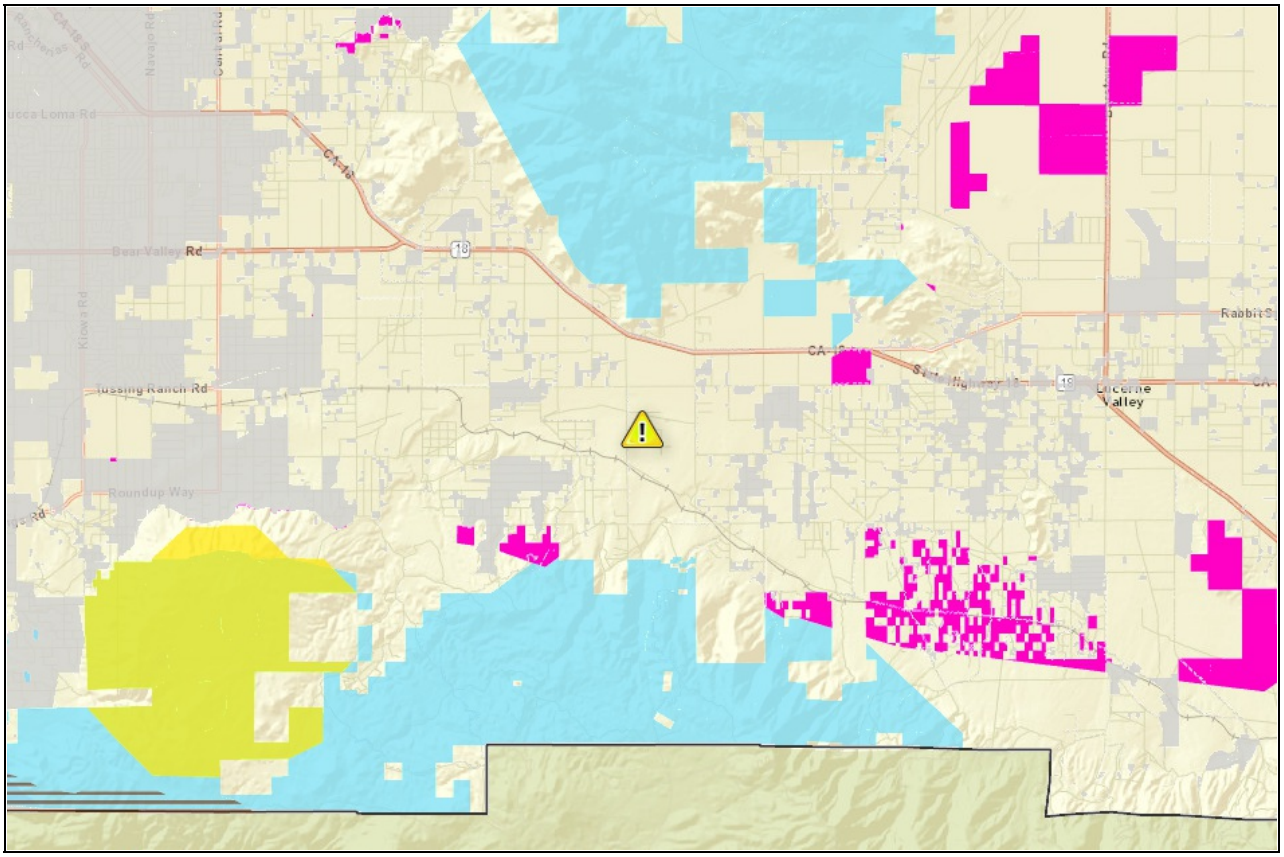
Comment: These BLM lands north of Brown Road and west of US Highway 395 should be designated as an area of critical environmental concern to protect Mojave Ground Squirrel (MGS) habitat and enhance MGS...

Location-Specific Comments

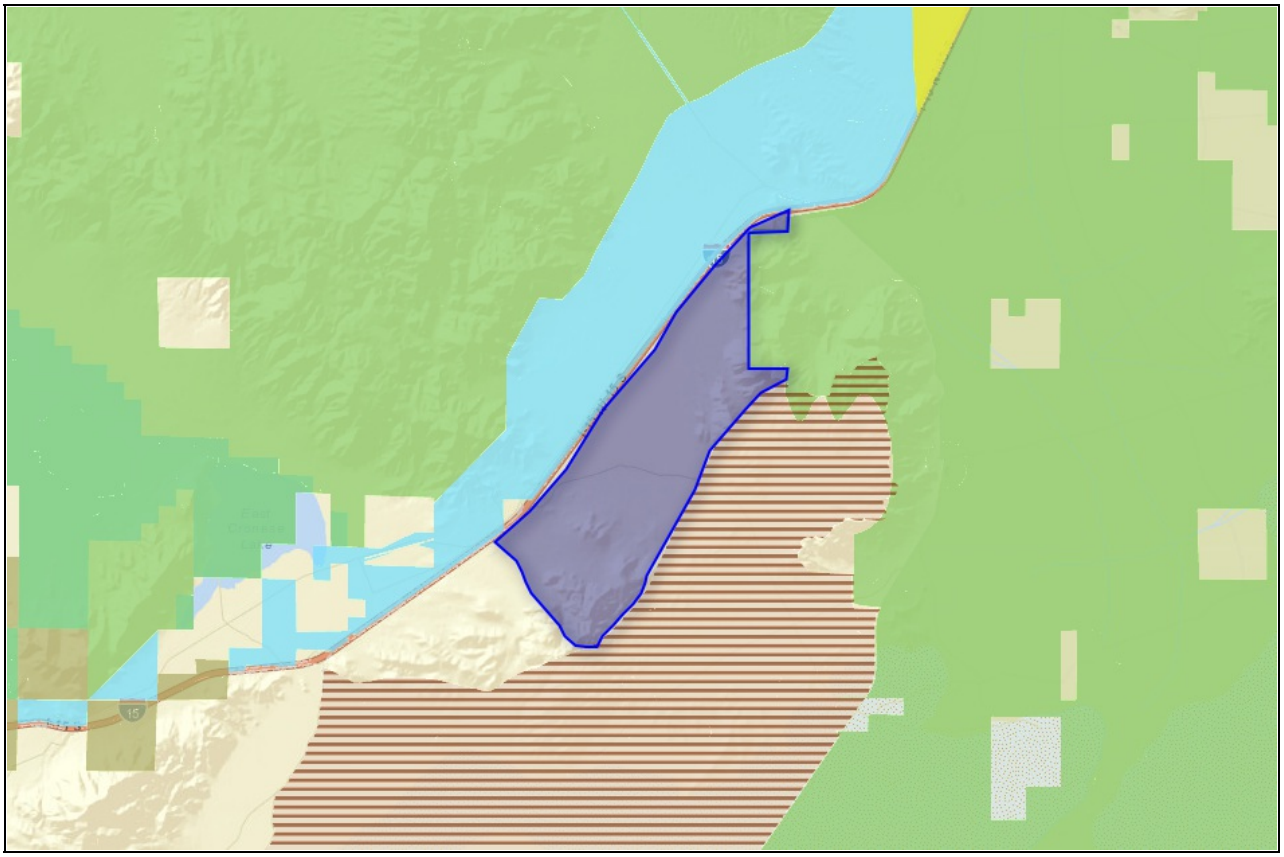
Comment These BLM lands should be included as part of the Juniper Flats NLCS designation.



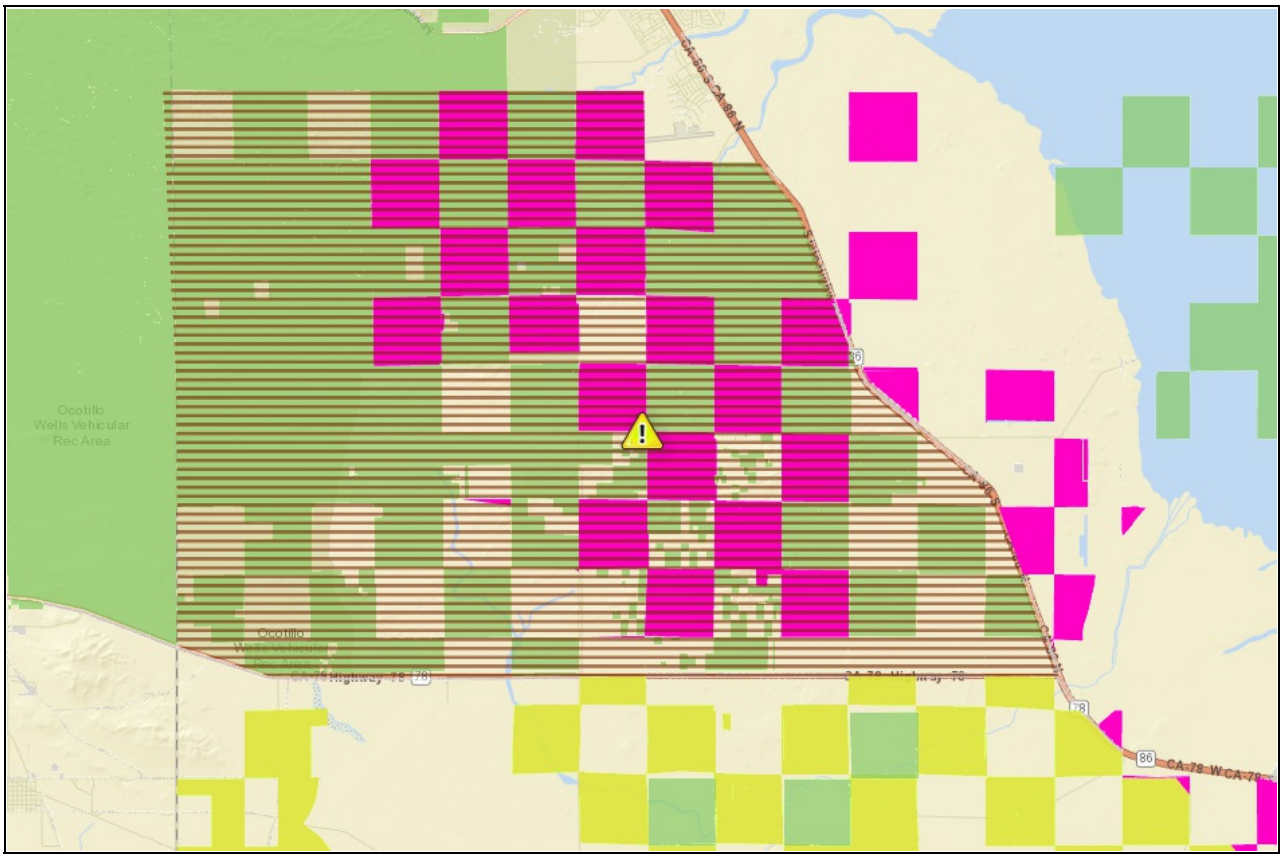
Comment The Lucerne Valley wildlife linkage connecting the Juniper Flats area with the Granite Mountains should be widened to include additional lands as part of the Conservation Priority Area.



Comment The South Soda Mountains and corresponding valley should be designated as an Area of Critical Environmental Concern to protect a critical opportunity to restore bighorn sheep habitat connectivity.



Comment The DFAs west of the Salton Sea and east of the Borrego Badlands should be removed as they fall within habitat reserve for the flat-tailed horned lizard.

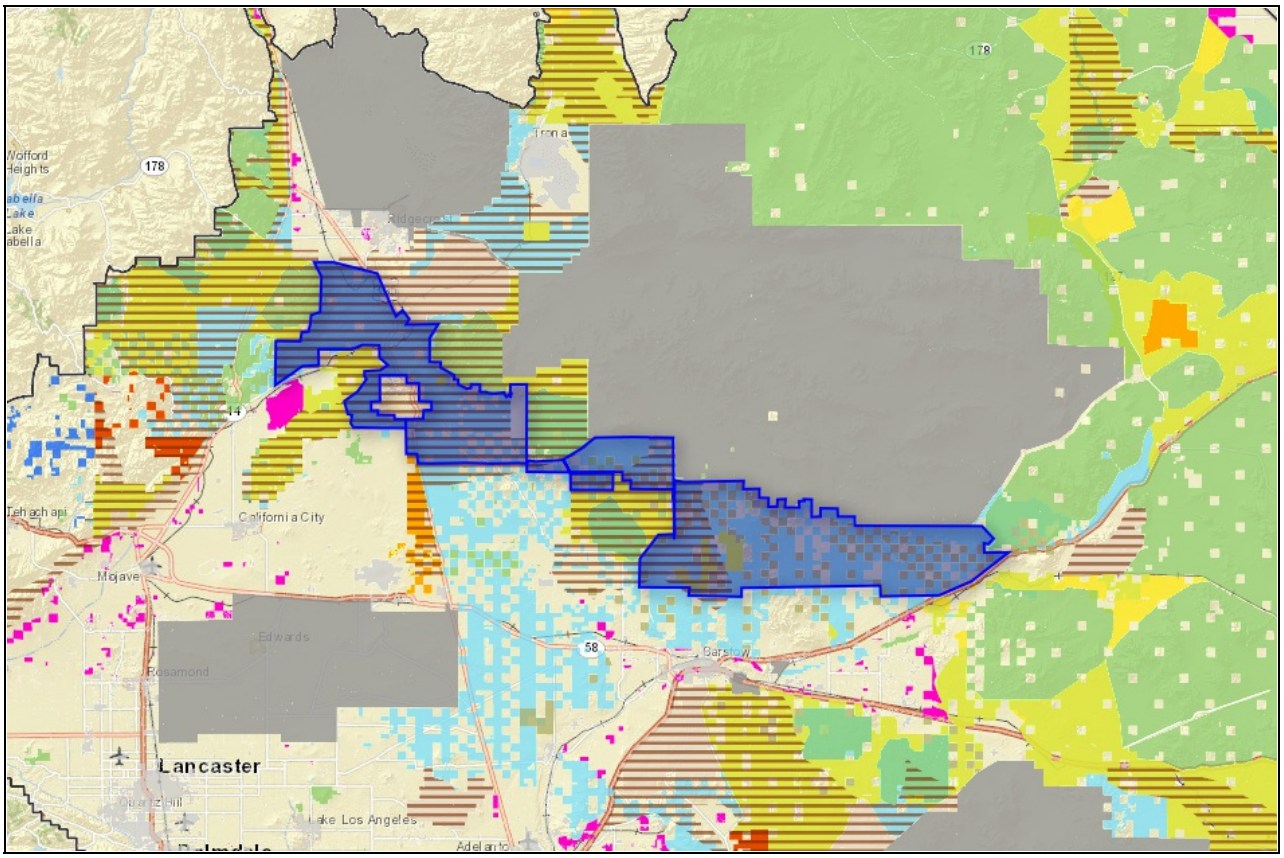


Comment Cuddeback Air Force Range was relinquished by the U.S. Air Force in 2012 back to the BLM. The BLM should designate these as ACEC and NLCS lands.

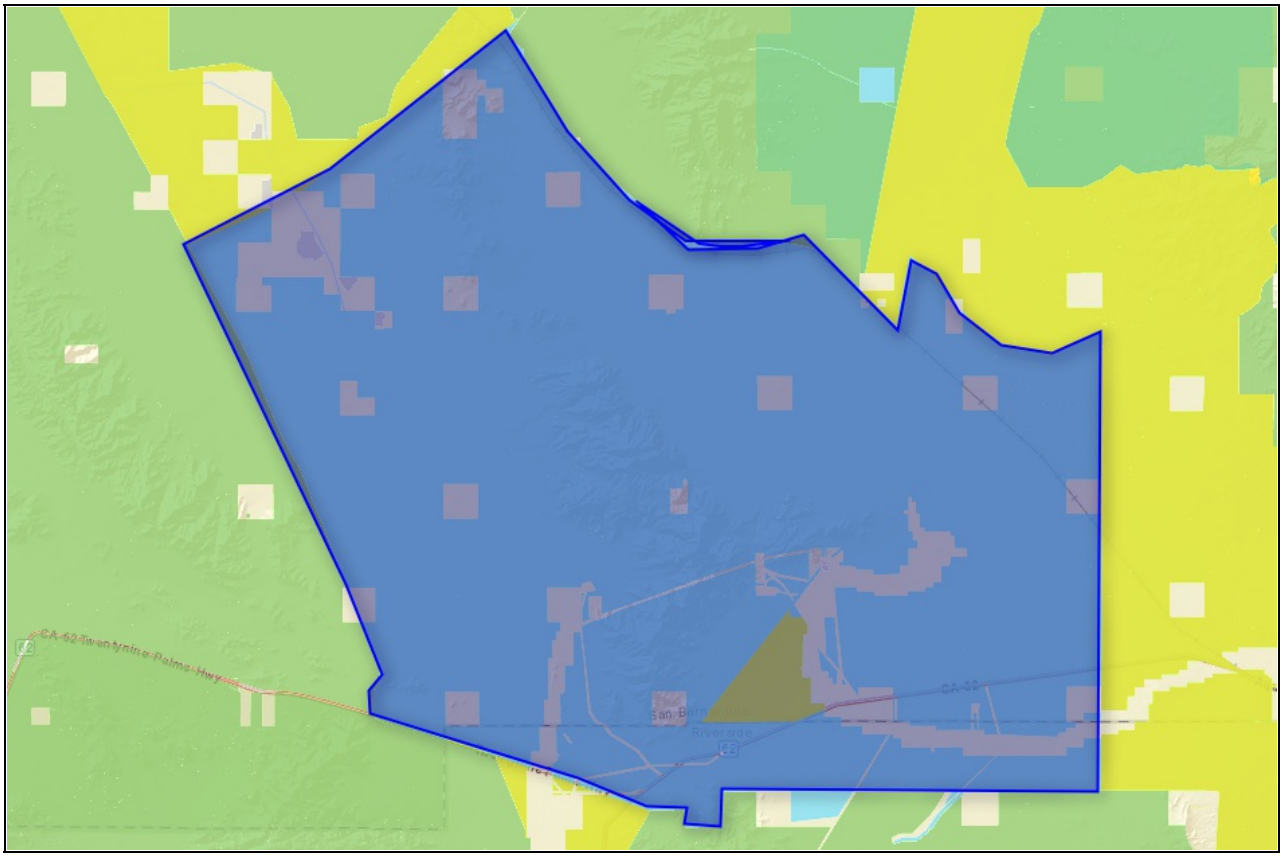
Comment The Alvord to El Paso Mountains landscape should be designated as NLCS for its scientific and cultural values. The Randsburg area is a historic mining district where gold mining began in the late 1800s and continued until approximately 1942. The landscape remains much as it did then.

The area also is adjacent to the Cuddeback Air Force Range, which has been in use since the late 1930s for training and flight testing, including a historic crash site of the X-15, which was tested in the 1960s and continues to hold the world record for the highest speed reached by a manned aircraft. Nearby Harper Dry Lake was also used by Howard Hughes and Northrop to test early prototypes of blended wing design aircraft.

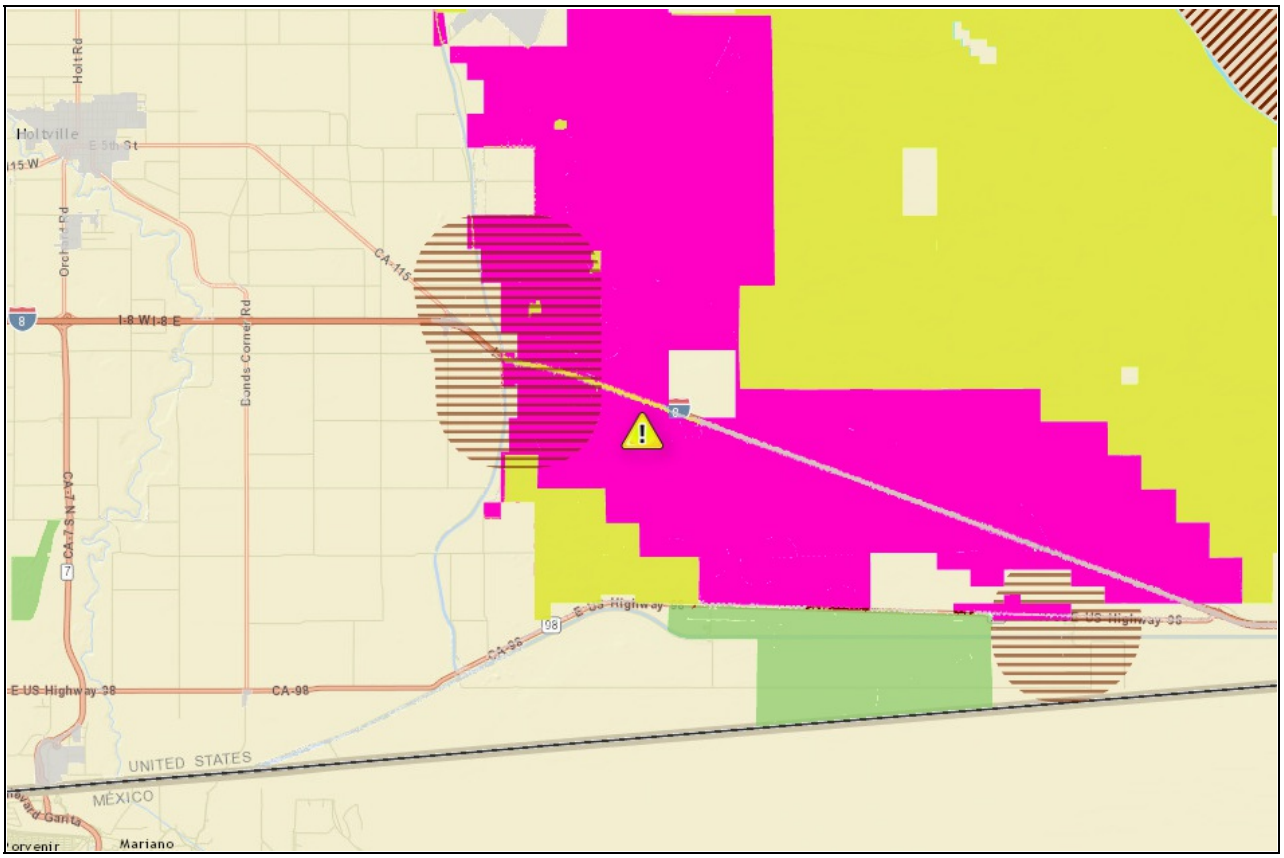
Additionally, the landscape contains critical habitat for the desert tortoise and Lane Mountain milkvetch; both are federally protected species under the Endangered Species Act. The area also provides core habitat and habitat connectivity for the Mohave Ground Squirrel, a covered species under the DRECP.



Comment NLCS designation should be extended to the lands around Iron Mountain to protect the wilderness characteristics of the area and include this as part of the uniquely intact ecosystem that stretches from the Blythe area northward.



Comment BLM LUPA map indicates conflicting designations - DFA overlapping with ACEC. The DFA designation should be removed.



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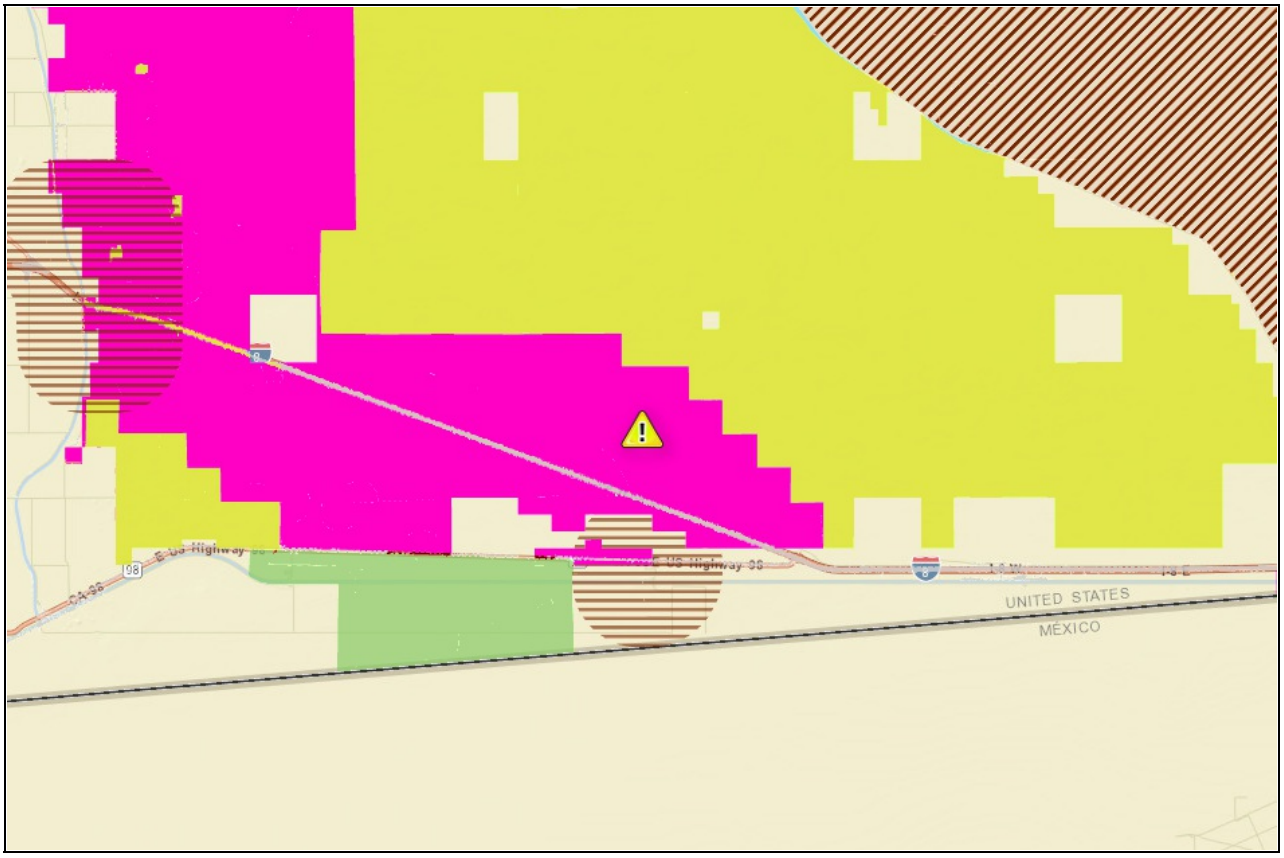
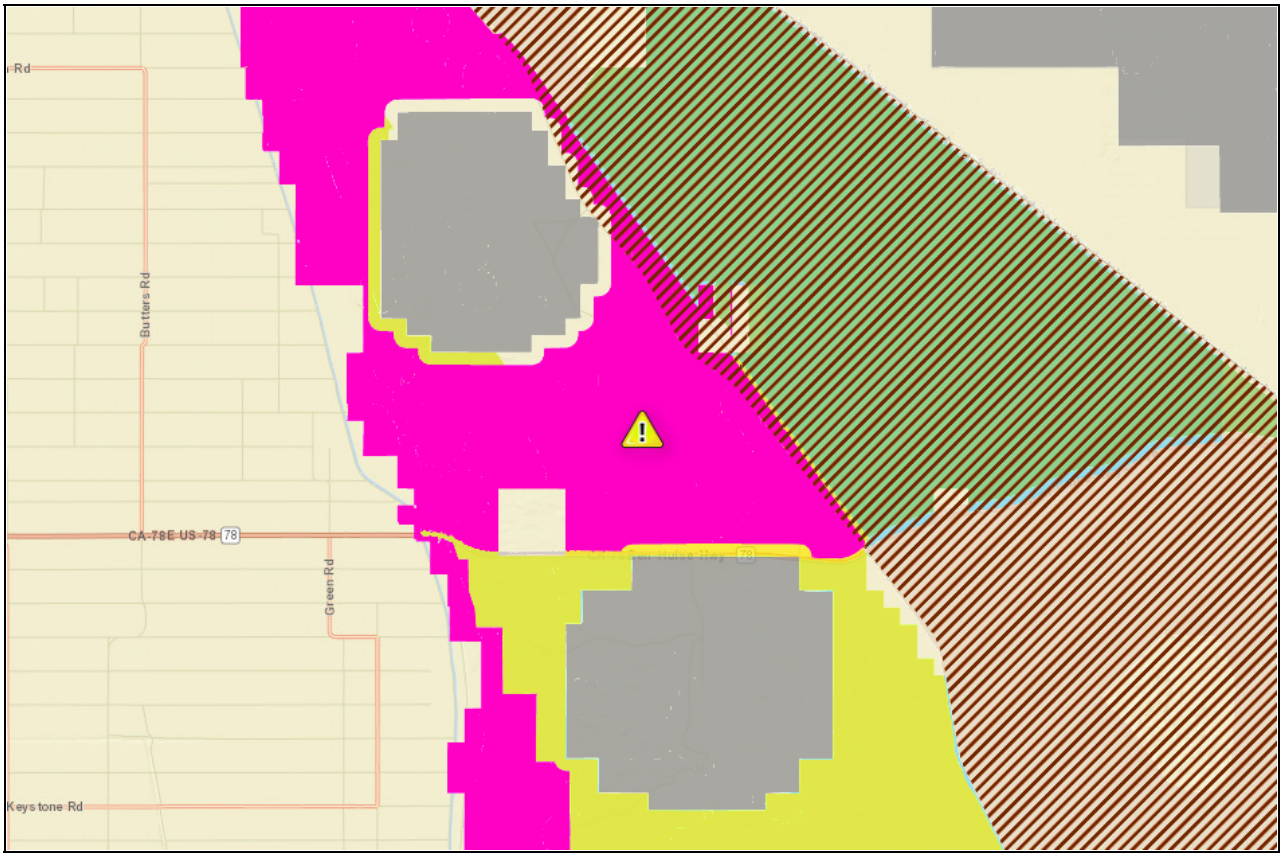
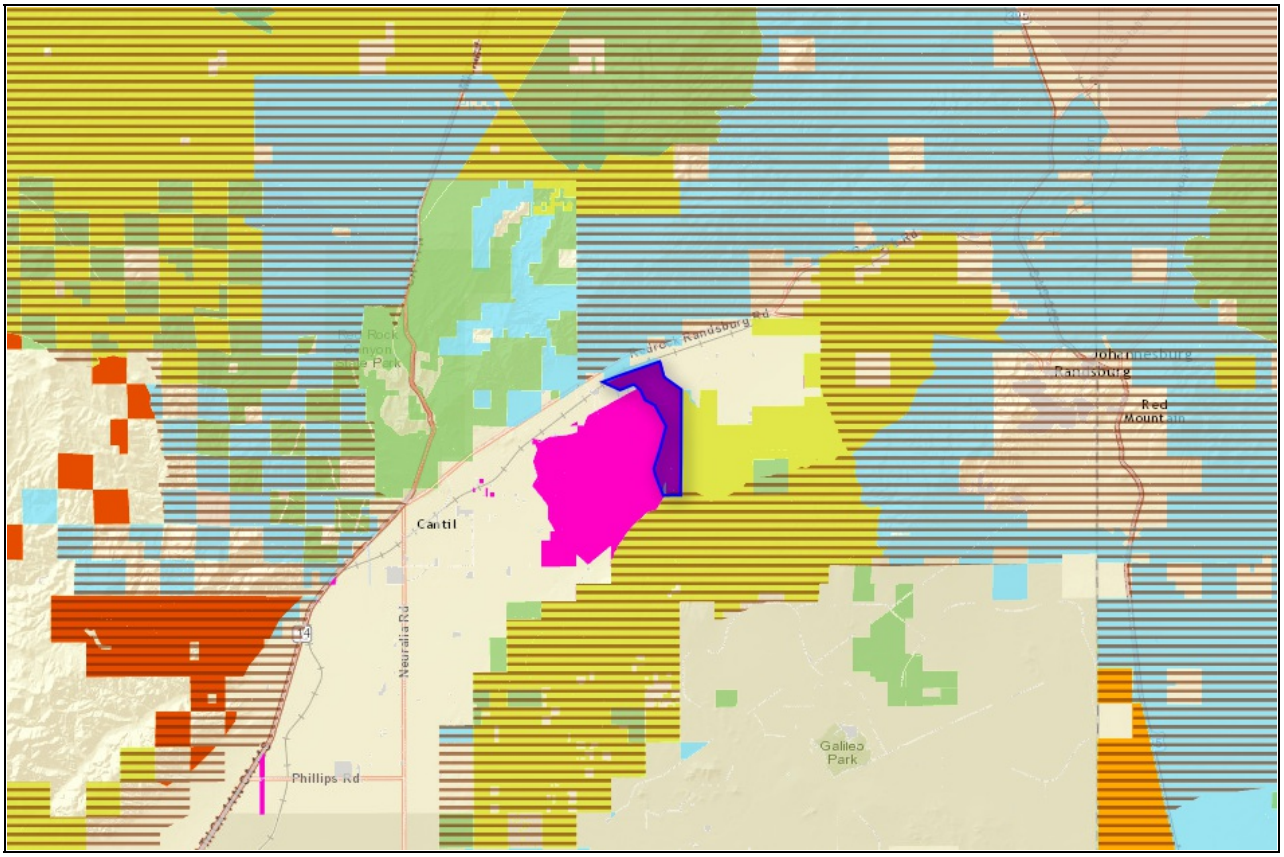


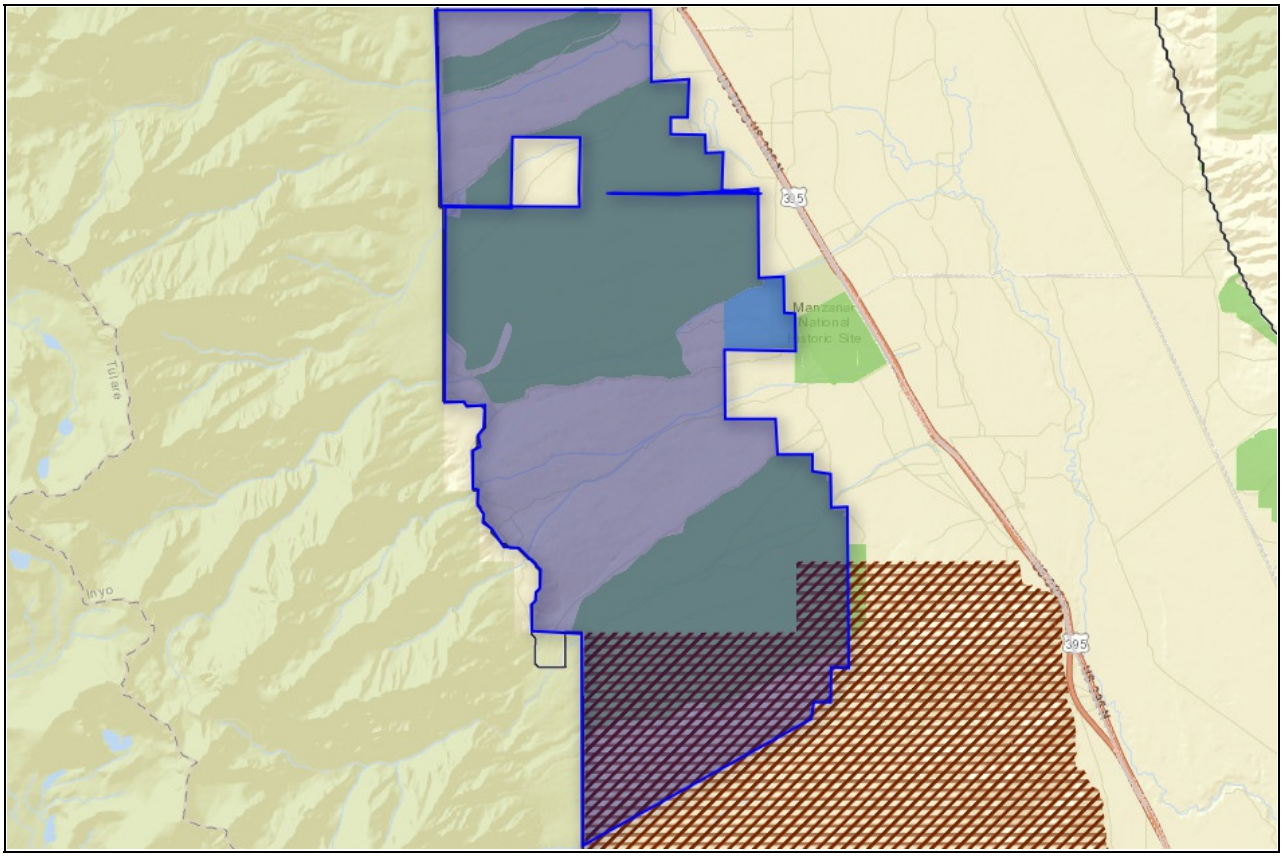
Comment BLM LUPA map contains conflicting designations in this area near the Algodones Dunes. BLM lands immediately next to the wilderness area and containing intact desert wildlands should be classified as an ACEC and NLCS to protect wildlife in an area otherwise burdened by DFA designations and off-highway vehicle recreation. Portions of this area include high and very highly intact flat-tailed horned lizard habitat.



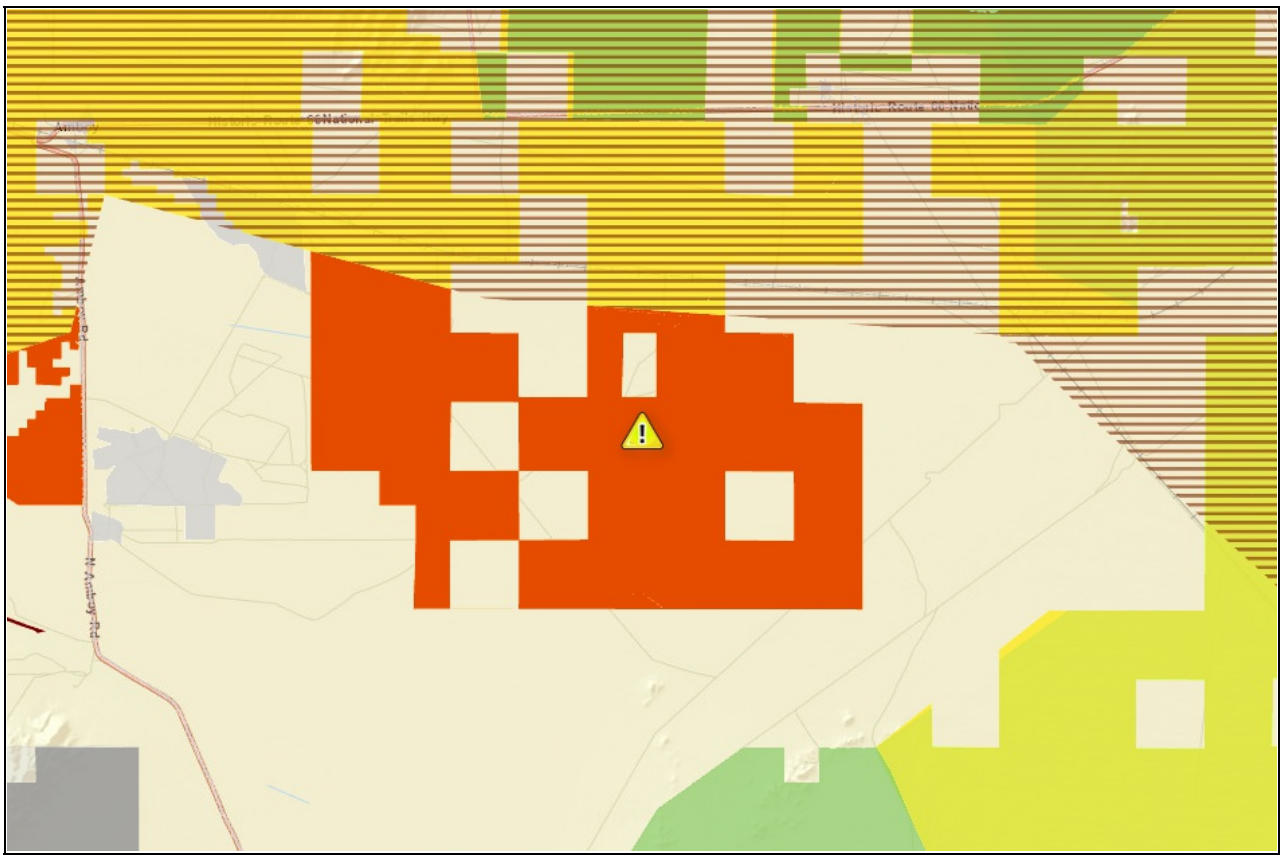
Comment The map depicts conflicting LUPA designations. DFA lands overlap with proposed ACEC. As desert habitat adjacent to the Desert Tortoise Natural Area, this should be designated as an ACEC.



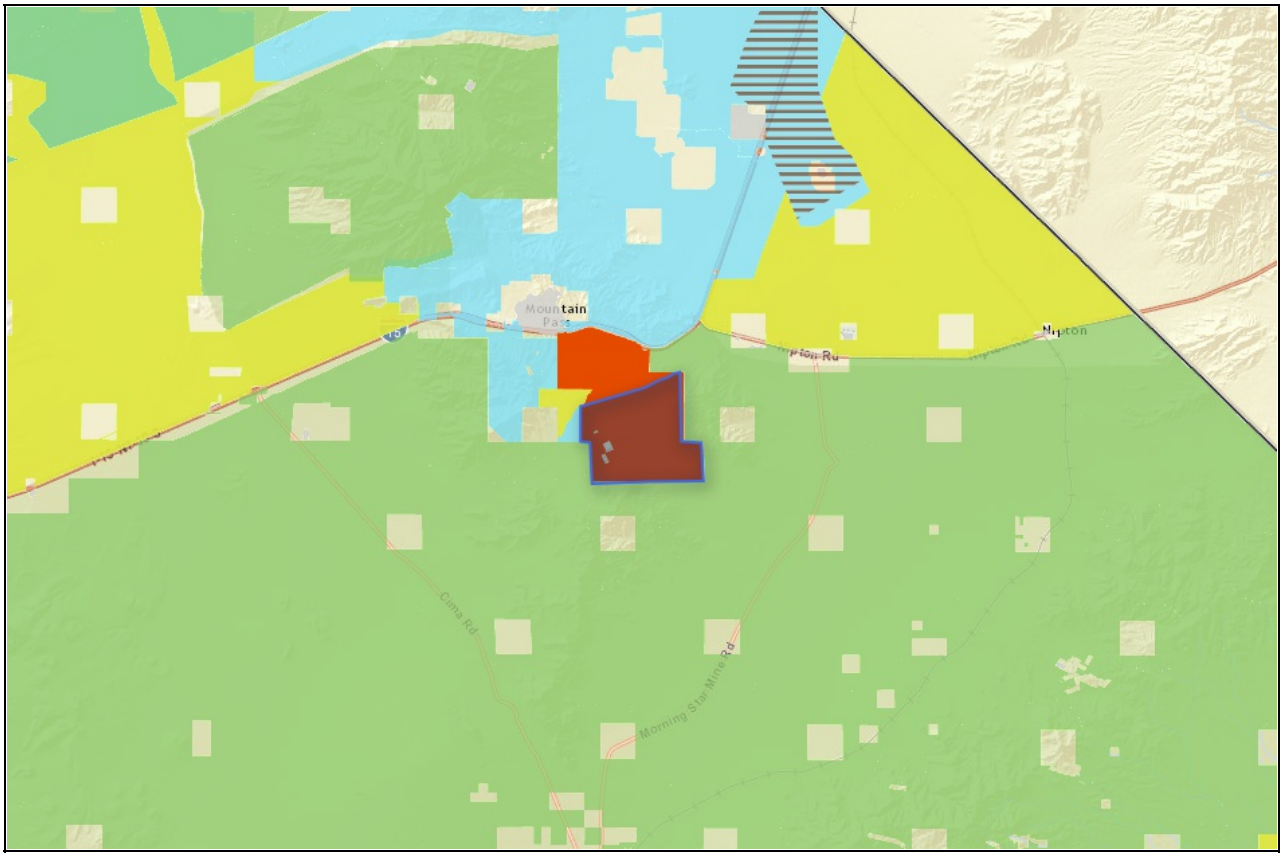
Comment The BLM lands in the vicinity of the Manzanar National Historic Site should be designated NLCS for their unique cultural value. The viewshed of the Manzanar site is part of the important historic context of the internment of Japanese-Americans during World War II, presenting visitors with the sense of isolation experienced by those wrongfully imprisoned.



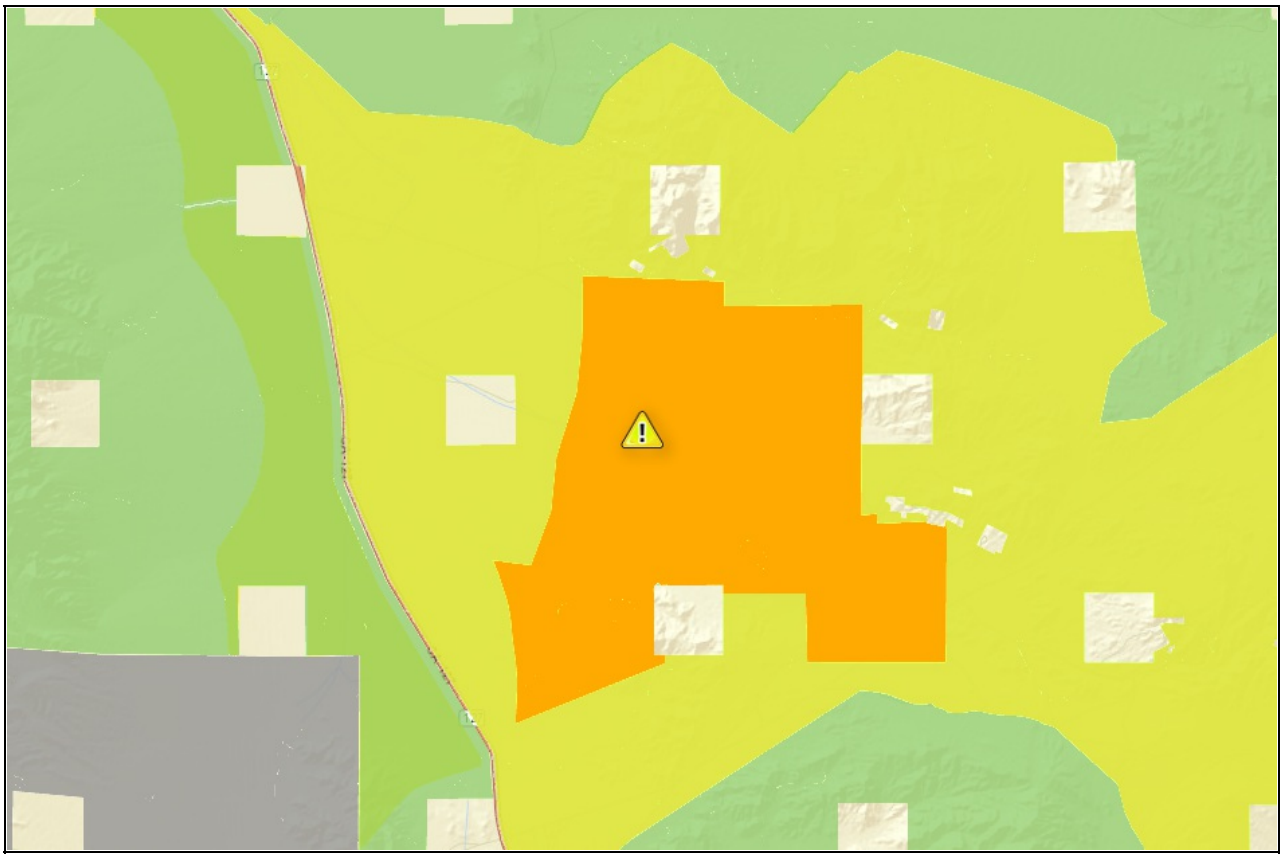
Comment The Future Assessment area in the Cadiz Valley could encourage energy development that is inconsistent with the visual resource management objectives currently being evaluated in the Route 66 Corridor Management Plan. If the Future Assessment Area is kept, it should be accompanied by management prescriptions that limit the height of structures and disruption of the landscape for visitors to the desert traveling on Route 66.



Comment This Future Assessment Area should be reduced to avoid the potential that future energy development will be visible to visitors to the Mojave National Preserve. People visit the Preserve for primitive recreation and solitude, but these values would be severely undermined if development of the hilltops of the Ivanpah Mountains is visible.



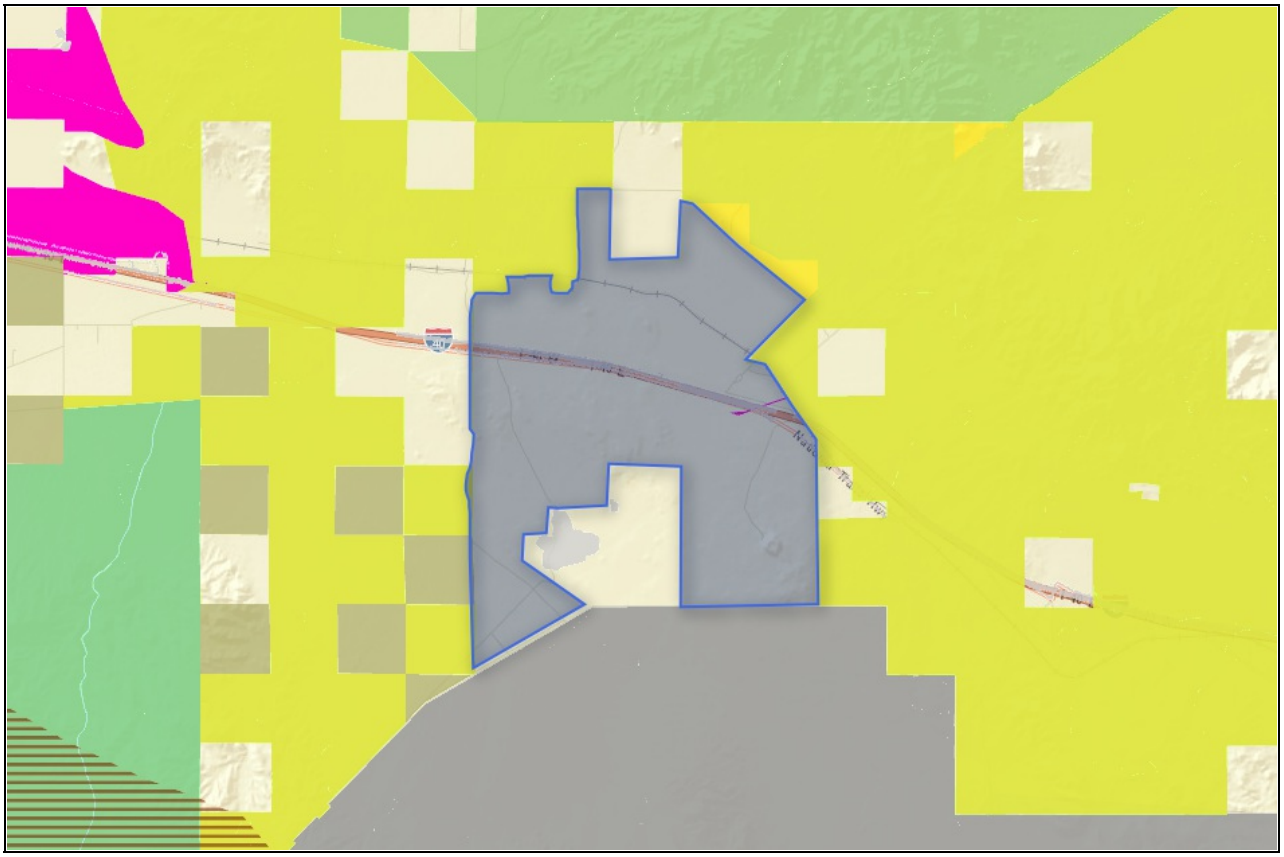
Comment The Special Analysis Area in the Silurian Valley should be rejected in its entirety, and the underlying lands should be designated as NLCS lands. Industrial-scale energy development or other types of large-scale destruction in the Silurian Valley would severely impede the qualities that underpin the surrounding NLCS lands. Mostly uninterrupted views of desert landscape provide a view of the landscape as seen by historic travelers of the Old Spanish Trail that runs immediately to the west of the Special Analysis Area.



Comment The Pisgah area south of the Cady Mountains should be designated as an ACEC and NLCS. To the north of Interstate 15, these lands were studied extensively for the now abandoned Calico Solar power project. Desert tortoises and the white-margined beardtongue have been found within the areas outlined. Also, Mojave fringe-toed lizards are present in the sandy washes just north of I-15.

To the south, the Pisgah lava fields provide critical areas to study adaptive color polymorphism and unusually high genetic diversity in reptiles, according to a peer-reviewed study by Steven Micheletti, Eliseo Parra, and Eric Routman published in 2012.

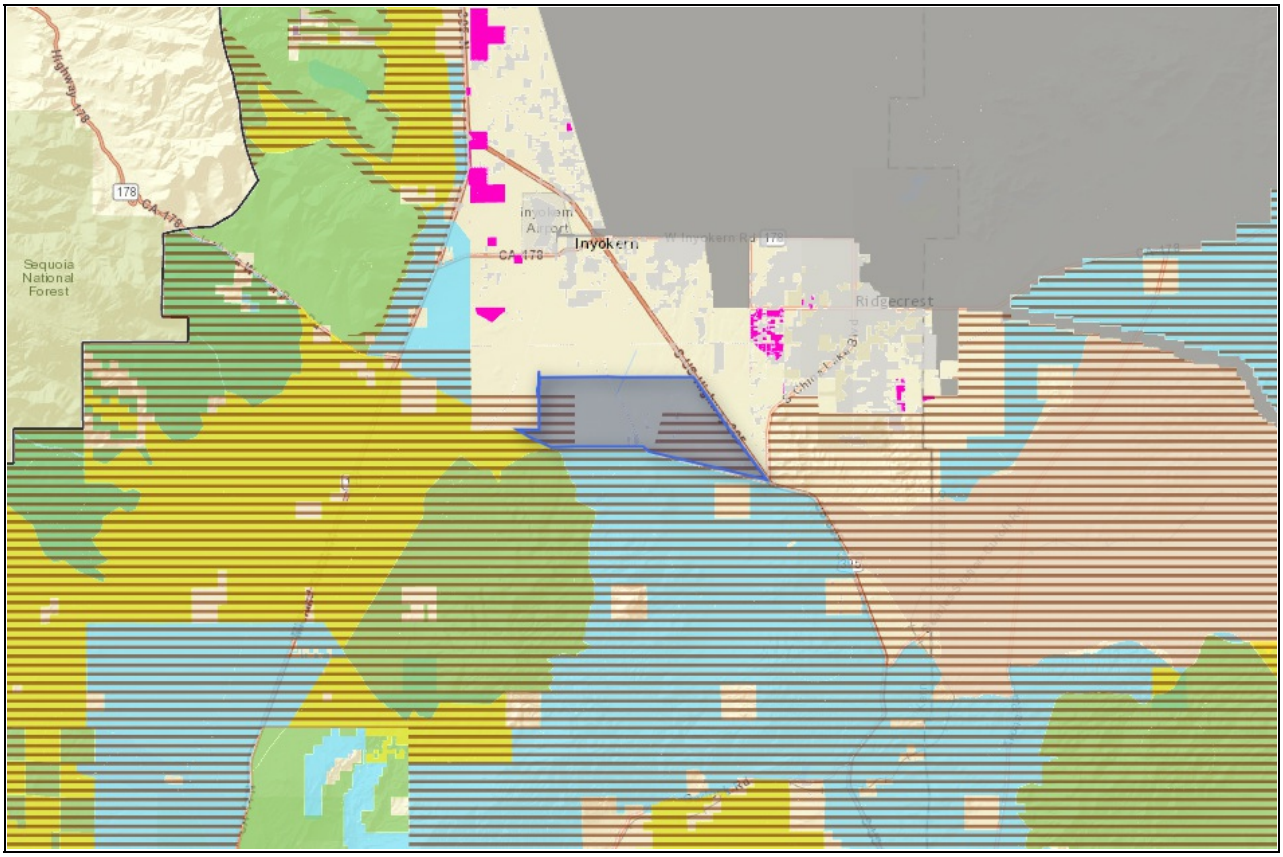
Furthermore, ACEC status for lands south of I-15 may enhance protection of habitat connectivity linking the Ord-Rodman and Newberryy NLCS area to the east.



Comment These BLM lands north of Brown Road and west of US Highway 395 should be designated as an area of critical environmental concern to protect Mojave Ground Squirrel (MGS) habitat and enhance MGS connectivity for the core population in the Indian Wells area with other known population to the south and east. Studies conducted for the now abandoned Ridgecrest Solar power project found high quality Mojave Ground Squirrel habitat in the wash north of Brown Road.

Studies also found a desert tortoise density of 9.8 animals per square kilometer.

The area proposed as an ACEC south of Brown Road could be impacted by private land parcels, requiring that additional ACEC designation north of Brown Road may be necessary to compensate for degradation to the ACEC to the south. Google Earth imagery indicates the private parcel immediately to the south of Brown Road has already been substantially degraded with the clearing of what appear to be roads for off-highway vehicle activity.



Datasets

Proposed Special Recreation Management Areas (SRMA), Preferred Alt.

http://drecp.databasin.org/datasets/1aaa7689dad346388308fcc64d67000a

Credits: Data provided by Dudek.

Layers:
- Proposed Special Recreation Management Areas (SRMA), Preferred Alt.

Existing Special Recreation Management Areas (SRMA), DRECP

http://drecp.databasin.org/datasets/21f9412a3c7943ccbfa0ce98f1c33297

Credits: Data provided by Dudek.

Layers:
- Existing Special Recreation Management Areas (SRMA), DRECP

DRECP Boundary

http://drecp.databasin.org/datasets/58fa78605578482aa27955052341ee85

Credits: Desert Renewable Energy Conservation Plan, Dudek

Layers:
- DRECP Boundary

Development Focus Areas on BLM Land, Preferred Alt.

http://drecp.databasin.org/datasets/ab98d839591a47c9b5997e1de0ca1dd3

Credits: California Energy Commission, U.S. Bureau of Land Management, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Dudek, DRAFT Desert Renewable Energy Conservation Plan (DRECP) and EIR/EIS.

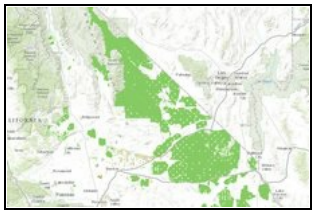
Layers:
- Development Focus Areas on BLM Land, Preferred Alt.

Study Area Lands on BLM Land, Preferred Alt.

http://drecp.databasin.org/datasets/613700dd7d7b419ca601050a2545f601

Credits: California Energy Commission, U.S. Bureau of Land Management, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Dudek, DRAFT Desert Renewable Energy Conservation Plan (DRECP) and EIR/EIS.

Layers:
- Study Area Lands on BLM Land, Preferred Alt.



Reserve Design Envelope (Existing Cons.), DRECP

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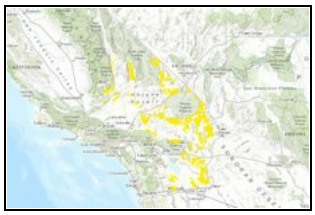
Credits: California Energy Commission, U.S. Bureau of Land Management, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Dudek, DRAFT Desert Renewable Energy Conservation Plan (DRECP) and EIR/EIS.

Layers:
- Reserve Design Envelope (Existing Cons.), DRECP



Reserve Design Envelope (NLCS) on BLM Land, Preferred Alt.

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Credits: California Energy Commission, U.S. Bureau of Land Management, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Dudek, DRAFT Desert Renewable Energy Conservation Plan (DRECP) and EIR/EIS.

Layers:
- Reserve Design Envelope (NLCS) on BLM Land, Preferred Alt.

Reserve Design Envelope (ACECs & Wildlife Allocation) on BLM Land, Preferred Alt.

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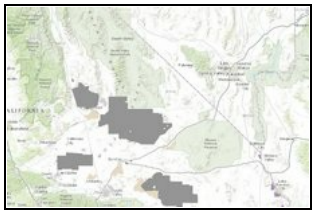
Credits: California Energy Commission, U.S. Bureau of Land Management, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Dudek, DRAFT Desert Renewable Energy Conservation Plan (DRECP) and EIR/EIS.

Layers:
- Reserve Design Envelope (ACECs & Wildlife Allocation) on BLM Land, Preferred Alt.



Other Lands, DRECP

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Credits: California Energy Commission, U.S. Bureau of Land Management, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Dudek, DRAFT Desert Renewable Energy Conservation Plan (DRECP) and EIR/EIS.

Layers:
- Other Lands, DRECP

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Potential impacts of proposed solar energy development near the South Soda Mountains on desert bighorn sheep connectivity

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Report to the California Department of Fish and Wildlife, National Park Service, and Bureau of Land Management

Summary
This report evaluates implications of the proposed renewable energy project in the vicinity of the Soda Mountains relative to conservation of desert bighorn sheep (*Ovis canadensis nelsoni*) in the Mojave Desert of California. The proposed solar array would straddle Interstate 15 and cover areas between the North and South Soda Mountains, on the northwest edge of the Mojave National Preserve. Although the exact footprint of the project is not yet clear, the intensity of development within such solar arrays would likely prevent movement of bighorn sheep through project areas. Past bighorn sheep movement between the North and South Soda has been blocked by Interstate 15. However, restoration of this movement corridor may be possible by either 1) modifying existing locations where the Interstate crosses washes via bridges to create potential underpasses for bighorn sheep by enticing bighorn sheep to those areas, or 2) construction of an overpass structure as has been implemented successfully over Highway 93 in Arizona. To determine the importance of the affected area for restoration of bighorn sheep connectivity, we used network analysis of an empirically-derived connectivity model for desert bighorn sheep to evaluate short- and long-term consequences of restoring the Soda Mountains connection for gene flow and recolonization by desert bighorn sheep. We also assessed potential underpass and overpass crossing sites using remotely-sensed data and site visits. The network analysis indicated that the North-South Soda Mountain connection is the most important restorable corridor for long-term demographic potential (i.e., population recolonization by ewes) across the entire southeastern Mojave Desert of California, as it would provide the best and only opportunity for movement between bighorn populations in the Mojave National Preserve and the large complex of populations to the north of Interstate 15, and would facilitate gene flow as well resulting in long-term (multi-step) connections with bighorn sheep populations in Death Valley National Park. We identified four existing underpasses in or near the affected area, and identified two specific locations where overpass structures might be built based on the distribution of bighorn sheep habitat. All potential crossing locations, including both existing underpasses and sites for potential overpass construction, are on or adjacent to the area proposed for renewable energy development. Therefore, the proposed development may negatively affect the potential to restore this extremely important movement corridor for bighorn sheep.

Introduction

Desert bighorn sheep (*Ovis canadensis nelsoni*) have strong cultural, ecological, and economic significance in the Mojave Desert of California. In this region this species exhibits a metapopulation

structure: populations occupy numerous small mountain ranges that are separated by varying expanses of relatively flat desert (Fig. 1), with infrequent but continual crossing of those flats by individuals migrating between populations. Preserving and, where possible, augmenting connectivity among bighorn populations is an important conservation objective for genetic and demographic reasons. The relative isolation and small size of bighorn populations makes them very vulnerable to loss of genetic diversity from the pervasive force of genetic drift (Epps *et al.* 2005), but dispersal between mountain ranges counteracts this loss through gene flow and thereby works to maintain genetic diversity, and ultimately the ability of the species to adapt to changing environmental conditions. The high rate of past population extinction in this metapopulation (Torres, Bleich & Wehausen 1994) means that dispersal is also necessary for re-colonization of vacant habitat where extinctions have occurred (Epps *et al.* 2010). Numerous such re-colonization events have been documented in recent decades (Wehausen 2012, Epps *et al.* 2010).

Although core mountainous habitat where bighorn sheep reside, forage, and breed remains largely intact in the region, surrounding dispersal habitat has been fragmented over the past century by interstate highways, canals, urbanization, mining operations, and other anthropogenic developments (Epps *et al.* 2005). Ongoing and proposed renewable energy development in the Mojave Desert threatens to further reduce connectivity among bighorn populations by obstructing dispersal corridors. A proactive approach that focuses on restoring key dispersal corridors is an important option for managing desert bighorn populations in the region and is called for in the California Department of Fish and Wildlife draft conservation plan for these sheep (Wehausen 2012).

Here, we discuss potential impacts to bighorn connectivity of the proposed solar energy development between the North and South Soda Mountains (Fig. 1). We focus on this specific area because our recent analyses indicate that it could be especially important to efforts to restore metapopulation connectivity. Our comments are based on the results of an unpublished modeling study that addressed potential management actions to preserve and improve connectivity among bighorn populations in this region, which we describe briefly below.

Modeling genetic and demographic connectivity among populations

We combined an existing bighorn landscape resistance model (Epps *et al.* 2007) with a network theory approach to construct models of genetic connectivity and demographic connectivity in the Mojave Desert bighorn sheep metapopulation. We define genetic connectivity as the potential for gene flow among populations, and demographic connectivity as the potential for re-colonization of empty patches. Analyses of gene flow data by Epps et al. (2007) found that genetic connectivity among Mojave Desert bighorn populations is a function of a combination of geographic distance between populations and the slope of the intervening terrain, with bighorn sheep preferring more steeply-sloped terrain (>10%) that better allows them to escape predators. The combination of slope and distance that reflects the dispersal resistance differences of habitat of different slopes is termed "effective distance." Using genetic data and telemetry data, we estimated that the maximum effective distance over which individuals will disperse in this metapopulation (ED_{MAX}) is approximately 60 percent greater for rams than for ewes. This means that populations that are genetically connected may not necessarily be demographically connected because genes can be transmitted among populations by rams alone, but recolonization of empty patches requires both rams and ewes to disperse.

We used the Epps et al. (2007) landscape resistance model to predict the location and effective distance of the least-cost path (LCP) between all pairs of occupied habitat patches; these LCPs were assumed to represent likely dispersal corridors between populations, but do not

represent all such corridors used by sheep. We then constructed two networks to represent existing connectivity within the metapopulation: 1) a genetic network including all dispersal corridors between patches separated by < ED_{MAX} for rams; and 2) a demographic network including those corridors < ED_{MAX} for ewes. Predicted paths that intersected a barrier feature (e.g., interstate highway, canal, urban area) were excluded from the network, as bighorn very rarely cross these barriers.

We identified 21 dispersal corridors that are currently interrupted by anthropogenic barriers but would otherwise connect populations within the estimated ED_{MAX} of rams (i.e., would provide genetic connectivity). Fifteen of these corridors were also within the shorter ED_{MAX} of ewes (i.e., would also provide demographic connectivity). These corridors were considered potential targets of management actions to mitigate barriers to restore connectivity. Examples of such actions are the building of wildlife crossing structures over freeways or using water to bait sheep to use existing freeway bridges as underpasses, as recommended in Wehausen (2012). In Arizona two such bridges recently constructed across Highway 93 for bighorn sheep received immediate use by the target species.

Prioritizing corridor restoration actions

We ranked restorable corridors according to their predicted influence on regional connectivity using two network metrics:

1. Effectively connected pairs (ECP) – a measure of short-term connectivity based on the number of pairs of patches that are linked by an effective distance within the dispersal range for a single dispersal event by an individual.
2. Mean weighted closeness (MWC) - a measure of long-term connectivity based on the average total effective distance between pairs of habitat patches along the shortest series of dispersal paths.

We added restorable corridors to the network model one at a time and recalculated connectivity metrics after each addition. Corridors whose addition resulted in the largest increases in network connectivity were inferred to be highest priority for restoration. We also calculated the proportional change in network metrics (Δ value) associated with each corridor addition. Results of this analysis are shown in Table 1.

Significance of the South Soda Mountains to metapopulation connectivity

The corridor linking the Avawatz Mountains and S. Soda Mountains was the highest-ranking restorable corridor in our analysis in terms of impact on long-term demographic connectivity (Table 1, right column; Fig. 2). This corridor is the most influential restorable corridor because if restored it would demographically link two major clusters of populations on either side of I-15. In fact, our model suggests that the Avawatz--S. Soda corridor is the only restorable corridor that is short enough to connect populations on either side of I-15 within the estimated maximum dispersal range of a ewe.

The proposed solar development along I-15 that lies between the North and South Soda Mountains (Fig. 2) has the potential to interfere with, if not preclude, future corridor restoration efforts in this location, including the building of one or more bridges for sheep. Although the footprint of the proposed development has not been finalized, the most recently-available estimate of that footprint would affect most of the area directly between the two mountain ranges. Given the

intensity of proposed development in these areas and associated fencing, it is very unlikely that bighorn sheep would be able to move across any developed area.

The potential connection between the S. Soda Mountains and the habitat patches north of I-15 is a critical component of what we consider to be the most efficient management strategy for maximizing metapopulation connectivity: restoring one key dispersal corridor across each of the interstate highways that currently fragment the Mojave Desert (I-15, I-40, and I-10). Our model suggests that this strategy would increase connectivity by 46 to 93 percent, depending on the type of connectivity considered (genetic vs. demographic and short-term vs. long-term). We consider it important for regulatory agencies to give this issue adequate consideration when evaluating potential development projects so as to avoid actions that might limit or preclude future efforts to re-establish connectivity for bighorn sheep. Below are some pertinent details.

Restoring metapopulation connectivity across I-15 at the Soda Mountains

In this section we discuss our recommendations for restoring connectivity across Interstate 15 at the Soda Mountains. These recommendations are based on our observations from field and remote-sensing exploration of the area in the vicinity of the Soda Mountains, discussions with other experienced personnel who have investigated bighorn sheep activity in the area within the last 1-5 years, previous genetic studies (e.g. Epps et al. 2007), as well as the combined expertise of the contributing authors derived from decades of research on desert bighorn sheep.

In Figure 3 we identify what we consider to be two potential locations for the construction of structures for bighorn sheep to cross over I-15 (1 and 2 on Fig. 3). These locations were chosen because topographic features are most favorable for bighorn sheep use (e.g., Epps et al. 2007). Prior to the construction of Interstate Highway 15 bighorn sheep would have readily crossed between the North and South Soda Mountains at both locations. Currently there are differences between these two potential overpass sites. At location 1 there is a lack of steeper sloped habitat immediately adjacent to the where the overpass would begin on the south side of the freeway. Currently, evidence of bighorn sheep use ends in steeper habitat about 1.5 km south of where the overpass would begin. In contrast, at location 2 there is steep habitat right to where the overpass would begin and clear sign of current bighorn sheep use (observed February 2013) at the site where the overpass would begin and the adjacent habitat. Additionally, at this site there remain decades-old bighorn sheep trails from many sheep crossing at this location prior to the construction of Interstate Highway 15. The abundant water on the east edge of the South Soda Mountains readily explains the historic high use of this crossing point. Sheep would have moved between this water and the North Soda Mountains frequently in summer.

Figure 3 also includes the locations of four existing highway bridges across washes (A-D on Fig. 3) that have potential for use by bighorn sheep as freeway undercrossings. Wehausen (2012) recommended research into the use of supplemental water near potential undercrossings as a way to bait desert bighorn sheep to potential undercrossing. Given the social nature of bighorn sheep and their associated behavioral trait of learning about habitat patches from each other, the use of such an underpass will likely increase quickly once it begins.

These four potential undercrossings vary considerably in width from about 4.5m wide (A and C) to 22m for B and 27m for D. However, our site inspections in February 2013 found that none of these was too narrow for sheep use, and that there is no fencing across the underpass entrances that might inhibit use by bighorn sheep. All four locations lie outside of habitat with >10% slope, but C and D are closer to such habitat, especially the north side of D, where steep habitat is immediately adjacent (Fig. 3). However, the 10% slope cutoff used in our modeling is not an absolute habitat division. There is variation in adjacent intermountain habitat below a 10% slope

cutoff and in the amount of bighorn sheep use it receives. Desert bighorn sheep regularly venture up to a few hundred meters out from the base of mountain ranges into intermountain habitat for short time periods, and in some situations have been known to move considerable distances across intermountain habitat regularly to obtain water. Dispersing sheep readily venture far out into intermountain habitat. The analysis of gene flow by Epps et al. (2007) indicates that bighorn sheep will disperse across as much as 16.4 km of intermountain terrain <10% slope when moving between core habitat areas. All four potential undercrossings fall well under the maximum dispersal distance for both sexes of desert bighorn sheep. For locations A and B (Figure 3) the distance is greatest, but at about 3.7 km between the North and South Soda Mountains in that area it is still a relatively short intermountain distance for desert bighorn sheep to cross. Considerable gene flow typically occurs across that distance in the absence of barriers (Epps *et al.* 2007); thus, all the intermountain habitat between the North and South Soda Mountains has potential to be used for dispersal.

Based on our field observations in the area, there is currently well-established bighorn sheep use of habitat on the south side of the proposed project site in the South Soda Mountains and between there and Cave Mountain, and these sheep may use undercrossings A-D occasionally. It would take years of monitoring to determine the extent of such use. In contrast, the North Soda Mountains no longer support a resident population of sheep. Prior to the construction of I-15, sheep would have moved readily between the North and South Soda Mountains and would have had access to the current excellent water on the east side of the South Soda Mountains. That very reliable water in the South Soda Mountains has allowed a recent natural colonization there to grow into a population of 50-100 sheep based on a ground count conducted in May 2012 by California Department of Fish and Wildlife. When the much larger and higher North Bristol Mountains were available, the total population was undoubtedly larger.

Wehausen (2012) recommended the development of water in the North Soda Mountains as a way to encourage more use of that range by sheep dispersing south from the Avawatz Mountains. Even if used only by dispersing rams, habitat patches like the North Soda Mountains can be very important to gene flow and connectivity in general. Increased use of the North Soda Mountains could lead to increased use of undercrossings locations A-D. Given the major migration barrier of I-15, it is important to retain these potential crossing locations at least until a freeway overpass for bighorn sheep can be built. The development of a solar power generation project between the North and South Soda Mountains would very likely preclude such use of some of these underpasses.

Acknowledgements

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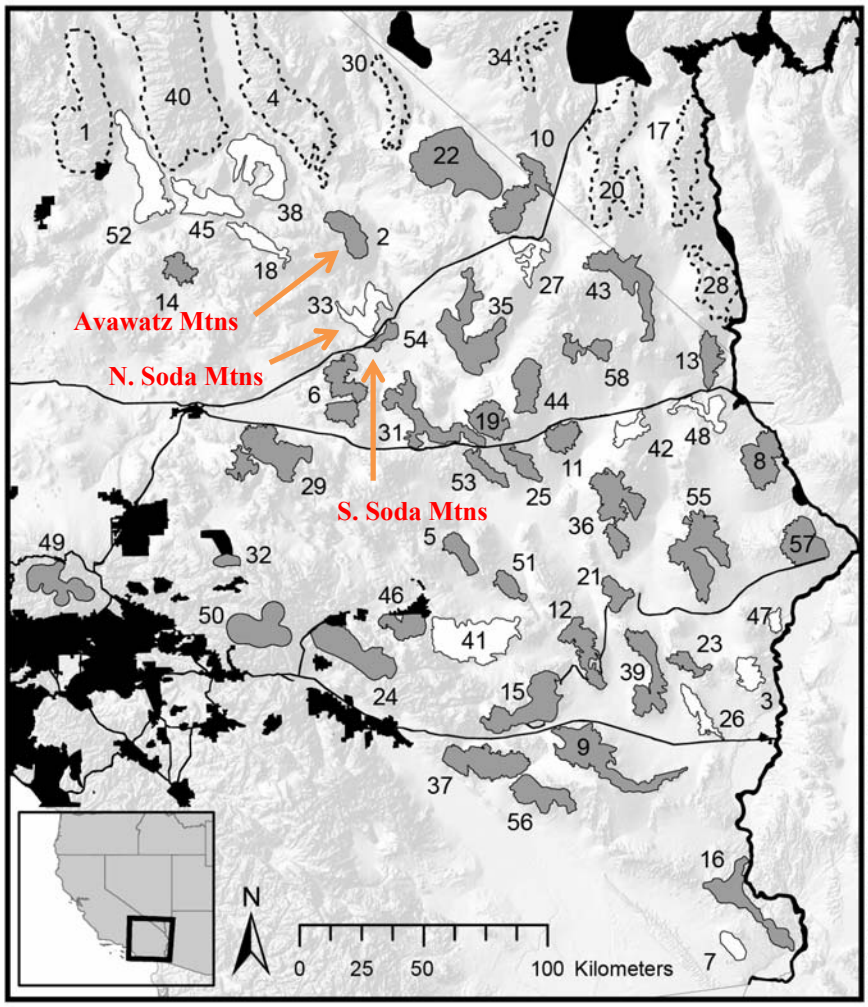

1-Argus Mtns (ARG); 2-Avawatz Mtns (AVA); 3-Big Maria Mtns (BMA); 4-Black Mtns/Greenwater Range (BGR); 5-Bullion Mtns (BUL); 6-Cady Mtns (CAD); 7-Cargo Muchacho Mtns (CAR); 8-Chemehuevi Mtns (CHE); 9-Chuckwalla Mtns (CHU); 10-Clark Mtns/S. Spring Range (CSS); 11-Clipper Mtns (CLI); 12-Coxcomb Mtns (COX); 13-Dead Mtns (DEA); 14-Eagle Crags (ECR); 15-Eagle Mtns (EMO); 16-E. Chocolate Mtns (ECH); 17-Eldorado Mtns (EDO); 18-Ft. Irwin Granite Mtns (FIG); 19-Granite Mtns (GRA); 20-Highland Range/McCullough Range (HMC); 21-Iron Mtns (IRO); 22-Kingston Mtns/Mesquite Range (KME); 23-Little Maria Mtns (LMA); 24-Little San Bernardino Mtns (LSB); 25-Marble Mtns (MAR); 26-McCoy Mtns (MCY); 27-Mescal Range/Ivanpah Mtns (MIV); 28-Newberry Mtns (NNV); 29-Newberry Mtns/Ord Mtns (NOR); 30-Nopah Mtns (NOP); 31-N. Bristol Mtns (NBR); 32-N. San Bernardino Mtns/-Cushenbury Mtns (NSB); 33-N. Soda Mtns (NSO); 34-N. Spring Range (NSP); 35-Old Dad Pk/Kelso Mtns/Marl Mtns/Club Pk/Indian Spring (OKM); 36-Old Woman Mtns (OWO); 37-Orocopia Mtns (ORO); 38-Owlshead Mtns (OWL); 39-Palen Mtns/Riverside Granite Mtns (PRG); 40-Panamint Mtns (PAN); 41-Pinto Mtns (PIN); 42-Piute Mtns (PIU); 43-Piute Range/Castle Pks/Castle Mtns (PCC); 44-Providence Mtns (PRO); 45-Quail Mtns (QUA); 46-Queen Mtn (QUE); 47-Riverside Mtns (RIV); 48-Sacramento Mtns (SAC); 49-San Gabriel Mtns (SGA); 50-San Gorgonio Mtns (SGO); 51-Sheephole Mtns (SHE); 52-Slate Range (SLA); 53-S. Bristol Mtns (SBR); 54-S. Soda Mtns (SSO); 55-Turtle Mtns (TUR); 56-W. Chocolate Mtns (WCH); 57-Whipple Mtns (WHI); 58-Woods Mtns/Hackberry Mtns (WHA)

Figure 1. Desert bighorn sheep habitat patches in the Mojave Desert region. Gray polygons are occupied patches, white polygons are unoccupied patches, and hollow dashed polygons are adjacent patches outside the study area considered in our analysis. Barriers to dispersal (interstate highways, urban areas, etc.) are shown in black.

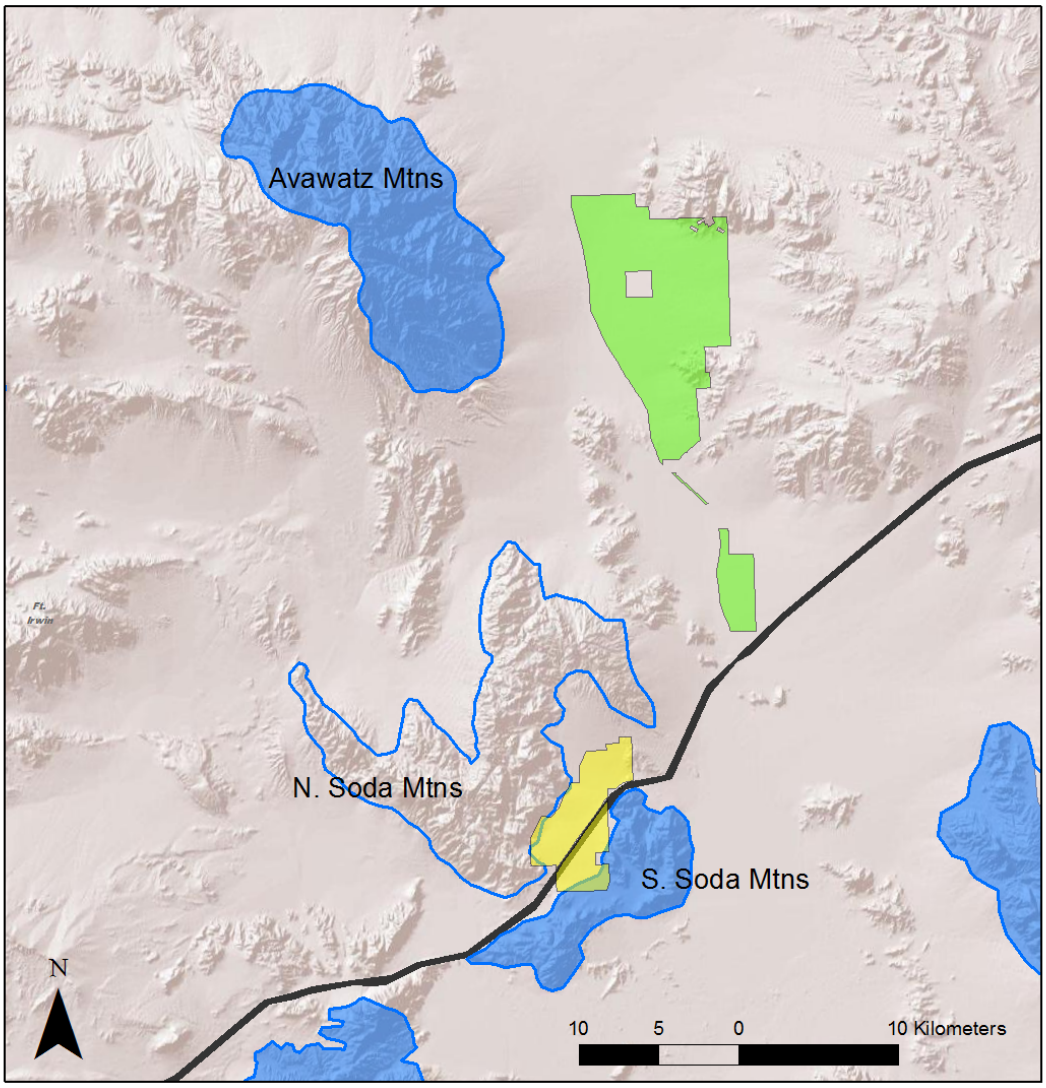

Figure 2. Proposed renewable energy developments near the South Soda Mountains. The filled blue polygons are mountain habitat currently occupied by desert bighorn sheep. The open blue polygon is currently vacant historic bighorn sheep habitat (with general boundaries inferred based on topography). The yellow polygon is the general region of the proposed solar energy facility, for which exact boundaries have not yet been established. Green polygons are proposed wind energy facilities in the vicinity. The thick black line represents Interstate 15.

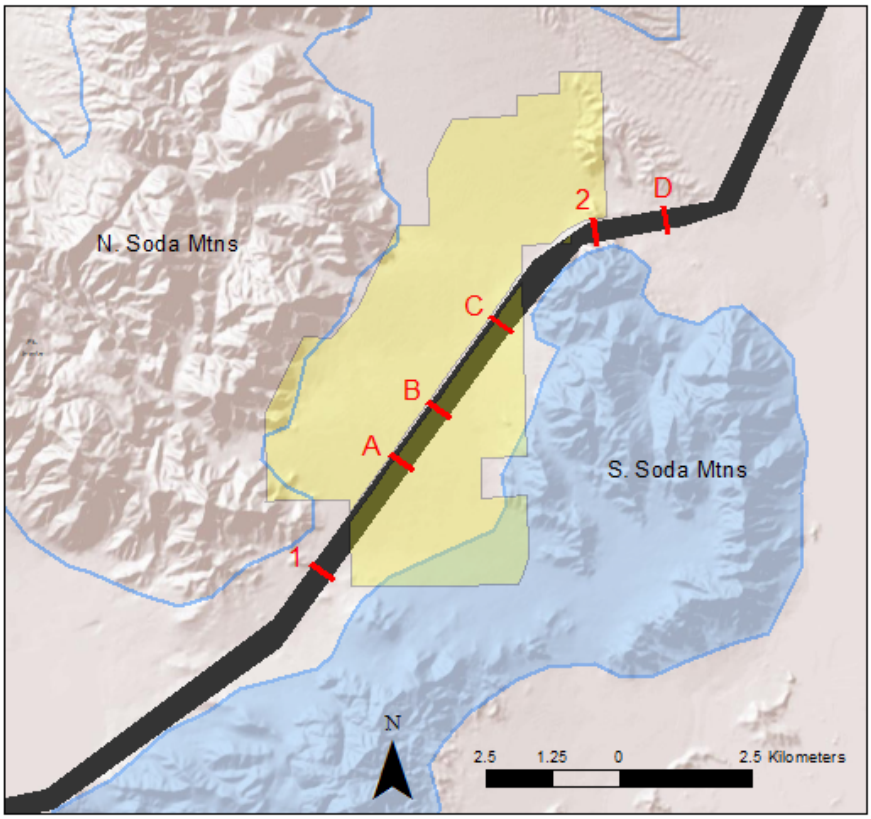

Figure 3. Potential locations for bighorn sheep to cross between the South Soda Mountains (filled blue polygon) and North Soda Mountains (open blue polygon). Red lines show locations of existing underpasses (A-D) and recommended sites for construction of wildlife overpasses (1, 2) across Interstate 15 (thick black line). Bighorn sheep sign and old trailing was observed in the immediate vicinity of location 2 on the south side of the interstate highway in February 2013. The yellow polygon reflects the general region of the proposed solar energy facility, for which exact boundaries have not yet been established.

Table 1. Prioritization of restorable corridors in the genetic and demographic networks based on ECP[a] and MWC[b]. The Δ value is the proportional increase in connectivity (as measured by ECP or MWC) when the specified corridor is restored to the network. Corridors are ranked from highest to lowest importance, with separate rankings for each combination of network type and network metric. Results for the Avawatz--S. Soda corridor (AVA-SSO) are highlighted in red. See Fig. 1 for patch name abbreviations.

Genetic network						Demographic network					
ECP			MWC			ECP			MWC		
Corridor	Δ value	Rank	Corridor	Δ value	Rank	Corridor	Δ value	Rank	Corridor	Δ value	Rank
GRA-MAR	0.246	1	GRA-MAR	0.342	1	GRA-MAR	0.231	1.5	AVA-SSO	0.196	1
NBR-SBR	0.197	2	NBR-SBR	0.308	2	NBR-SBR	0.231	1.5	GRA-MAR	0.196	2
EMO-ORO	0.123	3	CLI-PRO	0.280	3	LSB-SGO	0.108	3	NBR-SBR	0.185	3
CHU-EMO	0.115	4	BUL-CAD	0.225	4	EMO-ORO	0.092	4	CLI-PRO	0.110	4
CLI-PRO	0.090	5.5	BUL-NBR	0.217	5	CHU-EMO	0.077	5.5	EMO-ORO	0.101	5
LSB-ORO	0.090	5.5	CAD-NOR	0.205	6	LSB-NSB	0.077	5.5	CHU-EMO	0.096	6
ORO-QUE	0.066	7	AVA-CAD	0.171	7	LSB-ORO	0.062	7.5	LSB-SGO	0.094	7
AVA-CAD	0.049	8.5	AVA-SSO	0.166	8	ORO-QUE	0.062	7.5	COX-PRG	0.090	8
AVA-SSO	0.049	8.5	CHE-DEA	0.159	9	NSB-SGA	0.031	9.5	LSB-ORO	0.084	9
ORO-SHE	0.033	10	EMO-ORO	0.155	10	SGA-SGO	0.031	9.5	LSB-NSB	0.072	10
BUL-CAD	0.025	11.5	CHU-EMO	0.148	11	AVA-SSO	0.015	13	ORO-QUE	0.071	11
SGA-SGO	0.025	11.5	KME-OKM	0.147	12	CHE-DEA	0.015	13	COX-IRO	0.071	12
CAD-NOR	0.016	15.5	CSS-PRO	0.142	13	CLI-PRO	0.015	13	CHE-DEA	0.028	13
CHE-DEA	0.016	15.5	LSB-ORO	0.141	14	COX-IRO	0.015	13	NSB-SGA	0.020	14
CSS-PRO	0.016	15.5	CSS-WHA	0.141	15	COX-PRG	0.015	13	SGA-SGO	0.018	15
CSS-WHA	0.016	15.5	ORO-QUE	0.132	16						
KME-OKM	0.016	15.5	ORO-SHE	0.094	17						
NSB-SGA	0.016	15.5	CHU-PRG	0.081	18						
BUL-NBR	0.008	20	SGA-SGO	0.041	19						
CHU-PRG	0.008	20	NSB-SGA	0.039	20						
NOR-SGA	0.008	20	NOR-SGA	0.022	21						

[a] Effectively connected pairs, a measure of short-term network connectivity.
[b] Mean weighted closeness, a measure of long-term network connectivity.